INNOVATION AND IMPACT
Reviewing the influence and legacy of Spore

INTERVIEW
Edward Mabaya explores what is needed to scale digital projects in agriculture

AGRI-FINANCE
Looking to the future for credit and finance solutions

Final issue

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SPORE

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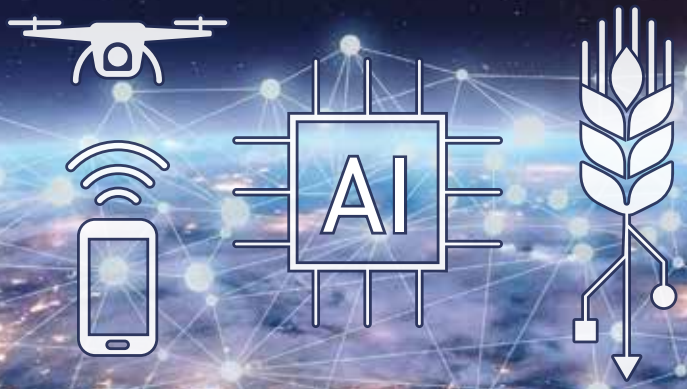

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SPORE N°195

EDITORIAL

Spore's final edition - a lasting legacy

Michael Hailu, director – CTA

This will be the last editorial I will be penning for *Spore* since I will complete my term as CTA Director at the end of February 2020. Unfortunately, this issue will be the final edition after 34 years of uninterrupted publication as, with the end of the Cotonou Agreement between the EU and ACP countries, the financial and legal framework that has supported CTA, and hence *Spore*, will expire.

During my travels over the last decade as CTA director, I have met with a wide range of partners, including many senior government officials who have often told me how much they have appreciated *Spore* as a valuable source of information for their work. The information provided in *Spore* has been instrumental in knowledge exchange, in the sharing of different opinions and insights, and in providing readers with the latest developments in agriculture. *Spore* has helped shape curricula and training materials, set up new business ventures, and allowed many to keep up-to-date with information that was not readily available elsewhere. Extension officers who have gone on to hold senior positions within ministries and other key departments have informed me that *Spore* continued to be valued as they moved from working with farmers in the field to more advisory and decision-making positions.

Spore has been respected for the insights and innovations it has highlighted to its readers; for the service it has provided in facilitating exchange in good farming practices across ACP practitioners; and, for many, the magazine could almost be considered a household name. In recent years, with the digitalisation of *Spore*, we have worked to provide the articles in a variety of formats, beyond just the print magazine, so that it is more readily available and accessible to a younger and more digitally-minded audience, while not neglecting our long-standing, traditional readership.

It is not always easy to measure the extensive impact of a publication over such a long period of time but we know that *Spore* is recognised and appreciated for the quality of its agricultural journalism across ACP regions, including allowing a network of Francophone and Anglophone correspondents to have an avenue for providing stories from the field. With our monthly opinion pieces, we have been able to encourage the sharing of different viewpoints from a range of highly respected organisations and, in our *Spore* exclusive interviews, to feature high-level experts and practitioners in agricultural and agribusiness development to share their perspectives.

It is the end of an era and I have no doubt that *Spore* will be missed but, at CTA, we are pleased that we have been part – and even led – critical conversations on key topics on agricultural transformation through this timeless publication.

It has been an honour and privilege for me to have been associated with *Spore* for many years.

INNOVATION AND IMPACT

A focus on agricultural transformation over the years

As a tool contributing to sustainable agricultural transformation, *Spore*'s influence is well recognised. In this final Trends article, we review the legacy of CTA's flagship publication and how it has evolved from a short technical bulletin to a comprehensive online and print magazine.

Susanna Cartmell-Thorp

At its peak, hard copies of *Spore* were distributed to over 60,000 subscribers (organisations and individuals) in ACP countries and read by a great many more. A 2015 independent evaluation of *Spore* stated that: "*Spore* magazine has improved the knowledge and skills of its worldwide audience. The new knowledge acquired improved the capacities of the readers in the long-term with effect spread beyond the immediate beneficiaries as most of them share the magazine, often with more than five people."

Born out of a CTA bulletin in 1986, *Spore* launched in English and French 3 years after CTA was established. However, in Issue 1, CTA's stipulation for the bi-monthly printed publication was that "rather than promoting CTA, *Spore* aims to ensure the widest possible dissemination of information of relevance to the agricultural world, in order to fertilise ideas and allow them to germinate. It is in this down-to-earth way that *Spore* hopes to participate in the process of rural development."

Since the early years of *Spore*, the global perspective on agricultural development has changed and so the magazine has also evolved to become more than a technical bulletin providing agricultural production advice to providing in-depth coverage of the topics and issues of broader relevance to agribusiness and sustainable agriculture critical to agricultural transformation. "The content of *Spore* is varied and rich. What I like in particular is the 'Dossier' where a problem is discussed in an in-depth way and well detailed, therefore giving lots of information, and this makes the reader reflect on agricultural issues in a general way," said Souleymane Nacro, a researcher at the Institute of Environment and Agricultural Research of Burkina Faso during a workshop of *Spore* readers held as part of the external 2015 *Spore* evaluation. Always highly valued as a reference source, *Spore* has been shown to have been used in multiple ways, including in teaching material for spreading knowledge, as well as practical improvements in agricultural practices and in stimulating new agribusiness ventures.

John Gushit, a lecturer in the Faculty of Natural Sciences at the University of Jos, Nigeria, stated in feedback to CTA: "I write to thank you for how *Spore* has guided me in my research," citing a specific article about a project in Kenya featured in the June/July 2012 issue (No. 159). The information helped him to design his research project on helping smallholder farmers to make better and safer use of pesticides. "This project will have a positive impact on the users of these chemicals, as it will enhance good farming practice and healthy living among smallholders," Gushit emphasised.

1,500

individuals and organisations from South Kivu, DRC, subscribed to *Spore* by 2014, up from 100 in 2010, after CTA struck a distribution deal with *Proximédias Libres*

In 2010, the *Spore* June/July 2010 issue (No. 147) featured a short article reporting on quail farming that had taken off in Cameroon. The information caught the attention of Thomas Munyoro, a retired policeman in Kenya's Nyeri district and

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For 34 years, *Spore* has been providing ACP farmers with information on agricultural developments to help them increase their productivity and incomes

a leading light in the 2010 Strategic Self-Help Group, a local NGO for retired civil servants. Munyoro read the article in the offices of the Kenya National Federation of Agricultural Producers. "My colleagues and I had been rearing rabbits, but they were affected by many diseases, so we were looking for other activities," he recalled. Attracted by the idea of quail farming after reading *Spore*, they researched the topic further and found a quail producer in Nairobi to source chicks in order to establish a business selling quails' eggs, which were in great demand for their medicinal properties. Before long, Munyoro had over 100 laying quail and his business was thriving.

Extending the reach of *Spore*

As a relatively small institution with a large mandate, it has been necessary for CTA in all its activities to build smart partnerships with farmers' organisations, government agencies, research networks, youth and women's groups and the private sector to add value and bring about sustainable transformation ›

Cultivating a passion for journalism

As a long-standing *Spore* correspondent, it is not an understatement to say that CTA support has enabled me to mature as an agriculture journalist. It is over 20 years since I first received radio production training in 1997 in order to become a correspondent for CTA's Rural Radio Resource Packs (RRRPs), which provided me with an opportunity to report on agriculture in Africa and the role of smallholder farmers in growing, processing and marketing food. As a result, I developed radio programmes on innovative agricultural issues that were freely broadcast across Africa. The programmes, which were often also shared on cassette and CD-ROM at farmer club meetings, armed farmers with useful information. Some of these farmers, who I interviewed for RRRP programmes, told me that the programmes had enabled them to quickly and easily diagnose crop and animal diseases and seek treatment, which was especially important when they had limited interactions with extension advisors.

When the RRRPs were discontinued, my long-standing association with CTA unlocked an opportunity to become a correspondent for *Spore*. This has been an insightful experience, which has enabled me to blend specialised scientific agriculture research and farmer narratives with meticulous fact-checking, analysis and creativity. Coverage of key conferences, sponsored by CTA, and writing stories about CTA's work across ACP countries has also honed my writing skills and enabled farmers to share their experiences with a wide audience. This work – which has been published online and in print, including by international outlets such as the *Inter Press Service* – has raised my professional profile. As a result, I was invited to judge the 2018 and 2019 International Federation of Agriculture Journalist (IFAJ) Star Prize, and in July 2019 I was awarded an IFAJ fellowship designed to provide professional development, leadership training and networking opportunities to agricultural journalists from developing countries.

Busani Bafana

in the agricultural sector. Strategic partnerships have also featured in the dissemination of *Spore*, particularly for extending the reach of the print edition and *Spore* has prided itself on reaching places where other magazines found it difficult to gain a readership. One example was South Kivu, in the Democratic Republic of Congo (DRC), a region which suffered greatly from armed conflict during 1998–2003; even years later, communications remained difficult.

With little or poor internet connections in South Kivu, CTA struck a *Spore* distribution deal with *Proximédias Libres*, a local company with a good network of partners. Before the partnership was launched in 2010, there were just 100 *Spore* subscribers in South Kivu. By 2014, there were 1,500 including NGOs, churches, radio clubs, schools, government departments and individuals. The magazines were shipped to the regional capital, Bukavu, and distributed by bus, motorbike and pirogue (canoe) with copies also collected from radio stations and churches. *Spore* was put to good use by educational institutions, and information from the magazine was regularly transmitted by local radio stations. Readers' responses were overwhelmingly positive: "I am an avid reader of your magazine, it brings so much to me and my small student community," stated Arsene Birindwa from DRC. "I strongly believe that awareness-raising on the use of ICTs in agriculture and the added value of agricultural products is making the Congolese agricultural sector increasingly attractive for young people and stimulating their interest in agriculture."

Following this success in DRC, CTA developed an innovative partnership in Cameroon with the monthly newspaper *La Voix du Paysan/The Farmers' Voice*, which distributed *Spore* free-of-charge. As a result, between 2010 and 2013, the number of subscribers receiving *Spore* more than doubled from 3,000 to over 7,500. Readership surveys in Cameroon revealed a high level of satisfaction. Over 50% of respondents stated that the magazine provided them with useful information about agricultural and rural development worldwide and in neighbouring countries; approximately 16% benefited from technical information and 10% from references and useful addresses. In Uganda, a similar readership survey provided a number of examples of specific activities inspired by *Spore*, including on post-harvest practices, biogas, fruit growing, fish farming and vegetable production.

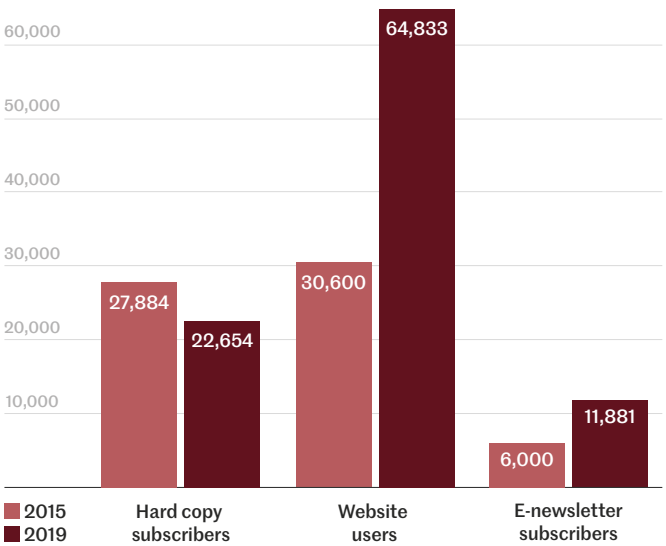
Changing with the times

Interacting with readers, and allowing exchange between readers, has always been a priority for *Spore*. In the past, letters and emails were received and selected extracts of testimonies, appreciations and comments on articles were published in the *M@ilbox* section of the printed magazine. In the December 2012/January 2013 issue (No. 161), one reader wrote: "The magazine has been and is still of immense assistance to me as a government field staff advisor; it always keeps me abreast of the latest developments in agriculture."

Regular surveys also allowed *Spore* to maintain contact with its readership and, in 2006, with the magazine celebrating 20 years, the editorial team tracked down some of the readers who had shown an interest in *Spore* in a 2001 readership survey. Tibi Guissou, a microbiologist at the INERA agricultural institute stated that he frequently quoted *Spore* in articles he wrote for specialist magazines. "Unlike other publications which focus too much on one aspect, *Spore* has a more multi-disciplinary approach," said the researcher, who had done much work on the jujube (red date) after being inspired by a *Spore* article. In Jamaica, environmentalist Dr Frank E Lawrence reported that the publication was his constant companion. "*Spore* is one of the most useful sources for providing information in helping and motivating small-scale producers," adding that he regularly passed on copies and articles to other people.

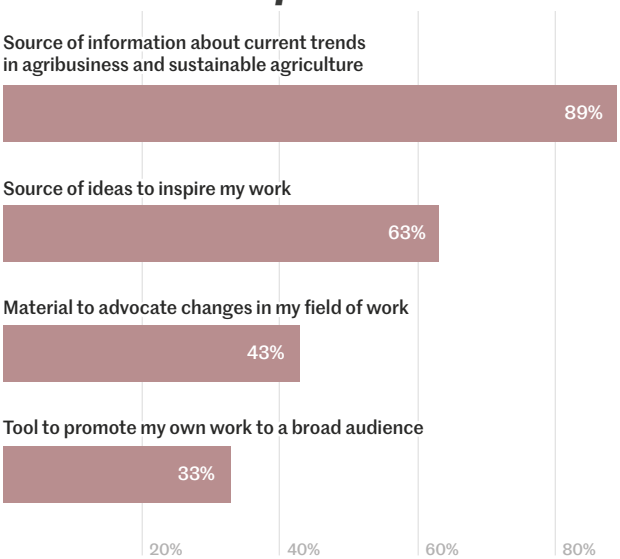
In recent years, to respond to the demands of a more digitally-minded audience and to appeal to a younger

Numbers of people reached by Spore



SOURCE: CTA, 2019

How readers use *Spore*



SOURCE: CTA, 2018

Hard copies of *Spore* were distributed to over 60,000 subscribers in ACP countries at its peak

© KUDZANAI CHIMHANDA/CTA

readership, articles are provided in a variety of formats, beyond just the print magazine. Increased digital content includes a greater number of articles published on the *Spore* website, a bi-monthly newsletter and an active social media presence. Since 2017, *Spore* has also been also available as an e-pub on key e-reader platforms (Amazon, Apple and Google).

A transformative approach

Highlighting innovation and impact is key in all of the articles written for *Spore* which now focuses on three thematic areas that are key to agricultural transformation in Africa and beyond: entrepreneurship, digitalisation for agriculture and climate-smart agriculture (CSA). To complement the in-depth analyses provided, short thematic articles, field reports and interviews are written by a network of ACP correspondents who regularly contribute ideas. A number of these correspondents (see box, *Cultivating a passion for journalism*) have been supported by CTA through their media and journalistic activities, including radio and print training.

As times have changed, written letters are no longer received but *Spore*'s social media channels provide a valuable way to interact with readers as well as contributors.

One tweet on a young woman entrepreneur's presentation particularly resonated with the social media audience: "Did you eat insects for lunch today at the #AGRF2019? Great #circulareconomy presentation by @HuijbersTalash on using #insects 4 #livestockfeed".

Capturing the dynamism of young ntrepreneurs such as these in our journalistic collaborations for *Spore* is a real pleasure for us as a team of writers and editors. The energy and enthusiasm of young people to transform agriculture and make a real difference is aptly captured by the business leader's interview with Isaac Sesi in this edition. Sesi has a real passion that shines through for inspiring other young people to get into science and technology. Sharing his interview on LinkedIn, he received over 250 reactions in just 1 week – using his network to extend the reach of *Spore*. Sesi and Huijbers are just two of a number of impressive entrepreneurs featured in this and other recent editions of *Spore*. Others include Ngabaghila Chatata of Thanthwe Farmers (https://tinyurl.com/ur6tqgg). Promoting CSA approaches (greenhouses and drip irrigation), Chatata has transformed her horticulture farm into an agribusiness hub that is incubating over 3,000 youth and smallholder farmers a year and is producing over 100 t of high-quality fruit and vegetables year-round for supply to local hotels and supermarkets in Malawi. And featured in this edition, from Kenya, 28 year old Rodgers Kirwa, who uses the profits from his harvests to sustain his iAgribiz Africa Model Farm and provide training courses to over 2,000 local farmers, which has resulted in yield increases of up to 100% (see *Kenyan Smallholders Adopt Market-Oriented Production*).

A fond farewell

It is with great sadness that the *Spore* team acknowledge that *Spore* is coming to an end. However, the archive of articles will continue to be available online (https://tinyurl.com/tsktwcw). As the current editorial team, we and our network of ACP correspondents, have been proud to be a part of the *Spore* story, to report on such a wide portfolio of topics and to network with an extensive range of partners and organisations. We thank you, our readers; without your support and interest in receiving the information provided in *Spore*, the publication would not have endured – over 3 decades is a lasting legacy indeed. ■

REDUCING FOOD IMPORTS

St. Lucian youth cooperative mushrooms into success

Using temperature-controlled technology and sustainable farming techniques, Marquis River Farm has replaced St. Lucia's imports of foreign mushrooms with domestic production, while growing local demand by 400%.

Natalie Dookie

To help address St. Lucia's vast fruits and vegetables import bill, and the region's high youth unemployment rate, philanthropist Peter Dillon set up Marquis River Farm – a youth-owned cooperative – in 2014. In addition to providing the land and capital to help start the cooperative, Dillon and his wife Pattie trained 15 young men and women, who were previously unemployed, on how to farm profitably. The cooperative operates on a profit-sharing, worker-ownership model where net profits are split three-ways: re-payment of the start-up loan which is interest-free, building the farm's savings, and profit sharing among the workers.

With St. Lucia importing mushrooms valuing on average €0.19 million per year, Dillon decided that this high value crop presented a good opportunity for import substitution and founded the brand Simply Mushrooms. When mushroom production started in 2014, local demand was 205-227 kg/week; today, the cooperative sells 680-907 kg/week. The varieties grown are white (50%), brown (40%) button mushrooms known as creminis, and portobello (10%). Restaurants, hotels and private homes account for most of Simply Mushrooms sales, as well as local supermarkets, including a weekly supply to all nine Massy Stores, the largest supermarket chain in St. Lucia. As a result of Simply Mushrooms' production, St. Lucia stopped importing mushrooms in 2018.

Most mushroom species need a cool environment with temperatures of around 21°C to grow so the cooperative invested in the required technology.

© JO BOXALL

A youth-owned cooperative is selling up to 900 kg of mushrooms a week in St Lucia

680-907 kg/week

of mushrooms is sold by Marquis River Farm

"The mushrooms are grown indoors, in climate-controlled refrigerated shipping containers outfitted with air conditioning units, which shield them from the environmental stress of a tropical climate. The containers are also hurricane-resilient, constructed close together, with firm foundations. The units are solar-powered, which has resulted in the farm's electric bill reducing from EC$8,000 (€2,704) per month to EC$4,000 (€1,352)," Dillon explains.

The farm uses the 3 t of high-grade compost generated as a waste product from the mushrooms to sustainably cultivate salad greens and microgreens, including arugula, pea, radish, mustard and beet shoots. Constantly innovating, Marquis also recently began producing a liquid seaweed extract, taking advantage of readily available sargassum seaweed, which has become a nuisance to coastal life. With production of seaweed fertiliser – approximately 1,360 l per month – the farm is well on its way to becoming fully self-sufficient.

Dillon wants to take his youth cooperative business model Caribbean-wide. "This project is not only profitable but it is sustainable, modular and scalable, making it easy to implement. There are many benefits of agricultural import substitution, such as foreign exchange savings, and increased employment especially in rural areas for young people and women," he says. Actively seeking investors, Dillon wants to set up organic mushroom cooperatives in Antigua and Barbuda, Grenada, and St. Vincent and the Grenadines. ■

PACKAGED PRODUCE

Cotonou's convenience foods

Whilst addressing the problem of post-harvest losses, entrepreneur Aldred Dogue discovered the ready-to-cook vegetable market and established Africa Food Mill to meet growing demand.

Inoussa Maïga

In Cotonou, 23-year-old Aldred Dogue sells pre-prepared, ready-to-cook vegetables that have been washed, cut and frozen straight from the field, to some 20 supermarkets. "Most of my customers are people who work, who do their shopping in supermarkets and who have a certain amount of buying power," confides Dogue, who targets middle and upper-class consumers.

The young entrepreneur has taken his time achieving his ambitions. "I started with carrots, green beans and cabbage. I made product prototypes that I proposed to supermarkets," he explains. "In the beginning [2017], I was processing barely 200 kg a month." Two years after its launch, Africa Food Mill transforms nearly 2 t of vegetables every month, which are bought from some 300 small-scale farmers grouped into four cooperatives. "We have a contract – I'm a regular client for these farmers and I only work with them. We agree on a price that suits them and that suits me," says Dogue.

While studying nutrition and food technologies at the Université d'Abomey-Calavi, Dogue was also working with farmers whose produce was perishing before reaching the market, and who asked him to help reduce their post-harvest losses. "I carried out a market survey and realised that there was a potential for ready-to-use vegetables," explains the young entrepreneur, who started buying the producers' unsold vegetables. "Even though their sales problem is not totally resolved, I think that I am a safe solution for them."

Dogue has several national and international distinctions to his name. In August 2017, 3 months after launching Africa Foods Mill, he received the Best Business Plan Award from the Young People's Chamber of Commerce in Benin, along with 500,000 FCFA (€760). In 2018, he was awarded the Anzisha prize worth US$7,500 (€6,800). The acclaim of winning the awards has helped him reach out to potential investors, and the prize money has gone towards renting a space so that he no longer processes the vegetables from home.

Dogue acknowledges that there are still challenges to overcome. "I still don't have the packaging I want. When I compare it with imported products, I don't think it's [the design] quite there yet. The goal is to get in touch with a company that can provide packaging that best promotes my products," he says.

In the near future, Africa Food Mill hopes to raise around €253,600 to establish a factory. "At the moment, we're doing almost everything by hand, so output is not yet on par with demand. I also want to be able to start transforming fruit such as mango and pineapple into dried fruit and juice," he explains. His ambition is to enter the Nigerian market with his vegetables within the next 5 years. "I've planned to buy refrigerated lorries for that. And after 8 to 10 years, I will replicate my model in other countries." ■

Founded by Aldred Dogue, Africa Foods Mill works with 300 small producers to provide ready-to-cook vegetable supermarkets

© ADONIS DOGUE/AFRICA FOODS MILL

VOUCHING FOR FARMERS

Crowdfunding platform supports Ivorian producers

In Côte d'Ivoire, a fundraising platform offers consumers the possibility to financially support small farmers in exchange for harvests at a discount.

Sophie Reeve and Vincent Defait

© SEEKEWA

Through Seekewa's crowdfunding platform, local consumers and international organisations are connecting Ivorian farmers with agri inputs and equipment

Interest-free financing is being provided to farmers by local consumers and international organisations through an Ivorian online voucher system; in exchange, the smallholder farmers sell their produce to the investors at below-market prices. The crowdfunding platform, developed by fintech start-up Seekewa, helps small farmers to create an online profile, which describes their farming activities as well as their material and financial needs for their production goals.

Investors registered with the platform purchase electronic vouchers for a minimum of US$25 (€22.85), which are then converted into 'points' that the investor allocates through the website against the farmers' required goods and services – such as seeds/other inputs, agricultural equipment or labour. Seekewa uses the credit provided through the voucher to purchase the services. "We don't give farmers monetary loans, but instead supply the equipment and services they need in order to improve their production," explains Serge Zamblé, president of Seekewa.

102 projects have been financed in Côte d'Ivoire through Seekewa

"We have partnerships with suppliers who give us very fair wholesale prices. In the centre of the country, for instance, machetes are sold near villages for 3,000 FCFA [€4.59]. Our supplier charges us 1,250 FCFA [€1.91] for them. This means that we can supply farmers with a machete for approximately 2,000 FCFA [€3.06]," says Frédéric Zamblé, managing director of Seekewa. "Our two main sources of income are discounts from wholesalers for the purchase of equipment and inputs, and margins achieved by selling on the harvested crops," explains Serge.

The farmer has 1 year to repay the costs of the services, with the understanding that Seekewa will purchase their harvest. The investor can then buy the harvested crop at a discounted price or donate it to a school or a hospital, for instance.

When a farmer is interested in joining the platform, Seekewa sends one of their analysts to assess the farm's needs and the potential for return on investment by analysing the soil, ease of access to the plot, the presence of a water source or an irrigation system, etc. "The analyst uses our app, Seekewa Insight to assess the farmer's skills. For a project to be eligible, it must be run by a farmer who has the skills. We ensure that the project is technically feasible and will be economically profitable," says Serge.

In Brihiri, in the south of the country, Sanogo Awa and her husband used to grow rice on a plot that was too small for them to earn a decent living. "I needed to expand my field to one additional hectare," she says. Seekewa allowed her to raise the necessary funds to buy an extra plot of land and increase her productivity. "I now have better profits and can help my community," she continues.

Launched in February 2018, Seekewa has so far financed 102 projects in Côte d'Ivoire, increasing the production of crops such as aubergines, cocoa, maize, onions, rice, peppers and tomatoes. A total of €80,000 has been raised to support farmers with contributions from around 50 private individuals and organisations, including the insurance company ASCOMA, Compagnie Ivoirienne D'électricité, the German development agency, Deutsche Gesellschaft für Internationale Zusammenarbeit, and the International Organisation for Migration.

The objective of the start-up is to finance at least 1,500 projects by 2021 and to supply at least 10,000 households in Côte d'Ivoire with fresh produce. "We are thinking of expanding our activities to Benin, Burkina Faso and Nigeria. Within 5 years, we want to be the leading supplier of fresh food produce in West Africa," states Serge. ■

MACHINE LEARNING

Offering crop advice and financing in Kenya

A Kenyan agricultural fintech company is using machine learning, remote sensing and mobile technology to boost yields and maximise smallholder farmers profits by providing them with customised advice and financing.

Bob Koigi

With bundled financing, insurance, advice and access to inputs, Apollo Agriculture has been supporting small-scale maize farmers since 2016. To access a loan from Apollo Agriculture, farmers send a free message to a USSD code; the company then uses data collected by field agents, as well as satellite imagery, to map the location and size of the farm and create a unique profile of each farmer. Using machine learning models that process this data, Apollo Agriculture automatically evaluates each farmer's creditworthiness and, once approved for a loan, customers pick up their financed inputs at their nearest agrodealer. Each loan is also bundled with insurance in the event of yield losses.

Pre-recorded interactive voice response (IVR) calls deliver content on farming techniques – developed by Apollo Agriculture's agronomy team – to farmers' phones, enabling the company to engage with farmers, regardless of their literacy level or remote location. Outstanding questions and/or concerns from farmers not addressed in the IVR calls are answered by calling a toll-free call centre. The bi-weekly calls are often made later in the day, when farmers are generally finished with their farm duties, but customers can request a call-back at a time that is more suitable to their schedule.

© APOLLO AGRICULTURE

Using machine learning, satellite imagery, and digital processes, Apollo Agriculture is providing inputs, advice, and insurance to farmers

Maize and bean farmer, Alfred Ayoko, recollects how instrumental the calls were in rescuing his maize during a Fall Armyworm invasion in 2018. "When the worms invaded our farms and started wiping out our produce in record time, Apollo Agriculture sent us advice on how to control the pest through simple practices like intercropping [beans with their main maize crop]. They were also very swift in assisting us with access to pesticides [in the form of an add-on loan] from the companies that they partner with to tame the spread," Ayoko recalls. He adds that the voice calls have filled a gap left by extension officers who, as a result of government cuts, have been less available to offer advisory services to farmers.

Benjamin Njenga, co-founder and director of operations at Apollo Agriculture, explains that Apollo's digital approach has reduced the cost of reaching farmers and allowed them to reach more farmers within a shorter period of time. Apollo Agriculture is now expanding into other crops including potato and sorghum, and partnering with more organisations to improve access to markets for farmers. ■

IoT

Tracking fishponds

A KENYAN TECH company is using a mobile app, Samaki (Swahili for fish), to help farmers monitor the conditions of their fish ponds, and collect data for daily record keeping and sampling, all of which is then relayed to farmers' phones in real time. The company, Upande, specialises in Internet of Things (IoT) based sensors and special cameras that monitor key conditions in a fish pond including the level and temperature of water, and pH, oxygen and nitrate levels. Thresholds are set for each sensor, which automatically alert a farmer by email or SMS when there is a change in condition. The data also enables farmers to analyse fish growth and monitor the efficiency of their farms to ensure they are making a profit.

Digital extension

Farming advice at your fingertips

IN ZIMBABWE, a mobile app is reducing the challenges associated with the delivery of traditional extension services. Kurima Mari provides farmers with information on the advantages and disadvantages of different crop varieties and livestock types, financial services, and contact details of dealers to simplify access to markets. Since 2016, over 10,000 farmers and 1,000 extension workers across Zimbabwe have registered with the app. It also contains an in-depth offline library for diversified agriculture literature, and a self-help toolkit for farmers which includes video tutorials, therefore complementing the existing work of extension officers. The app is available in English, Shona and Ndebele languages, enabling greater access for farming communities across the country.

SUSTAINABLE STIMULANT

Restoring quality for Zimbabwe's coffee-farming communities

Terracing and tree management are being adopted by Zimbabwean farmers, amongst other environmentally-friendly land management techniques, to revive coffee production and sustainable livelihoods.

Tonderayi Mukeredzi

Farmers in eastern Zimbabwe are receiving training and materials to produce coffee using climate-smart, sustainable practices. Through a 5-year AAA Sustainable Quality™ training programme (2017-2021), run by Nespresso in partnership with TechnoServe, smallholders are improving the quality and quantity of their coffee crops using land management practices, such as agroforestry.

"We used to randomly apply fertilisers but we have been taught new ways to build soil nutrition, such as through the use of composts. Last season, I used 17 composts after training and for my current coffee crop, I used 24 composts," says David Muganyura, who grows coffee on a 2-ha plot. Muganyura is also growing banana trees as shade cover for the coffee plants to moderate temperature and conserve crop moisture. Despite growing coffee for over three decades, Muganyura admits that the new, sustainable coffee farming methods are helping him to increase productivity. "For many years, we have been struggling to revive coffee production until TechnoServe came to provide us with environmentally-friendly ways of growing coffee," says Muganyura, who has seen coffee production increase among local smallholders from 10 to 30 t since 2018.

Miriam Mwarazi, another coffee farmer and member of the Batanai women's coffee growing group, was previously using unsustainable farming techniques. "I used to carry huge knapsacks to spray the crop but we were taught integrated pest management, which involves using insect trappers. Hence, I no longer use sprays because they are harmful to the environment," she explains. "The training programme has taught us to terrace our land to protect it from landslides or erosion, and to use mulching to preserve moisture in the fields," Mwarazi adds.

Although Nespresso has no contract with the farmers, being a part of the AAA programme enables them to sell their coffee to the company, which pays a premium to the farmers if they grow the crop sustainably. Nespresso says it will invest over €9 million over the next 5 years, as part of a 'Reviving Origins' programme, to bolster high-quality coffee production in Zimbabwe and other coffee-producing regions, such as Colombia and Puerto Rico.

Yann De Pietro, Nespresso's sustainability and digital manager says that at the start of the programme, adoption of good farming practices was very low with only 3% of farmers adopting more than half of the practices. However, after training was delivered in 2017 and 2018, the volume of export-quality coffee doubled from 26 to 51%. According to Daniel Weston, Nespresso's head of sustainability, the company bought 20 t of coffee from the smallholder farmers in 2018. "This project is not only bringing back some of the world's best coffee – it is bringing back economic opportunities in Zimbabwe's hard-hit rural areas," says William Warshauer, president and CEO of TechnoServe.

Midway Bhunu, TechnoServe's programme manager for the Nespresso Zimbabwe Reviving Origins programme says farmers are implementing nurseries to increase production on their farms. "We have established group level nurseries for shade trees as well as locally-adapted indigenous trees, which provide shade and coexist easily with coffee plants during long dry spells, and where farmers don't have adequate rainfall or irrigation, they need shade," says Bhunu. Seventeen nurseries have been prepared from which 5,000 shade trees will be planted at the beginning of the rainy season in November/December. "We have also provided harvesting and processing workshops to the farmers to achieve the quality Nespresso is looking for," Bhunu adds. ■

Zimbabwean coffee farmers are implementing new, sustainable coffee farming methods to increase productivity

Green wall

Defence again desertification

AN 8,000 KM wall of trees is being built in Africa through more than 20 countries, from Senegal to Djibouti, and aims to stop the impending desertification of the Sahara. A decade on from its launch, the wall is 15% complete, with 11.4 million trees planted in Senegal alone. In Burkina Faso, Mali and Niger, more than 2 million seeds have been planted from over 50 different species of trees. This buffer should stabilise and keep soils moist, slow the drying and scouring effects of the wind, and create a micro-climate to allow crops to grow around the trees. Once finished, the wall will be the largest living structure on the planet. "It's not a wall that separates. It's a wall of hope, a wall of life," says Niger's former Minister of Environment, Almoustapha Garba.

Weather-proof maize

Drought tolerant developments

FARMERS IN ETHIOPIA are phasing out old varieties of maize that struggle under drought conditions, to cultivate a newer, drought-tolerant variety. BH661, a hybrid developed by the Ethiopian Institute of Agricultural Research (EIAR), uses the International Maize and Wheat Improvement Center's drought-tolerant inbred lines and one of EIAR's lines. In experiments carried out by EIAR, BH661 demonstrated a 10% better on-farm grain yield, higher biomass production, shorter maturity, 34% reduction in lodging (breakage of stalk near ground) and 10% better grain yield, compared to previous varieties. "If we experience a drought, it may be not that bad thanks to BH661's drought tolerance," says local farmer Square Regassa.

SOIL CONDITIONING

Kenyan farmers reverse soil damage to boost climate resilience

Smallholders in Kenya are receiving training in good soil practices and the application of 100% organic inputs to scale up soil restoration and reduce plant stress under changing climatic conditions.

Sophie Reeve

Bean, coffee, rice and maize farmers, as well as fruit farmers in Kenya, are accessing affordable, organic inputs to boost their soil health and climate resilience. The products contain biodegradable materials, such as seaweed and plant extracts, which help to balance soil pH, increase moisture retention, and boost soil fertility to help crops survive harsh weather conditions. Since 2016, over 20,000 farmers have been trained in good soil practices and in the application of these products. As a result, banana and coffee farmers have doubled their yields, while bean, rice and maize farmers have seen at least a 40% increment within one season of organic fertiliser use.

Developed by Kenyan start-up, KOFAR, in collaboration with the University of Texas and Kenya research institutions, the formulations include K-Tiba (Reclaim); this soil stimulant works to reverse the damaging effects of continuous chemical inputs and enhance crop growth by reducing sodium content in the root zone. Another innovation is Tawi Plus, a foliar treatment which is used to increase carbohydrate levels within a plant and increase yields. A 120 ml bottle of Tawi Plus costs KSh 1,200 (€10.46) and contains strains of the high-nutrient seaweed kelp found in temperate oceans, as well as growth stimulants and specific vital trace elements, to improve plant health and reduce plant stress.

© JAMES KARUGA

KOFAR founder Francescah Munyi helps a coffee farmer to apply organic inputs to her crop

"What motivates me to work is to see the small-scale farmers who rely entirely on farming being able to increase their earnings and, at the same time, knowing that now the farmers who have used our products have cleaner and safer food to eat," says KOFAR founder, Francescah Munyi, who initially came up with the idea when she saw that productivity on her mother's farm was flagging. "At first I was sceptical about the KOFAR products, but 1 year later my fears have been put to rest, I even refer all my friends to KOFAR," says coffee grower John Murimi. Increased use of the inputs is also encouraging farmers to move away from synthetic fertilisers which, in turn, is helping to reduce emissions of the greenhouse gas nitrous oxide: "I used to use 7 bags of chemical fertiliser per planting season, now I only use one!" exclaims Joseph Munene, a rice farmer from Bahati.

The company is now looking for support to scale out the training and sale of its products across Kenya and the wider Eastern African region. ■

EDWARD MABAYA

Digitalisation: a complementary process

Edward Mabaya, manager of agribusiness development at the African Development Bank, explores what is needed to scale digital projects in Africa's food market to achieve development on the continent.

Susanna Cartmell-Thorp

Why do you feel digitalisation is so important for agriculture?

To answer that excellent question, one needs to step back and recognise that agriculture is central to the economic development of the African continent. A large percentage of the population in Africa relies on agriculture for livelihoods, and yet Africa is still importing about US$50 billion (€45 billion) a year worth of processed food annually despite the vast agriculture production potential. Along with this big challenge, there is the huge opportunity of feeding Africa; the food market in Africa is projected to reach about US$1 trillion (€0.9 trillion) by 2030.

So, while Africa has not yet achieved its green revolution, it is well poised to take advantage of the digitalisation revolution. In a way, this is the first revolution that Africa seems to be fully on board with. In recent years, internet connectivity and mobile phone penetration have been rising faster in Africa than anywhere else in the world and there is a lot of innovation taking place across the continent. Thus, there is a unique opportunity to use this momentum and to use this digital frontier to pull along the agricultural sector for continental development.

Agriculture, at its core, has not changed much for the last 100 years; crops still need fertiliser, good seed, sunshine, soil and water to grow. As development partners we need to continue to work on delivering these core ingredients to improve agricultural productivity on the continent. What is new with digitalisation is that we can deliver these solutions faster, cheaper and more efficiently to smallholder farmers in ways that could not have been done before. So digital solutions are an enabler and it is important to keep reminding ourselves that digitalisation is not a replacement to our previous activities, but is a complementary process to allow us to provide more targeted solutions to farmers more rapidly and cost-effectively.

What are the main challenges to scaling digital solutions for achieving impact and what needs to be done to overcome them?

First of all, I am excited about the prospects of these new and different solutions that are bringing a breath of fresh air to a sector like agriculture which seems to be dealing with perennial problems of low productivity, pests, diseases and climate change. We have numerous solutions across the continent and, according to the CTA/Dalberg report, *The Digitalisation of African Agriculture*, in 2018 there were at least 365 ICT and digital solutions actively operating in the African agricultural space reaching out to around 32 million smallholder farmers. These are impressive numbers for something that is relatively new, but they are nowhere near reaching the hundreds of millions more smallholder farmers who are needed to transform agriculture in Africa.

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Agripreneurial start-up Investiv, has been supported through the Bank's initiatives to embrace technology like drones to increase productivity

Most of these solutions are still very much in the pilot phase and we know that Africa needs more than just pilots;

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Edward Mabaya explains what the African Development Bank is doing to support governments and the private sector in introducing and scaling up digital solutions along the agricultural value chain

we need projects that can be scaled up fast. There are numerous challenges for achieving scale, some of which are highlighted in the report, but I want to speak to two key challenges – limited financing and the lack of large-scale platforms.

With financing, we know every revolution requires somebody to bank roll it in order to achieve scale. Most of the ICT projects that we have out there are stepped up small and medium-sized enterprises (SME) that have developed unique digital solutions that seem to be applicable but, for them to reach a larger number of farmers, large-scale financing is needed for project expansion within a very short time. We see a key role for development finance institutions, such as the African Development Bank. To that end, we have recently launched the 'Digital Solutions for African Agriculture' flagship initiative, which will support governments and the private sector in introducing and scaling up digital solutions along the agricultural value chain.

Regarding large-scale platforms, most SMEs are interested in developing their own databases and retaining as much of that information for themselves as possible and monetising that data. However, we know that scaling up requires a platform that is big enough so that the different, unique applications share information and data, allow the farmer to benefit the most, and ensure that the same information is not collected each time a farmer registers with an application. These large-scale platforms must be interoperable, meaning that they are able to exchange and make use of information across different products or systems. Governments have a unique role to play in developing these large-scale platforms. Any new applications or tools that are useful to farmers can be linked to the platform. We cannot achieve scale if every small project is uniquely interested in keeping information to themselves. The creation of large-scale platforms is critical to scaling up digital solutions to achieve the transformative impact that is needed across the continent.

How will the recent CTA/Dalberg digitalisation report inform the African Development Bank's work on digitalisation?

The timing of this report could not be any better; at the same time that this report came out, we launched our flagship programme on 'Digital Solutions for African Agriculture' and are still very much in the early stages of developing that initiative. The report was useful in mapping out the landscape of digital agriculture across the continent – it provides a comprehensive description of who is doing what, where they are doing it, and at what scale. Before this report came out, most players in this space were acting on very limited information. Now, with all this information about the players, the tools and the issues to be addressed, it is much easier to design projects in different countries.

I am delighted to have been part of the team that peer reviewed this report, which now serves as a reference manual for many institutions that are working within the digital agriculture space. For my team in the African Development Bank, *The Digitalisation of African Agriculture* report has been a useful document, especially by informing governments about the numerous potentials that digitalisation presents. We are using the report already in the early stages of designing projects and I think we will continue to utilise it as a key reference document. ■

PARMESH SHAH

Building an alliance for disruptive agri-tech

Global lead for rural livelihoods and agricultural jobs at the World Bank, Parmesh Shah, shares his opinion on how Africa can enhance its food systems through digitalisation for agriculture (D4Ag) collaboration and innovation.

Susanna Cartmell-Thorp

© SUSANNA CARTMELL-THORP

Parmesh Shah outlines how the World Bank is working to get digital platforms to connect with 1 million Kenyan farmers

The World Bank provides knowledge and financing to help close the global digital divide in least developed countries. What are digital solutions doing to help transform Africa's food system?

The four main issues which digital solutions can address in Africa's food systems have to do with productivity, markets, financial inclusion and data-based service delivery. Africa is at one third of the average global productivity for many commodities; the main reason for this is low availability of key inputs, as well as services, which are provided in a very traditional way. However, digital solutions can disrupt this and ensure that we reduce the productivity gap.

For example, there are a lot of commodities being produced in Africa but prices are low because there is no aggregation; digital solutions allow prices to be communicated quickly, enabling communities to aggregate faster and command a larger share of the markets and the value chain. Similarly, in spite of good financial inclusion overall in Africa, the availability of credit and insurance services is still very poor because we are still relying on bricks and mortar models of financial inclusion (i.e. physical spaces like commercial banks as opposed to online/mobile banking). The final thing is about data; a lot of data being collected is not converted into advisory services for smallholders very quickly. So, if we can tackle all these challenges, we feel that Africa can really transform its food system.

Kenya's most promising agri-tech innovations will be supported by a World Bank initiative, which aims to get 1 million Kenyan farmers on a digital platform over the next 3 years. Is this not overly ambitious?

We have been working for the last 6–8 months on how we can bring the excitement in the innovation and start-up world on fintech to agriculture. We have two projects in Kenya where we work across all 45 counties with 1 million farmers to increase their productivity and profitability. Earlier in 2019, we also participated as a partner in the Disruptive Agriculture Technology Knowledge Challenge event where we brought together digital innovators and stakeholders in Kenya from across the agri-tech spectrum under one platform, enabling sourcing of more disruptive solutions, which will be piloted with 100,000 farmers in World Bank-supported projects.

Our main task now is to create trust between all the platform players so that we can provide ongoing incubation over time. We chose Kenya because it is already a hub for the innovative fintech system; but whilst there are many innovative companies in the ecosystem on the financial side, they are not yet linked to agriculture. We find that Kenya has the best conditions, worldwide, to achieve this initially but we are planning to then launch smaller versions of this platform in other countries, like Ethiopia, Nigeria, Rwanda and other places, which also have elements of this ecosystem in place.

The recent D4Ag CTA/Dalberg report has proposed a global alliance model to try and address this issue. How does the World Bank see the development of such a platform?

We fully endorse the key recommendations made in the D4Ag report suggesting a global alliance for digitally-enabled agriculture as this sector will not develop unless a wider coalition of stakeholders comes together to support innovation. The coalition needs to include the data, IT and telecom companies, as well as agri-tech start-ups and innovators, producer organisations, agribusiness companies, commercial banks, fintech innovators, governments, research institutions and other development finance agencies. This alliance will create an enabling ecosystem for disruptive agri-tech and digitally-enabled agriculture. And in Kenya, we are working on developing this alliance as a proof of concept for how this could work. ■

Dossier

TRANSFORMING AGRICULTURE WITH ARTIFICIAL INTELLIGENCE

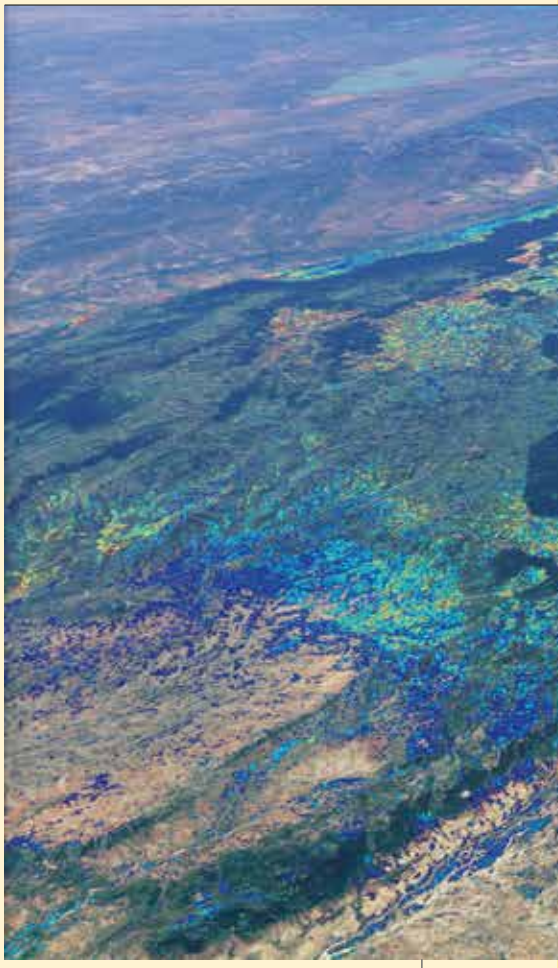
At a time where the world needs to produce more with fewer resources, artificial intelligence (AI) could help to transform agriculture worldwide.

DIGITAL AGRICULTURE

Making the most of machine learning on farm

The ability of agricultural equipment to think, predict and advise farmers via a variety of artificial intelligence (AI) applications presents Africa with the potential to achieve food security.

Tiane Cline



AtlasAI integrates satellite information and AI to provide data on agricultural outcomes, as shown with maize yields in Kenya

"AI is the broader concept of machines being able to carry out tasks in a way that is considered smart. The smart processes include machines being able to function automatically, reason and learn by themselves," explains Claudia Ayin, an independent ICT consultant. Machine learning is the aspect of AI that allows computers to learn by themselves. "Machine learning is therefore a branch of AI that is able to process large data sets and let machines learn for themselves without having been explicitly programmed," she adds.

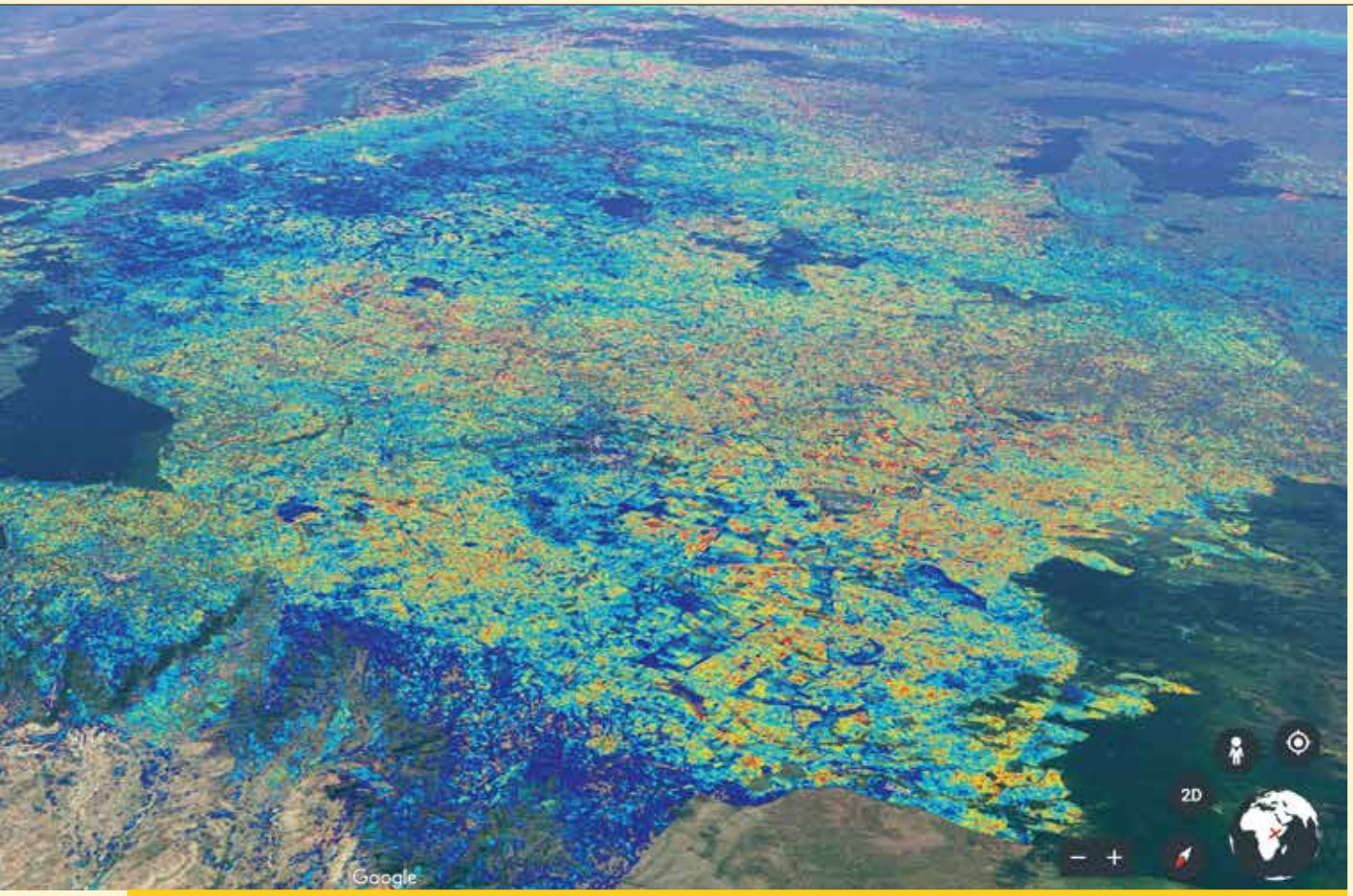
According to MarketsandMarkets, an Indian research company, in 2018 the worldwide AI in agriculture market was valued at €545 million and, by 2025, is expected to reach €2.4 billion as more and more smallholder farmers adopt new, data-driven technologies. With the help of data scientists and big tech companies, small-scale farmers in ACP countries are increasingly benefiting from the predictive abilities of AI and machine learning in order to access finance and insurance, predict yields and tackle pests and diseases, to run more profitable and 'smarter' sustainable farms.

Data matters

In order to develop effective AI solutions and understand how smallholder farmers use AI and machine learning, agri-tech companies need high-quality data. The future of farming therefore lies in collecting and analysing quality agriculture data in order to maximise efficiency.

Availability of data is crucial. For example, climate uncertainty increases risk for farmers. "It's not raining less, it's just more variable," explains Wesley Black, a farm planner from Bloemfontein, South Africa. "AI will become essential when it comes to helping small-scale farmers tackle climate change." So for climate resilience, crop and livestock insurance is a key element. However, data is crucial for insurers who need to know the likelihood of crop failure; lenders need to know the likelihood of default, and traders need to know where surplus and deficit regions are. But few, if any, data sources exist that provide this kind of mass information at a broad scale.

African scientists can now have access to free and open source satellite data as a result of a deal signed by the African Union with the European Commission's Copernicus programme in 2018. But using satellite data to predict weather patterns is no easy task. IBM, for example, processes data from multiple satellites using Watson's Decision Platform for Agriculture, which aims to combine predictive analytics, AI, weather data, and Internet of Things sensors to give farmers insights on ploughing, planting, spraying, and harvesting. Each satellite provides a digital image at different intervals, be it vegetation, soil and water cover, sea and land surface temperature or weather patterns. Using varied AI ›



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© AGRIPREDICT

AgriPredict uses machine learning to diagnose plant and animal diseases from photos taken by farmers on their mobile phones

AgriPredict: informed farming for Zambia's smallholders

A risk and disaster management tool using AI has been developed by Zambian agri-tech company, AgriPredict, to help smallholders overcome agricultural challenges, such as droughts, pests and diseases.

Using the AgriPredict web and mobile-based platform, Zambian farmers are able to take photos of a suspected diseased plant/animal in order to receive a diagnosis, options for treatment, if required, as well as location of the nearest agro-dealer. Through machine learning, the tool can also predict pest and disease occurrence, as well as forecast weather patterns, enabling users to take preventative measures to limit potential crop and livestock losses.

AgriPredict was founded as a result of *Tuta absoluta*, a tomato disease, and advent of Fall Armyworm that caused significant crop losses for Zambian farmers in 2016. "We noticed that there were no tools to help farmers mitigate, prevent or even counter these challenges," says Mwila Kangwa, AgriPredict CEO.

The appeal of AgriPredict lies in how the company has tailor-made the platform to enable easy access to a wide range of farmers; the information is easily accessible via web services, basic mobile phones (USSD and SMS), smartphones (Android and iOS) and tablets, as well as via a social media chat bot (Facebook). "The platform is built by farmers, for farmers. Our vision for AgriPredict is to become the biggest data hub in Africa, providing proper insights to enable farmers to make better informed decisions," says Kangwa. The platform is currently under further development to include both voice and visual features to overcome digital literacy barriers.

"AgriPredict has been cost saving; it tells me what disease is affecting my tomato. Before, I would have had to employ a full-time agronomist to help with the running of the farm, but ever since we started using AgriPredict, it cut down that cost completely," says farmer Yunike Phiri.

Initial development of the platform was made possible with support from the SNV Netherlands Development Organisation for a pilot project focusing on Zambia's tomato and maize value chains. The pilot, which was launched in October 2018, involves 22,000 farmers in the Eastern Province and included training sessions on app utilisation, site visits and gathering feedback from farmers. A social media campaign '#coolfarmers' is also underway to promote the technology and increase interest among youths.

Maduka Emmanuel

› techniques and algorithms, IBM puts together all the data points to create a more in-depth and usable image of a farm: "Every day we receive around 45 terabytes of data but the data cannot be used as is. Every satellite gives you a portion of a farm, but not one gives you an actual representation of the farm. With AI, we fuse all these images together to get the full picture," explains Kommy Weldemariam, IBM Research Africa's chief scientist.

AI potential for protecting against pests

Besides climate change, pests and diseases are a key challenge for small-scale farmers and is one that will be further exacerbated by climate variability. Each year, according to CABI estimates, about 50% of Africa's crops are lost to pest and diseases.

"Hundreds of millions of African farmers are already suffering from the effects of climate change," says David Hughes, an entomologist from Pennsylvania State University, and the leader of the project that created PlantVillage Nuru, an Android tool, which has been developed to diagnose crop diseases even without an internet connection. Developed by Penn State's PlantVillage and the International Institute of Tropical Agriculture, Nuru is used in several African countries, including in Kenya in collaboration with SelfHelp Africa to diagnose mite and viral diseases in cassava, as well as to identify fall armyworm infections in maize. Advice from experts – mainly at CGIAR, FAO and governments – is sent offline and in local languages (currently in Swahili, French, Twi, Hindi and English). Although still in beta testing, 28,000 cassava farmers across seven counties in Kenya will benefit from the tool this year. "Digital tools are increasingly becoming integral components... of identification, monitoring, training, and decision-making of globally-important crop pests and diseases," Hughes states.

A new AI tool that can predict crop growth and help protect vital food supplies from intensifying heat is being added to Nuru. It uses data from a UN satellite that tracks a decade's worth of information about water availability, along with weather forecasting, to determine crop productivity. "AI offers the potential to get a single set of eyes to look at this problem," says Hughes. "Nuru is like an extension officer that is always there for farmers, in their fields."

Hughes believes that in low-income countries that lack human capital in fields like agricultural science, there is an opportunity to use AI to help break the cycle of poverty. Founded in August 2018, Agrix Tech, based in Yaoundé, Ghana, is also using AI to help farmers tackle pests and diseases. Using a mobile phone app, farmers scan the leaf of an infected crop. The app uses an AI library to analyse the issue and provide treatment recommendations via text and voice messages, in customised African local languages, for those who cannot read. According to Adamou Nchange Kouotou, Agrix Tech's founder and CEO, the app has a 99% accuracy rate and, most importantly, does not need the internet to function.

Banking on AI

In order to deliver economic and agricultural insights to farmers throughout Africa, AtlasAI – a Silicon Valley tech company that addresses economic data and market intelligence needs in developing countries – uses technology that integrates satellite information and AI with high-quality data from the field. AtlasAI currently generates data for all African countries and is working with organisations that serve governments and farmers in multiple countries: "At AtlasAI, we use cutting edge AI and satellite data to provide granular, accurate, and scalable data on agricultural outcomes across the continent," explains Marshall Burke, a professor at Stanford University and one of AtlasAI's three co-founders.

For example, smallholder farmers are underserved by most financial markets; they have difficulty borrowing, they are unable to buy insurance, and they are often at a disadvantage in non-competitive trading environments. With AI and the right data sources, this is an issue AtlasAI looks to solve: "Having accurate, low-cost data on smallholder farmers allows companies to actually design products and services that fit their needs," adds Burke.

Moving from products to homegrown services that incorporate advanced agricultural analytics and AI is something Hello Tractor, a US start-up based in Kenya and Nigeria, has made work.

Uses of AI in agriculture

Small-scale farmers in ACP countries are increasingly benefiting from the predictive abilities of AI and machine learning.

Weather forecasting

Using deep learning algorithms, AI can analyse vast data sets to provide short-term weather forecasts and long-term climate predictions.

Automating farm equipment

Smart farm equipment can coordinate with sensors and data from drones/satellites to optimise performance and service delivery.

Predict/estimate crop yields

By analysing satellite data and high-quality field data, AI is being used to predict/estimate yields at farmer and country level.

Access finance and insurance

The use of AI enables lenders to undertake credit risk assessments for farmers and predict the likelihood of default.

When Hello Tractor first launched in 2014, their flagship product was an affordable, ultra-low horsepower, two-wheel tractor fitted with monitoring technology. "We sold these to enterprising farmers or cooperatives, who then accessed our tractor-sharing platform to identify and service additional demand from smallholders," explains Jehiel Oliver, Hello Tractor's CEO.

In January 2017, Hello Tractor made the strategic decision to focus more on their application than on the tractors themselves. It proved to be an effective model, allowing Hello Tractor to capture 75% of private commercial tractor inflows to Nigeria, expand to five markets across Africa through strategic partnerships, and touch the lives of over 250,000 farmers.

Hello Tractor, in partnership with IBM, is now piloting an advanced agricultural analytics and decision-making tool that cuts across the mechanisation ecosystem. Their data sets are used for fertiliser, seed and financial companies to access real-time, unfiltered information about a farm. "Utilising AI, farmers on the Hello Tractor platform gain access to timely and relevant information to increase their yields, tractor fleet owners receive insights to save time and earn more, and banks are empowered with information for better underwriting and portfolio management," explains Oliver. "More specifically, we can apply machine learning to not only help predict when farmers should receive their tractor services, but this data can also be mined to develop advice on what inputs should be applied and when," he says.

© HELLO TRACTOR

By utilising AI, Hello Tractor's platform provides farmers with timely and relevant information to increase their yields

Thinking of Africa

From IBM to Deloitte, Amazon Web Services and Google, there are many key corporate players which are working throughout the African continent and partnering with smaller companies and farmers to create locally-relevant AI-focussed solutions. "With AI, we have the potential to unlock increased yields, higher revenues and lower losses," says Isaac Sesi, the co-founder of Sesi Technologies, an agri-tech company which develops hardware and software solutions for farmers and agribusinesses in Africa. "Yet, it is necessary that these AI tools are developed taking into consideration the context of local agriculture in Africa to ensure that these solutions are relevant and applicable to African ›

Crop and soil monitoring

Algorithms process and analyse data captured by drones/satellites, sensors and smart phones to assess crop and soil health and identify plant diseases.

Livestock management

AI-enabled sensors can detect livestock diseases, connect farmers to veterinarians, and provide alerts on animal movements.

"Having accurate, low-cost data on smallholder farmers allows companies to actually design products and services that fit their needs"

› agricultural systems, thus necessitating that Africans, who best understand African problems more intimately, be at the forefront of the development of these tools."

Microsoft, through its 4Afrika Initiative, supports the digital transformation of African agriculture. "A while back we noticed that agricultural companies were trying to make sense of things like big data, AI, machine learning and analytics. These things rapidly moved their way into agriculture and most companies were not equipped to handle or deal with these new technologies. The need for technology companies like Microsoft to help them navigate this shift is critical," says Amrote Abdella, Microsoft 4Afrika's regional director. "We believe technology advancements have the potential to drive significant economic growth and societal impact, specifically because technology is able to bridge gaps in infrastructure that have previously kept people locked out of the formal economy and unable to access essential services on the continent."

Working with Felix Musau from Kenya, Microsoft helped to develop AGIN, a mobile and Azure cloud-based service

"With AI, we have the potential to unlock increased yields, higher revenues and lower losses"

that connects farmers to much-needed credit services. Using mobile phones, farmers can capture information like farm size, location, soil composition and crops grown. Using Azure's built-in AI and machine learning tools, AGIN then helps farmers to establish a credit profile, allowing them to access resources like small loans, with credit lines they can use without ever visiting a bank.

AGIN has served over 140,000 farmers in Kenya and facilitated over US$1.3 million (€1.2 million) per month in transactions, including loans and insurance. After receiving financial and technical support from Microsoft 4Afrika, AGIN now has hopes to expand its reach to 300 million farmers in sub-Saharan Africa by 2020.

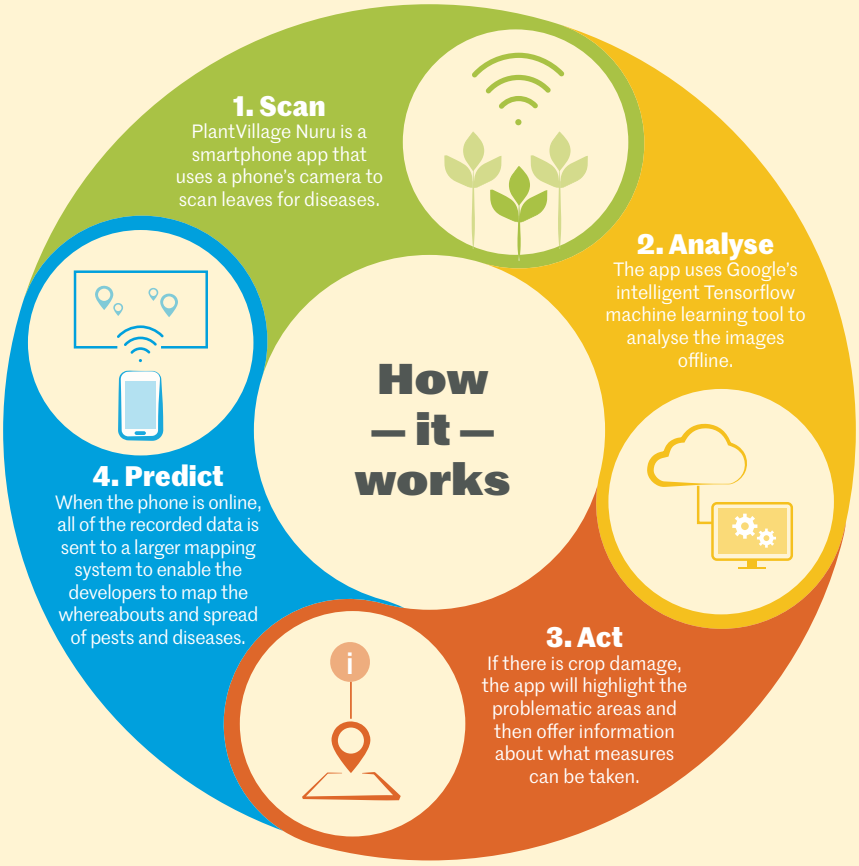
Microsoft 4Afrika also works closely with Tulaa, a commerce solution for rural African farmers. Tulaa uses mobile technology and mobile money to enable farms to save and borrow to purchase inputs and agricultural advice, and market their crops at harvest. Though 4Afrika's AI PopUp Lab in Kenya, Microsoft assisted Tulaa with integrating machine learning into their model to assess credit worthiness. "AI and machine learning offer unprecedented opportunities to reach millions of farmers far more efficiently than we could in the past. At Tulaa, we are only beginning to realise the potential of this technology to transform supply chains and the lives of smallholder farmers," says Hillary Miller-Wise, Tulaa's CEO.

"The ability for platforms like Tulaa to scale will be driven in part by our ability to harness the power of AI. The zeitgeist now is around bundled services and platform solutions for smallholder farmers. One of the major reasons that these models are emerging is the availability of AI and machine learning that was not there even 5 years ago," adds Miller-Wise. CTA is also encouraging young developers to embrace data analytics and AI. During the 2019 edition of Pitch AgriHack – CTA's competition supporting young digital agriculture start-ups – a special prize on 'Data Analytics' was awarded.

The future of agriculture is set to be more automated and data-driven. With innovative, African-driven solutions that make use of AI, smallholder farmers throughout the continent will be able to make smarter, data-driven decisions, becoming more proactive and profitable, as they farm for the future. "We're just at the start of a revolution in AI," says Tom Ilube, a futurist and the founder of the African Science Academy in Ghana. "At the heart of AI is the algorithms that drive it. These algorithms define the future. If Africa is going to be a part of the future, we need to be defining the algorithms that tell us what the future looks like." ■

PlantVillage Nuru

Nuru uses AI to diagnose mite and viral diseases in cassava, and fall armyworm infections in maize



SOURCE: PLANTVILLAGE, 2019

INTERVIEW

Amrote Abdella: Enabling data-driven farming to increase productivity

Tiana Cline

Amrote Abdella, highlights the importance of enabling Africans to fully utilise AI and Internet of Things (IoT) technology to meet Africa's needs.

With so many different agri-tech companies working on AI in Africa, where do you think are the most promising developments?

A lot of agri-tech solutions focus on connecting farmers to finance, information (such as weather and pricing) and resources. This is much-needed, especially since a large portion of rural farmers are unconnected and unbanked and struggle to access products like insurance and farming inputs. The majority of our efforts with our partners focus on the utilisation of AI and IoT to enable data-driven farming to increase farm productivity.

What do you feel is needed to ensure that AI solutions are developed by Africans to meet Africa's needs?

Despite some 400 agri-tech solutions already in play, 90% of the market remains untapped. The use of those solutions by farmers on the continent is dependent on a solution's usefulness, affordability and availability. To achieve this, three things are needed: first, laying the foundation for digital skills in agriculture. This includes the ability of entrepreneurs to recognise and pursue opportunities in agri-tech and agribusiness, and farmers having the ability to meaningfully use technologies. Second is an enabling environment, which includes policies and infrastructure to support the digitisation of agriculture. Many farms still lack the power and connectivity that AI-enabled solutions need. Our FarmBeats project adopts an end-to-end approach to help solve this by introducing low-cost, solar-powered technologies and alternative broadband solutions, like TV white spaces, which uses unused frequencies in the TV spectrum to generate high-speed, widespread broadband in last-mile areas. Finally, research and development in the agri-tech space is needed to boost innovation and knowledge-sharing.

A World Economic Forum 2018 gender gap report highlights that only 22% of the world's AI professionals are women. Where does change need to happen to reduce this gap?

Change needs to happen at a school and cultural level to encourage more young girls to pursue careers in science, technology and engineering. This is something Microsoft is actively working on through initiatives such as DigiGirlz and WISE4Afrika, which provide digital skills training and mentorship to young girls. In June 2019, Microsoft also hosted its first LEAP (Lending for Education in Africa Partnership) hackathon for 32 female developers, which challenged Kenyan participants to design agri-tech solutions. The competition winner, The BugSlayers, used Microsoft AI to enable pest and disease prediction. The creators have since been placed in 4Afrika's internship programme, where they're developing the capabilities to fine-tune the software before going to market. As more young girls get the opportunity to participate in this type of mentorship, we hope more will feel confident and encouraged to join the tech field.

What AI impacts do you hope to see being achieved with the new collaboration recently established between Microsoft and the Alliance for Green Revolution in Africa (AGRA)?

Our partnership with AGRA is one of knowledge transfer and ecosystem building, with the goal of supporting land optimisation and food security. The partnership will support our end-to-end approach to ensure AI is meaningfully adopted. Our focus will be on increasing data-driven precision farming through the use of AI and big data analytics, as well as advocate for the development of national digitisation policies.

There is also a very big need for us to invest in skills development, to improve digital skills within agriculture through digital content and internship programmes. This will build the foundation of what will be the full revolution of agri-tech in Africa. We believe Africa has the potential to significantly contribute to global food security. We believe technology can empower local farmers to support this growth.

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Amrote Abdella, regional director of Microsoft @4Afrika, is working to enable and accelerate digital transformation opportunities across the continent.

UGANDA

Monitoring livestock vitals with machine learning technology

AI-enabled chip and sensor technology, mobile application mapping veterinary services, and drones fitted with thermal sensing, are transforming the way livestock farmers monitor and protect their animals.

Bob Koigi

In Uganda, a new technology is embracing AI and machine learning to detect livestock diseases 2 days before they manifest, connect farmers to veterinary officers and monitor animal movement to avert theft. The innovation, dubbed Jaguza Luganda, constitutes a chip with a sensor that is connected to a radio-frequency identification (RFID) reader, and to users' mobile phones or computers. Since 2016, 18,000 Jaguza chips have been installed.

The chip and sensor technology is attached to an animal's ear, and an RFID reader is able to detect the sensor in the chip from up to 300 m away, or even further if an antenna or radar is installed to bolster the frequency. The chip monitors vital information about the animal, including temperature variations, feeding patterns and reproductive stages through the smart sensor, and is able to detect diseases 48 hours before they manifest, allowing for timely medical attention. "We use Jaguza to predict problems earlier, detecting cases like lameness or digestive disorders and provide recommendations to farmers on how to keep their cows healthy and improve the efficiency of their farms. Using these insights, we're already seeing a 35% increase in livestock production on our customers' farms," says Jaguza's founder, Ronald Katamba.

The technology can also track livestock movement and alert farmers, through mobile messages, in the event that animals wander beyond farm boundaries. "Jaguza learns patterns about a cow's movements from the sensor. We use this data to develop machine learning models and Tensor Flow algorithms," explains Katamba. The technology has also been effective in reducing cases of theft that

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are rampant in Uganda's livestock rearing regions. Charles Walugembe, who keeps 180 cows began to trial Jaguza in 2018. He chipped 50 of his exotic cows that were bringing him the highest returns for their meat and milk. "For the longest time, we have been hiring armed guards to watch our cows. We have been spending almost half of what we earn from our livestock to pay these guards and other protection methods like fencing, but somehow we still manage to lose them. Since using Jaguza, I am able to track movement no matter where I am and we haven't had any cases of missing livestock," he says.

Jaguza's chip and sensor technology is attached to an animal's ear to read vital information about the animal, including temperature variations

Mobile management

The Jaguza Livestock mobile application, which has 85 veterinarians signed up and on standby to respond to farmers' inquiries, compliments the sensor device. Using GPS, the app maps out the farmers' proximity to a veterinary officer, and provides information on the vet's specialisation and availability. Information on good livestock management practices, including feeding and disease detection is also provided on the app, which is available on both Android and iOS mobile devices. In order to reach farmers who are not connected to the internet, the technology is accessible offline through a USSD code. Over 1,250 users have downloaded the app to access livestock information, and both the sensor devices and the app have attracted farmers beyond Uganda – in Fiji, Mozambique and Namibia.

In a bid to streamline livestock keeping, the app also has a provision for record keeping, allowing farmers to record expenses and earnings. Dan Kisitu has been rearing cattle in Uganda for the last 15 years and signed up with Jaguza in 2017 to monitor his 40 cows. Besides managing to tackle common diseases like foot and mouth disease, rinderpest and East Coast fever, he has used the Jaguza app for record keeping, which has seen him reduce expenses. "I used to spend a lot of money on veterinary services and medicines, especially due to frequent disease outbreaks from which I lost a number of cows. Beyond getting alerts on any health issues of my cows before they escalate, I have managed to bring down expenses like feed and supplements by up to 50% using the electronic record keeping that allows me to identify where I am overspending," says Kisitu. "I have also been able to access information on good farm management practices for feeding, vaccination and reproduction, in a place where extension services are no longer readily available due to the scarcity of government officers," he adds.

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Large-scale livestock farmers are monitoring the health of individual cows using drones fitted with high definition cameras and thermal sensing technology

Scaling out with drone sensors

To cater to large-scale farmers, Katamba is using drones fitted with high definition cameras and thermal sensing technology. The drones, which are connected to the farmers' phones through a cloud-based system, track the animals' body temperatures and alert the farmers in the case of sickness. Where it might usually take up to a whole day to count each cow reared by large-scale farmers, the drones take on average 15 minutes to do a headcount. "Our drone tech uses 'smart cameras' that are powered by AI and facial recognition to identify individual animals in real-time. The cameras monitor the animals' presence on the farm and send real-time information to the farmers' mobile and computer. There are two signs, a red one which indicates that the cow is sick or unavailable and a green one indicating the cow is fine," he explains.

Despite the success of the technology, which has seen Katamba invited to Texas to promote Jaguza to livestock farmers in the area, he notes that regulations for flying drones in Uganda are not yet in place and poor internet connectivity has stood in the way of project implementation. "Drones are still banned in Uganda despite the numerous benefits they deliver to ordinary people. We are in constant communication with the government to have a policy shift in recognising these emerging technologies while investing in increasing internet connectivity to allow easier adoption of the innovations," says Katamba, who obtained a license to operate only after receiving a letter from the Chief of Defense Forces and the Uganda Civil Aviation Authority.

Jaguza is a member of the CTA AgriHack network, which supports young digital agripreneurs with capacity building opportunities, and was among the 2016 finalists of the Pitch AgriHack competition. The company won first prize as a mature start-up in the 2019 competition at the African Green Revolution Forum in Accra, Ghana. ■

SENEGAL

SOWIT: digital imaging of agriculture in Africa

Remote sensing and AI is being used by agri-tech start-up SOWIT to help African farmers in 15 countries optimise their crop yields.

Vincent Defait

For Hamza Bendahou and Rkha Chaham, tomorrow's agriculture will involve planting, fertilisation and irrigation, while also tapping the potential of algorithms and AI. These young entrepreneurs and co-founders of SOWIT – a start-up that provides "decision support systems that allow African farmers to optimise their operations efficiently and sustainably" – are committed to harnessing the power of drone- and satellite-based remote sensing and big data to fill the agricultural information void across the continent.

Founded in 2017, SOWIT has offices in France, Morocco and Senegal providing decision-making tools using state-of-the-art agricultural technology. The company combines field measurements, satellite images and more precise images captured by drones, supported by algorithms, to help farmers across 15 African countries to assess water and input needs and determine ideal harvesting times.

"AI enables us to better foresee how a situation will develop with less data," explains Chaham. "We collect information such as the reflectance (ratio of the amount of light reflected by plant leaves to the amount absorbed), plant architecture, size, etc. All of this gleaned crop information is dovetailed in a smart way with data gathered in the field. The aim is to ensure that the match between the virtual measurements and the actual situation in the field is reliable."

Better forecasting with less data

In Morocco, where SOWIT is firmly established, Abdelaziz Mernissi, a wheat, barley and olive producer in Saiga region, says, "In 2018, the lack of information regarding the main production operations (preliminary cultivation, seeding, fertilisation, crop protection, harvesting and marketing) held me back from making the most of the cropping season, despite the fact that we had benefited from more than 500 mm of evenly distributed rainfall." He continues, "Yields were 6 t/ha in some parts of the field while, in others, we were only getting 1 t/ha."

However, after mapping his field, SOWIT analysed the resulting data and provided Mernissi with a detailed real-time assessment of his crops (including crop health, growth and water needs), and an estimate of fertiliser requirements. SOWIT also helped Mernissi identify different factors that could

be deployed to improve his yields: optimal sowing date, the most accurate amounts of fertiliser to apply, irrigation tailored to the observed water stress conditions, etc. With this field intelligence, Mernissi was able to save 33 kg/ha of fertiliser, representing per-hectare gains of more than DH 700 (€65.74).

Precision drone imaging

In Sudan, SOWIT supports farming companies growing alfalfa, which is an important forage crop for livestock feed while also being a mainstay of the country's export economy. Alfalfa growers are hampered by high costs of imported fertiliser. "Our drone operator will assist these farmers throughout the season, provide them with information on the fertilisation and harvest period, and indicate exact fertiliser amounts to apply, and where, in order to maximise yields," says Chaham.

© GIACOMO RAMBALDI

SOWIT uses precise images captured by drones, supported by algorithms, to help farmers assess water and input needs and determine ideal harvesting times

Satellite images may be helpful in this quest, but are limited to a few pixels per hectare and thus can only serve to take into account the heterogeneity of the fields. Conversely, the resolution of higher frequency drone images taken below the cloud cover can reach several million pixels per hectare. So these pictures generally contain a wealth of information to fine-tune crop forecasts. "Time and scale are our main obstacles [to achieving good yields]," explains Faisal Mohamed Ali, operations manager for DAL Agriculture, a Sudanese conglomerate. "Through drones, we know what's going on (in the fields) and we can quickly intervene."

Drone services are affordable for large-scale producers but less so for smallholder farmers cultivating small plots. SOWIT is working in Ethiopia with the Agricultural Transformation Agency (ATA) and the Ministry of Agriculture on a CTA-led project and, by August 2019, had trained six drone pilots and six data analysts to work with the Ethiopian agencies, which are planning to roll out the data analysis services to cooperatives across the country. "The pictures and videos [taken by drones] will be used for analysis and agronomical interpretation on yield and crop health, facilitating timely intervention," says Techane Adugna, director of the Agricultural Commercialisation Cluster at ATA, while pointing out that, "The use of drones will also facilitate market linkage for the farmers by collecting real-time visuals from agricultural fields and sharing them with possible buyers."

> "Through drones, we know what's going on (in the fields) and we can quickly intervene."

And what about smallholders?

Although SOWIT works with small-scale farmers in many African countries via cooperatives or government agencies, AI services can still be unaffordable for many African farmers. "It all boils down to economics of scale," explains Giacomo Rambaldi, senior programme coordinator ICT4Ag at CTA and co-author, with Chaham, of *Drones on the Horizon – Transforming Africa's Agriculture*, a report which the African Union used in January 2018 to recommend that all African states use drone technology. "Drone technology and related AI can be deployed among smallholder business-oriented farmers growing the same crop in contiguous areas. Packaging drone-based advisory as part of other services (credit, mechanisation, etc.) offered by cooperatives or agribusinesses to their members is also a win-win option."

"CTA supported the conduct of applied research among smallholder farmers in Benin, Burkina Faso, Ghana and Rwanda (on-going)," Rambaldi explains. "The results of this research will form the stepping stones for farmers and other actors to take informed decisions on whether to trust, pilot-test and finally embrace this transformative technology." For the time being, SOWIT and the likes are pioneers on the Africa continent. ■

NIGERIA

Artificial intelligence: matching food demand and supply

A Nigerian start-up is using AI to guarantee markets for smallholder farmers and improve procurement efficiencies for large buyers.

Oluyinka Alawode

Foodlocker, a Nigerian foodstuff and grocery aggregator for large buyers, uses deep learning (a sub-branch of AI) for forecasting demand for farm produce and consumer goods. Deep learning uses layers of algorithms, called 'neural networks', and large amounts of data to enable computers to solve complex problems; the more the algorithms learn, the better they perform.

Launched in 2017, Foodlocker uses deep learning for assessing demand from its clients (food processors, exporters, hotels, restaurants, bars and retailers) for different commodities or food products (including rice, yam, legumes, poultry, condiments, cooking oils, cereals and beverages) through its e-commerce platform. Deep learning is then used to analyse historical trends data and forecast the quantity of each commodity that will be needed at certain times of year. This information is provided free to smallholder farmers the company is working with – through mobile phones and field agents – helping to take the guesswork out of what to produce, in what quantities and when.

Farmers are also provided by Foodlocker with offtaker guarantees, which specify quantities and pricing of goods as a way to guarantee them with a market. "I started out raising 100 kg of chicken for Foodlocker," says chicken farmer, Emperor. "Now demand is close to 1.8 t every month and I have had to expand and partner with other farmers."

"Deep learning allows us to not only anticipate and forecast demand, but also plan production schedules, influence the production programmes of smallholder farmers, and procure efficiently in order to meet expected demand," explains Foodlocker co-founder, Jennifer Okoduwa. "Deep learning is a very effective tool that allows us to provide clear demand requirements to farmers and guarantee market access." For large buyers of food commodities and products, deep learning enables Foodlocker to guarantee pricing regularity and the availability of quality produce.

Okoduwa adds, "We also provide inputs, access to high-yield varieties, and extension support through our partners. This ensures that farmers suffer fewer losses, increase their production and thus their profits, and are more incentivised to produce." Once harvested, Foodlocker collects the fresh produce from the farms and delivers it directly to its large buyers, who have pre-ordered. In addition, Foodlocker provides logistics and cold storage infrastructure, and lightly processes smallholder farmer outputs to be sold to other buyers through the firm's e-commerce platform or other sales channels. For example, the firm will clean and package rice into small bags, cut chicken into fillets, and degut fish.

© FOODLOCKER

Jennifer Okoduwa's company, Foodlocker, uses AI to forecast demand for farm produce to help farmers know what to produce, in what quantities and when

"Given the perishability of food and the infrastructural challenges in Africa, deep learning gives us a solid advantage over businesses that are just e-commerce platforms," Okoduwa adds. With accurate forecasting of future demand for food items, Foodlocker is able to reduce waste compared to other platforms that may over- or under-estimate food needs, and can provide assurances to its customers that they will be able to meet their demands. "Our aim is to upscale the business, from 600 smallholder suppliers currently to over 20,000 suppliers within the next 10 years," Okoduwa states.

In recognition of its innovative use of deep learning, in September 2019, Foodlocker won CTA's Pitch AgriHack Data Analytics Award. As well as receiving €10,000 in prize money, Foodlocker will also benefit from additional business support to help it improve its use of AI and grow the enterprise. ■

SPORE

Agribusiness

BEAN CHAMPIONS

Nigeria's rural women revolutionise local locust beans

A food manufacturing start-up is upscaling the potential of a cheap, nutritious local crop and providing rural women with access to a reliable market.

Emmanuel Maduka

In Nigeria, African locust beans are being transformed into affordable and nutritional dried bean seeds. Agri-processing company, LifePro Food Mills, which is based in Akure, south-western Nigeria, is working with women farmers to produce 750 kg of processed bean seeds each month. Under the brand name 'Hiru', the company currently sells to over 50 outlets – mostly supermarkets – within the country, as well as to UK and US markets.

Locust beans are an indigenous plant grown for their pods with the seeds crushed and fermented, mostly by rural women farmers, for processing into seasoning for soups and stews. Despite the nutritional properties of the beans, which are high in calcium, the crop has previously not been commercialised due to issues associated with the smell of the produce and poor shelf life. These issues arise from basic local processing methods, such as sun-drying the beans in the open.

To overcome these challenges, Adebowale Oparinu and Emmanuel Maduka co-founded LifePro Food Mills in 2018. "At the moment we are working with 20 women in rural areas whom we call our 'Hiru Champions'. We train them on hygienic ways to pre-process the bean seeds, which we buy from them at attractive prices to finalise processing in our factory. The women earn about €13.50–€22.50 each day depending on their production capacity. We aim to have empowered 200 women by 2020," says Oparinu.

To meet the supply demands of the company – and knowing that they have a ready market for their produce – the women 'champions' have scaled their production from 80 to 240 kg per week. They are trained by the start-up to pre-process the seeds by softening the pods (by boiling them) and manually depodding the seeds. LifePro Food Mills then reduces the beans' moisture content using a heat pump dehydrator, processing them into either a dried form or powdered product. The beans, which are packaged in 200 g pouches and have a shelf life of 1 year, cost ₦850 (€2.08) and are delivered to customers in Abuja, Akure, Ibadan and Lagos for free.

LifePro Food Mills processes African locust beans into nutritional dried bean seeds to sell under the brand name 'Hiru'

© EMMANUEL MADUKA

The LifePro team was able to secure ₦7.5 million (€19,000) in funding from an I-Startup Southwest Demo Day organised in 2018 by the Premier Hub Innovation Center in Akure. They used the investment to set-up their factory, purchase equipment to maximise production capacity, and reach out to more rural women. Funmilayo Faponda from the Ibule Soro local government area of Ondo State is one of the Hiru Champions. Prior to linking up with LifePro Food Mills, she was producing locust beans whilst also working as a cleaner to boost her income. "I feel so happy working with them [LifePro]. It has helped me take care of my father and two children; the constant income helps me eat well and buy needed supplies. I sell what I produce at better prices and can even produce much more with the assurance of selling it," she says.

750 kg

of processed bean seeds are produced each month by LifePro Food Mills

€13.50-22.50

is earned by women farmers each day

The company is continuing to innovate new bean-based products and has been working on a patented bouillon cube to be launched within the next 2 years. In 2020, Oparinu also hopes to expand into the Ghana market. ■

ECO-FRIENDLY STRAWS

Uganda's local grass reduces plastic use

Rural women farmers are earning additional incomes by harvesting a wild grass variety and selling to a local start-up for processing into biodegradable straws and stirrers.

Grace Musimami and Vincent Defait

A Ugandan agri-processing start-up is addressing the country's excessive use of plastic by exploiting a local wild grass, Luseke, to make biodegradable straws, whilst providing women farmers with a new source of income. Since its launch in March 2019, the company, Our Roots Africa, has sold some 10,000 Luseke straws to local and international restaurants, hotels and private customers.

Two hundred women farmers – 20 at the Our Roots Africa production centre, and 180 supplying the grass – are supplementing their earnings by working with the start-up. "Our aim is to have an impact on the daily income of women," explains Nakawuki Stella Lukwago, one of the company's six employees, which is based 40 km west of the capital Kampala. According to Lukwago, the collection and transformation of Luseke grass enables the women farmers to earn an additional €18-45 a month, which is a significant amount in a country where the majority of rural women live on less than US$1 (€0.9) a day. This is the case for Atim Harriet, who earns USh 5,000 (€1.25) per collection day. "Before joining this project, life was difficult. I struggled with household responsibilities," says the farmer, who can now provide for her family's needs. "We ensure that the women also have enough time to farm for their family," points out Lukwago.

Our Roots Africa trains the women to select and collect the grass, which grows with a hollow centre, without damaging them. At the production centre, the grass is then sorted by size and quality (for mixers or straws), washed, smoothed out to remove any prickles, and sterilised by boiling; the straws are then bagged up for distribution.

© OUR ROOTS AFRICA

200 women farmers are supplementing their incomes by selling wild grass to Our Roots Africa

At present, the cost of transporting the grass remains a major obstacle for the small company, as do certain traditional practices: many farmers prefer to burn the bushes to preserve their fields, unaware that Luseke grass can be a source of additional income. The quality of the grass also varies depending on its origin. For instance, straws originating from the district of Masaka can be reused, whereas those made from grass from the districts of Lwengo, Rukungiri and Kabale can only be used once. "We are currently testing these two types in our model garden to learn what determines the quality," says Lukwago.

Our Roots Africa has started receiving its first orders from abroad, with a packet of 25 straws costing US$6 (€5.45) on the company's website. "We have orders from restaurants in Brazil, the UK and Germany," states Lukwago. Our Roots Africa aims to achieve Fairtrade Certification in order to penetrate the European market, which has banned the use of non-reusable plastic straws by 2021.

The company also hopes to continue empowering local women farmers, "Our goal is to employ nearly 300 women producers and, in 5 years, we would like to work with 1,000 of them. Our dream is to make Luseke grass a new commercial crop on the international market," explains Lukwago. ■

MODEL FARMING

Kenyan smallholders adopt market-oriented production

To help farmers achieve year-round production and increased incomes in Kenya, a local training centre is providing technical advice on best practices and encouraging market research.

James Karuga

Over 2,000 smallholder farmers in Kenya have received training and technical support on how to produce high-value crops, form cooperatives and develop price negotiation skills – all free of charge. The trainings are provided at the iAgribiz Africa Model Farm in Nandi county, which was set up in 2018 by 27-year-old Rodgers Kirwa, who uses the profits from his harvests to sustain the farm and provide training courses. For local farmers, the training has resulted in yield increases of up to 100%.

At the 0.5 ha iAgribiz farm, three greenhouses have been erected to provide demonstration areas and showcase different practices, such as organic production, intercropping and drip irrigation technology. Visitors to the farm learn about the best techniques for growing produce such as cabbages, collard greens, cucumbers, indigenous vegetables, onions, tomatoes, as well as how to rear tilapia (using the farm's pond). Smallholders are also taught about the nutritional benefits of higher-value horticultural crops, such as broccoli, capsicum and lettuce, and how to diversify from common staples like maize and beans.

"Most smallholder farmers don't embrace farming technologies or visit agricultural research institutions to get knowledge," says Kirwa, whose training particularly targets rural farmers who usually buy inputs without getting advice on their use. By starting iAgribiz, Kirwa aimed to convince farmers of the benefits of using technologies like greenhouses and drip irrigation, to help them achieve year-round food production and income.

© IAGRIBIZ AFRICA MODEL FARM

iAgribiz trainees are taught how to form cooperatives and produce high-value crops

The model farm also offers internships of 3-4 months to local agricultural students, and connects them with scholarships in countries like China and Israel to get further practical on-farm training. The trainee students and farmers are encouraged to visit local markets to identify which crops will be in demand at harvest to help avoid post-harvest losses. "For the longest time, farmers grew (crops) without understanding the market needs, so their research has to start at the market first," emphasises Kirwa.

Prior to joining iAgribiz as a trainee in September 2018, Pierra Nyaruai had been growing her broccoli, cabbages, capsicum and spinach on separate sections of her farm. Through the training, she has learnt that intercropping can improve soil fertility, enhance pest control, and increase production levels. Since adopting the practice, her yields have increased by 20% and her income by 3%. "I also look for the market first before growing any crop," she says.

€93,482

generated in food crop sales over 3 years

300

vertical farms have been constructed since 2016

Besides agronomic trainings, iAgribiz trainees are taught to form cooperatives in order to increase their bargaining power when selling produce on the market. According to Kirwa, iAgribiz also links the cooperatives with input providers so they can access inputs and farm extension advice at a discounted rate. In future, Kirwa plans to have model farms all over Kenya and has already established two others in Kiambu, Central Kenya and in Eldoret in the Rift Valley. ■

LANDLESS PRODUCTION

Vertical farms raise incomes in Uganda

A Ugandan initiative is training groups of marginalised, landless women in vertical farming and vermi-composting to raise incomes and increase food security in the country's capital.

Peter Wamboga-Mugirya

Over 880 women from Ugandan slums are producing food crops, such as beans, eggplants, nakatti (a popular green vegetable), peas, spinach and tomatoes, through vertical farming. The women, who are organised into groups and trained by local NGO, Women Smile Uganda, have so far generated €93,482 in sales over 3 years. "They don't own land so we train them in making vertical farms, and how to grow crops with drip irrigation," says Lilian Nakigozi, CEO and co-founder of Women Smile Uganda.

© WOMEN SMILE UGANDA

Vertical farms are helping 880 landless women in Uganda produce up to 100 kg of produce per season

The NGO started operations in Kampala's sprawling slums of Katanga, grouping women into 20, 30 or 50 embers. Since 2016, Women Smile Uganda has constructed over 300 vertical farms. Nakigozi explains that they make medium and large-size vertical farms using simply built wooden structures, which accommodate 50 and 100 kg of produce per season, respectively. "And we have two seasons of crop production per year. The 7 m high vertical farms make them convenient to weed, prune or harvest without much hassle," she says. "We're building the capacity of the women to increase vertical farm production themselves, and interest is rising rapidly. We have a marketing arm of 15 people that go door-to-door creating awareness about our products and services, and women leaders in the groups pass on information to their colleagues."

Each women's group pays a membership fee of USh 50,000 (€12) in instalments and 5% of sales is returned and saved by Women Smile Uganda. "We're using this money to set up our own vertical farms manufacturing workshop and a demo-farm in Mityana district, north-west of Kampala," says Nakigozi, which she hopes will also attract agri-tourism revenue.

The women are also trained in how to make compost manure using biodegradable urban waste. "There's a lot of waste generated in Kampala which we can use for vermi-composting," Nakigozi explains. The women combine waste paper with cow dung, kitchen waste, earthworms and water, which is then stored in cans to decompose for 10-15 days. "The women mix the compost with the soil before placing it in the layers of wooden troughs that make up the vertical farms," Nakigozi says. The crops take up to 3 months to mature and are mostly purchased by a fresh produce bulk-buyer based at Kalerwe market, north of Kampala. "We harvest 5-10 bags of vegetables per month, producing a minimum of 60 bags a year," says Maureen Nalunga, chairperson of the largest women's group, the Twekembe Women's Group in Katwe. "Our members are happy because there is a positive change in their lives."

"In November 2019, we launch in Kampala's largest slum of Kisenyi; some of the beneficiaries will be Somali refugee women. Currently we're launching in Arua city, in the north-west Nile region – close to the Democratic Republic of Congo and South Sudan. Here, we've registered over 100 women who shall form a group for us to train," Nakigozi says. Women Smile Uganda intends to reach 3,500 women by 2023 and link them with financial institutions in order for them to access micro-loans. ■

AGRI-FINANCE

Looking to the future for credit and finance solutions

Smallholder farmers in Africa continue to face numerous hurdles accessing credit or loans to increase their production. Amongst other factors, partnerships are key to addressing this, but governments need to take the lead, state experts from the sector.

Helen Castell

To improve smallholders' access to agri-finance – either unilaterally, or in partnership with other actors – governments hold the most power and responsibility, emphasises Jerry Parkes, managing principal at agriculture-focused impact fund manager, Injaro Investments. He adds that governments must lead the development of agricultural value chains and harness the resources of the private sector, financial institutions, donors and NGOs. Governments should also champion digitisation to partner, where appropriate, with private sector agribusinesses, stresses Buddy Buruku, digital financial services consultant at the World Bank's think tank, Consultative Group to Assist the Poor.

Governments moving in the right direction include Ghana, which is rolling out a national ID and digital address system, under which locations and properties are all given a unique address code, to help farmers (and others) access formal financial services, explains Buruku. Big agribusinesses should now accelerate a switch from cash to digital payments, to not only speed up payments to farmers but allow individual smallholders to build a digital profile to make for easier and quicker risk scoring by potential lenders.

In Uganda, digital farmer profiling helped lead to the creation of Igara-Buhweju Tea Farmers' Savings and Credit Cooperative Organisation (see *Spore* article http://bit.ly/31YOU2o), which uses the profiles to provide input loans to farmers, notes Chris Addison, CTA senior programme coordinator for knowledge management. Blockchain technology, he adds, also holds huge promise to digitise agri-finance and agriculture overall, so would benefit from more government support.

Capitalising on concessionary capital

To lend to smallholder farmers, commercial banks first have to borrow at rates that are very expensive in some countries. However, if governments provided banks with subsidised loans at so-called 'concessionary' rates especially for the sector, banks would be able to lend more to smallholders and still earn a profit, states Andrew Ahiaku, head of agribusiness at Fidelity Bank Ghana. This has worked in Ghana, where the government-funded Export Trade, Agricultural and Industrial Development Fund charged 2.5% to lend to commercial banks, which were then allowed to charge borrowers up to 12%, ensuring a margin of around 9.5% to cover their credit risk.

Development banks, foundations and other donors should also invest more money at concessionary rates in blended finance agriculture-focused funds, especially those with longer lifespans, while also subsidising risk-mitigation tools like insurance and paying for technical assistance to support farmers, advises Parkes. Simon Schwall, CEO of agricultural insurtech OKO, would also like to see donors partnering more with promising start-ups, providing them with early stage funding or funding to expand into areas that are not yet commercially viable.

Agri-finance consultant Matthew Olaide Adetunji, however, believes that subsidised capital – as used by Nigeria's 'intervention funds' – should be scrapped if it crowds out private investment. For example, Nigeria's government recently privatised the Bank of Agriculture and licensed NIRSAL National Microfinance Bank in a bid to improve access to affordable agri-finance while also attracting private capital. These "very

SmartMoney International's CEO, Michael Spencer, argues that financial institutions need to develop closer working relationships with the rural communities they seek to serve

promising" privatised initiatives are designed to run as private banks but have grassroots networks to reach farmers and other agribusinesses, he notes.

Increasing innovation impacts

A more flexible, responsive approach to agri-finance innovations by financial regulators will also help, as witnessed by insurance service provider ACRE Africa in Kenya, Rwanda and Tanzania, recommends Stella Ndirangu, financial inclusion specialist at the insurance service provider. For example, when ACRE (initially Kilimo Salama) began bundling insurance with seed and selling it through Kenyan agrodealers, the distribution method was not approved under Kenya's Insurance Regulatory Authority. However, the regulator allowed the pilot to scale up and then worked to amend the policy (see *Spore* article http://bit.ly/2qSBqbo). Regulators in Tanzania and Rwanda also responded to ACRE lobbying to remove taxes on crop insurance to help make it more affordable.

Developing regulatory 'sandboxes' to allow small-scale testing of innovations by private firms in a controlled environment would also encourage innovation, as would launching competitions for innovators, believes Schwall. Adopting agri-tech solutions to serve harder to reach segments would help drive down the cost for commercial banks of offering credit to smallholders, encouraging them to scale up lending, adds Ahiaku.

The potential of partnerships

The development of value chain finance solutions is also enhanced by multi-actor partnerships with different actors such as banks, multilateral financial institutions, savings and credit cooperative societies, insurance service providers, input suppliers, produce offtakers and farmer organisations working in a 'closed circuit', suggests Ndirangu. Such partnerships would enable farmers to receive financial solutions for the best inputs, plus risk management solutions to improve production, she adds.

Commercial banks and microfinance providers would reach smallholders in rural areas more affordably by jointly creating a network of points of sale through which all products are available, suggests Schwall. Teaming up with private sector businesses to create bundled special offers – for example, offering free insurance credit when a customer buys phone credit or a discount on fertiliser from a specific supplier when taking a loan with a certain bank – could also incentivise take-up of financial products, he says.

Michael Spencer, CEO of SmartMoney International, argues that a closer working relationship with the rural communities they seek to serve would benefit all organisations involved in agri-finance. Creating financial products that meet the unique needs and constraints of rural markets can only be achieved by relocating staff to rural communities for an extended period and also recruiting, training and partnering with local members of those communities, he says.

Farmer organisations also need to become more proactive about working with aggregators, as this would reduce financial institutions' cost of serving farmers, suggests Ahiaku. Fidelity Bank Ghana, for example, is currently in talks to support 40,000 smallholders by connecting an input dealer through aggregators to farmer organisations and then finally to the last mile. "As a result of this partnership, the input dealer reduced her prices, the bank dropped its rates and the risk was largely mitigated," he states. "These partnerships are essential."

Helping smallholder farmers tap the credit and financial solutions they need to grow remains a multi-faceted challenge, and one for which there are no easy answers. However, with more cooperation and innovation, spearheaded by stronger government leadership and support, there are great opportunities ahead. ■

FOOD MARKETS

Trends and opportunities for connecting African trade

New policies, free trade areas and digital projects are changing Africa's regional food trade and opening up market linkages for actors of the agricultural value chain across the continent.

Sophie Reeve

The growing population, increased urbanisation and burgeoning middle-class in Africa is leading to increased demand for food, as well as greater calls from consumers for more varied and processed products. As a result, by 2030, the African food market is expected to be worth US$1 trillion (€900 billion). However, for Africa to benefit from this significant opportunity, continental trade needs to be enhanced; in 2017, intra-African trade accounted for just 17.6% of total African exports and, in 2016, agricultural goods represented just 20.7% of total intra-African export trade, according to estimates from the African Development Bank (AfDB).

To meet Africa's growing food demands, regional trade and integration will be essential, as discussed at the recent Brussels Development Briefing No 58 (https://tinyurl.com/y5bbt27k), which brought together a panel of experts around the topic, 'Africa's agriculture trade in a changing environment'. Antoine Bouët, co-leader of the Globalization and Markets Program at the International Food Policy Research Institute (IFPRI), presented findings from the *Africa Agriculture Trade Monitor 2019* (AATM), a joint initiative of IFPRI and CTA (see *An Assessment of Africa's Trade Performance in World Markets* in this edition). According to the AATM, African agricultural exports remain dominated by primary products, are not diversified enough to promote trading resilience, and are costly to export within and across Africa. Critical data provided in the AATM, and developed by AGRODEP – an African trade network of policy analysts – will be used to inform policymakers and value chain actors on regional trade investment opportunities.

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The AfCFTA is expected to significantly boost intra-regional trade within an African market of 1.2 billion people

Lessons of success

Key policy developments aiming to help tackle Africa's regional trade challenges, including the development of the African Continental Free Trade Area (AfCFTA), were also discussed at the Briefing. The continental agreement, which was launched in July 2019, is expected to significantly boost intra-regional trade within an African market of 1.2 billion people, as long as issues of non-tariff measures, customs procedures and transportation infrastructure are addressed. Other trade-related factors, such as harmonised standards to achieve a single market, and a high level of domestic policy integration backed up by

Africa's increasingly urban and middle-class population is calling for more convenient and processed food products

judicial enforcement, were highlighted as the key success factors of Europe's Common Agricultural Policy. Such an example could be used to inform Africa's regional trading policies, explained Professor Alan Matthews from Trinity College Dublin in Ireland.

> "It is important for Africa to trade among itself, to collaborate and cooperate"

Best practices, challenges and successes for regional trade in Africa were shared by Rose Mutuku of Smart Logistics Solutions (SKS) in Kenya, and Komi Agbokou of Choco Togo. An agribusiness with a focus on value-added and pre-cooked traditional foods, SKS produces ready-to-eat beans and pulse-based products, which are much appreciated in Kenya and the wider Eastern African region. To connect over 5,000 smallholder farmers with local and regional markets, SKS organises farmers and ensures the products meet national trading standards and those of neighbouring countries. The youth-led cooperative, Choco Togo, on the other hand, has built its success on targeting 100% certified organic cocoa varieties to meet a growing global trend for natural products, and placing more diversified chocolate products on the market.

Digital opportunities

"It is important for Africa to trade among itself, to collaborate and cooperate," emphasises Irene Ochem, founder and CEO of the African Women Innovation and Entrepreneurship Forum (AWIEF), an annual event held to highlight the advancement of women in Africa as innovators and entrepreneurs. "What we need to look at is the roles that women have in this process," she continued, speaking on the AfCFTA at the recent AWIEF, which ran under the theme, 'Enhancing impact: digitalisation, investment and intra-African trade'.

At an AWIEF side-event, a digital platform, #VALUE4HERConnect (https://tinyurl.com/y2r3ec2p), was launched to help women entrepreneurs harness the opportunities of the AfCFTA. The CTA and AWIEF initiative, which has already registered over 400 women, works by connecting women-led agribusinesses to potential investors and networks. "The platform will enhance the capacity of African women and youth to trade in agricultural commodities across borders, hence contributing to economic growth," says Chris Kiptoo, principal secretary in Kenya's Ministry of Trade.

Investments in digital projects and infrastructure will be key for enabling digital trading payments in Africa and promoting the emergence of digital entrepreneurs, according to Akinwumi Adesina, president of AfDB. Thus, as well as investing in physical infrastructure, such as roads, seaports and airports to enhance trading opportunities, the Bank is financing the development of digital structures to better connect African countries: "We financed what is called the Trans-Sahara Fibre Optic Network. It is linking Nigeria, Niger, Chad to Algeria," he says of the project, which aims to reduce the cost of access to ICT-based services and support the development of mobile financial services and e-trade. ■

ISAAC SESI

"The challenges we face bring opportunities to make a difference"

Isaac Sesi, co-founder of Sesi Technologies, speaks about his passion for technology and the importance of encouraging more women and young people into the sector.

Susanna Cartmell-Thorp

Sesi Technologies began as a university research project at Ghana's Kwame Nkrumah University of Science and Technology. Isaac Sesi, an electrical engineer, was drafted in to help the new team develop a low-cost grain moisture meter, which he realised had the potential to be commercialised.

As an entrepreneur, you are passionate about inspiring others. What is the key lesson you have for those who might want to follow in your footsteps?

The most important lesson that I have for young people is that they really have to focus, stick to one thing and be persistent because success is not going to happen overnight. Young people today seem to be in a hurry and, if results don't come soon enough, they just jump to the next thing – but then no good thing just happens right away. At one point, I was running three very different companies at the same time and I felt really burnt out; my focus was being split and progress on each business was slow. So I decided to focus solely on Sesi Technologies as I felt I had the skills and passion to really make it economically viable.

Isaac Sesi is passionate about empowering African farmers with affordable technology

A World Economic Forum 2018 report on the gender gap highlights that only 22% of the world's professionals working in artificial intelligence (AI) are women; it is likely that the proportion in Africa is far lower. Where does change need to happen to reduce this gap?

It has to start at school. STEM (science, technology, engineering and mathematics) and AI should be integrated in school curriculums and young girls should be encouraged and incentivised to participate in these activities. When girls gain an interest in STEM and are shown the potential of AI, and the difference they can make in their communities by going into this field, then the decision to go into AI becomes organic and natural. When we do this, instead of waiting till women are grown before trying to get them into AI, we see more females in the field.

© SESI TECHNOLOGIES

GrainMate is an affordable moisture meter which allows farmers to accurately measure moisture content in grains before and during storage

"AI should be integrated in school curriculums and young girls should be encouraged and incentivised to participate"

In Ghana, change is coming; it's gradual but the educational service is developing a new curriculum which has a lot of STEM components. Things like AI are still not fully integrated yet but this change in direction is good for the future. Outside of the traditional educational system, we are seeing so many opportunities for young people who want to be involved in AI, so gradually more awareness is being created and hopefully, within a few years, we should have more women in the field.

My personal passion for STEM led me to co-found the Nsesa Foundation, a non-profit whose vision is to inspire an innovation revolution in Africa and to get young Africans solving problems using science and technology. Since 2013, our programmes have trained hundreds of students and have reached over 300,000 people across the world.

You were recently one of two finalists to receive the GoGettaz Agripreneur Prize in the agri-food sector. Why do you think your innovation inspired the panel?

I was up against some tough competition but I feel like the panel was inspired by our promise to leverage technology to end poverty and hunger because food is something that is fundamental. We are exploring innovative business models to make technology available to farmers at a cost they can afford, for example by allowing farmers to exchange grain for GrainMate instead of paying cash. We are also pioneering a local manufacturing industry which is creating jobs for young people, women, and youth.

CTA runs a similar competition with its Pitch AgriHack for young entrepreneurs. What do you feel are the value of these competitions, even if you don't win the prize money?

The prize money is just a small part of what you could potentially get from these competitions because a lot of them are providing training and mentoring support, and are trying to connect the finalists to a network of people who can help them. The value you get from these things can't be quantified and, if taken seriously, far exceeds the prize money you would get. For instance, the publicity alone translated into business for us. So my advice to participants is that they should not only focus on the prize money but should also take advantage of whatever other opportunities these competitions present.

You are a part of a new cadre of innovative young Africans leading change in transforming African agriculture. Nevertheless, your generation faces many pressing issues. How does this shape your vision for the future?

I feel like the challenges we face bring opportunities to make a difference and make change happen, so I see this as exciting. The constraints of trying to innovate in Africa are numerous and complex but these challenges will force young people to think about how we build things, how we develop solutions and how we build resilience into these solutions right from the start. We are taught to thrive, irrespective of the challenges, so this gives us the confidence to be able to face any obstacles that come our way and be confident that as Africans we can develop solutions to overcome them. It means more work, but what's the fun if everything is rosy! ■

"Challenges will force young people to think about how we build things, how we develop solutions and how we build resilience"

DIARIÉTOU GAYE

"Women entrepreneurs should be considered as drivers of growth"

Diariétou Gaye, World Bank director of strategy and operation for the Africa region, looks at the findings of the report *'Profiting from Parity'* on the potential of women entrepreneurship for the continent.

Vincent Defait

This World Bank report brought to light new evidence of the obstacles faced by women entrepreneurs. What did you find out that was not already known?

Firstly, the report shows that there are more women entrepreneurs in Africa than anywhere else in the world. However, the level of profit generated by businesses run by women is 34% lower than that of men-run businesses. Looking particularly at the Democratic Republic of Congo, at a man/woman couple who manage different companies but in the same sector, the woman makes less profit than her husband. Moreover, on average, businesses managed by men have six times the capital of those managed by women. This is a major obstacle. Lastly, women often tend to launch businesses in saturated sectors: catering, hairdressing, selling vegetables and fruit, etc., which limits their incomes. The root of this disparity is a difference in level of education and skills; women do not have access to the same training opportunities.

Yet, some women entrepreneurs stand out from the rest. Why is that?

The first factor is related to training. We carried out an experiment in which we offered one group of women a traditional business training course and another group a training course focused on social and emotional skills (soft skills). The difference was incredible. Those who had completed the soft skills training course saw their profits grow by 40%, whereas those who had completed the business training course did not achieve any significant increase in their profits. These women learned how to take the initiative, to be proactive and to persevere. The report presents the example of Leïla in Togo. She was selling food on the road, but wanted to become a restaurateur. After completing the training course she expanded her micro-enterprise to such an extent that she now has a catering company that provides services for family and certain government events. The difference between Leïla and other women is that she was offered the opportunity to do entrepreneurship and leadership training.

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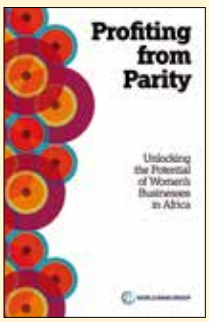
Diariétou Gaye explains why it is necessary to empower women to enable them to become drivers of economic growth

Women's entrepreneurship

Identifying obstacles and unlocking potential



Women are a lever for economic growth, but they need to be given the opportunity to make their business ventures grow. This is the main argument of the recent World Bank report, *Profiting from Parity: Unlocking the Potential of Women's Business in Africa*.

This report on the gender constraints affecting the choices and performance of women entrepreneurs sheds a new light on how social norms, networks and decisions taken at household level contribute to business success... or failure. Because, when it comes to entrepreneurship, women are at a disadvantage. Based on household and business survey data from 14 African countries, the report traces the common characteristics of barriers to women's entrepreneurship: customary laws restricting access to land, equal rights that are insufficiently guaranteed by law, patriarchy, lower levels of training, reduced access to networks and information, etc.

The report offers policymakers evidence-based guidance on designing programmes to target the multiple obstacles women face and improve the performance of women entrepreneurs. These include training programmes to encourage women to act with an entrepreneurial mindset and provide secure savings mechanisms. It is also important, among other policies and interventions, for governments to remove legal constraints to gender equality and to strengthen land tenure rights for women.

With more women in Africa than in any other region of the world launching into business, it is time for their potential to benefit everyone, starting with themselves.

Profiting from Parity: Unlocking the Potential of Women's Business in Africa
World Bank, 2019; 206 pp.
Downloadable as a PDF file from: https://tinyurl.com/y6249hn8

The report offers a series of portraits of women entrepreneurs. With whom do you identify the most?

There is Leïla, who I just talked about, but also Akouélé who had a small wedding dress rental store in Togo. After the training, she diversified her business. She started selling accessories such as veils and gloves, and selling clothes rather than just renting them, and she opened a second store in Benin. Everything is based on innovation, diversification and investment.

As soon as women are offered the possibility of developing new prospects beyond their simple business, they succeed. During the training, for example, one of the exercises involves jointly examining what was done proactively or responsively the previous day. The group discussions not only help them to understand what proactive means, but they also foster self-reflection. Once we realise that these training courses work, we present them to governments. This programme, for example, is being implemented in more than ten countries.

How do you hope that this report will be put to use?

First, in-house, we need to make it a component of our strategy as empowering women is at the heart of the World Bank's strategy for Africa. This type of study helps us give meaning, for example, to our country or regional strategies and is part of our discussions with the heads of state and the ministers of finance.

Moreover, women should be considered as drivers of a country's growth. This is the angle of development that we use in our work with county or regional authorities. When girls finish their secondary education, this creates a different dynamic. It's simple: if women are unable to play a role in a country's economy, that means half of the population is not working and is unproductive. ■

Gender and food

Dynamics of inequality

In transforming the food system and addressing its problems, including the dynamics of structural inequality, *Gender and Food* argues that the approach given to gender is critical. In West Africa, for example, 70% of agricultural production and food processing is completed by women, yet they own only 15% of land. The looming crisis of global food insecurity with gender inequality is effectively woven into one narrative, with emphasis that gender is core to the production, distribution and consumption of food.

Gender and Food: A Critical Look at the Food System
By SL Koch
Rowman & Littlefield, 2019; 136 pp.
€29
ISBN 978-14-4225-773-3
www.rowman.com

Gender gap in agriculture

Finding solutions

Studies have frequently shown that female farmers have lower rates of productivity compared with male farmers. Using research based on five African countries, this policy brief illustrates that reasons behind gender gaps in agriculture are not because women are less efficient farmers, but because they suffer from unfair access to agricultural inputs, such as high-yield crops, family labour, pesticides and fertiliser. It argues that by equalising this access, crop production could be boosted by up to 19% and lift many out of poverty.

The Gender Gap in Agricultural Productivity in Sub-Saharan Africa: Causes, Costs and Solutions
By Y Rodgers & H Akram-Lodhi
UN Women, 2019; 5 pp.
Downloadable as a PDF file from: https://tinyurl.com/y4tvde6k

CLIMATE CHANGE

Calling for action to avert a crisis

Climate change is a global crisis; millions of people are already suffering and the impacts are getting worse. Policies to mitigate and adapt to climate change are increasing but many argue that the window for action is closing.

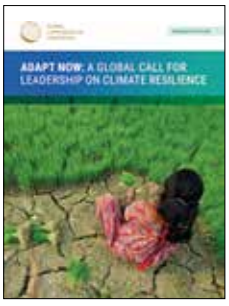
Olivia Frost

"Global actions to slow climate change are promising but insufficient," state the authors of *Adapt Now*. "We must invest in a massive effort to adapt to conditions that are now inevitable: higher temperatures, rising seas, fiercer storms, more unpredictable rainfall, and more acidic oceans." One of the key findings from this report by the Global Center on Adaptation is that investing US$1.8 trillion (€1.6 trillion) globally in five areas (early warning systems, climate-resilient infrastructure, improved dryland agriculture, mangrove protection, and investments in making water resources more resilient) from 2020 to 2030 could generate US$7.1 trillion (€6.37 trillion) in total net benefits.

Designed to inspire action among decision-makers, *Adapt Now* makes the case for climate adaptation and provides specific insights and recommendations in key sectors, including food security and water. To ensure that climate impacts, risks and solutions are factored into decision-making at all levels, the report calls for revolutions in: *understanding* to ensure the risks are fully understood and reflected in the decisions public and private actors make; *planning* to improve how we make policy and investment decisions and how we implement solutions; and *finance* to mobilise funds and resources to accelerate adaptation.

The need for government action is also highlighted by a recent World Bank report, *Productive Diversification in African Agriculture and its Effects on Resilience and Nutrition*. The report, which calls for on-farm diversification to improve resilience to climate change, states that there is no one-size-fits-all solution for fostering diversification. A selection of policy recommendations is provided that would enable governments to diversify agricultural production. One action highlighted is the need to invest more in agricultural research and development, focusing on practices, technologies and services that are gender, climate and nutrition-sensitive.

To maintain food security as the population increases and the negative impacts of climate change on vegetation increase, the Intergovernmental Panel on Climate Change's (IPCC) latest report, *Climate Change and Land: Summary for Policymakers*, states that better land management is essential. Designed as a key scientific input into forthcoming climate and environment negotiations – including the UN's Framework Convention on Climate Change Conference (COP25), being held in December 2019 – the report states that appropriate design of policies, institutions and governance systems at all scales can contribute to land-related adaptation and mitigation, while facilitating the pursuit of climate-adaptive development. "Land already in use could feed the world in a changing climate and provide biomass for renewable energy, but early, far-reaching action across several areas is required," emphasises Hans-Otto Pörtner, co-chair of IPCC Working Group II. ■



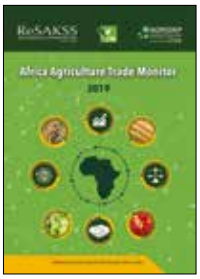
Adapt Now: A Global Call for Leadership on Climate Resilience
By M Bapna, C Brandon, C Chan *et al*.
The Global Center on Adaptation, 2019; 90 pp.
Downloadable as a PDF file from:
https://tinyurl.com/y4lshmnz

Productive Diversification in African Agriculture and its Effects on Resilience and Nutrition
Edited by C Heumesser & HA Kray
World Bank Group, 2019; 244 pp.
Downloadable as a PDF file from:
https://tinyurl.com/y6bdtlzj

Climate Change and Land: Summary for Policymakers
By A Arneth, H Barbosa, T Benton *et al*.
Intergovernmental Panel on Climate Change, 2019; 43 pp.
Downloadable as a PDF file from:
https://tinyurl.com/y5qukz9d

Trade monitor

As assessment of Africa's trade performance in world markets



Following on from the first *Africa Agriculture Trade Monitor* (AATM) released in 2018, the 2019 report is the second flagship document to assess the emerging and long-term trends and drivers behind Africa's regional and global trade in agricultural products.

A joint initiative of the International Food Policy Research Institute (IFPRI) and CTA, the 2019 AATM aims to examine two key points: 1) the effectiveness of regional trade initiatives in boosting economic integration and intra-African trade; and 2) the potential impact of broader integration on the continent's trade performance in the context of emerging protectionism. The publication is thus timely, following both the recent launch of the African Continental Free Trade Area (AfCFTA) initiative in May 2019, which is expected to increase intra-African trade by 52% by 2022, and in light of the rising protectionist tensions between China and the US.

While the AfCFTA is seen as a 'game changer' that will deliver deeper regional integration and spur economic growth through the elimination of tariff and non-tariff barriers on most goods, among other developments, the report warns that Africa stands to lose out if the current protectionism policies and other trade barriers become more widespread globally. On the other hand, according to the authors of Chapter 5, the China-US trade war could work in Africa's favour if the continent can take advantage of the changing patterns in global agricultural markets, and tensions remain confined to China and the US.

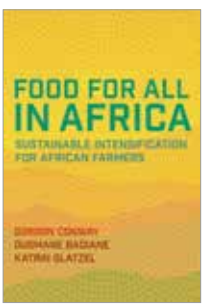
With regards to getting insight into Africa's agricultural trade, access to – and the quality of – international statistics from this sector is reportedly limited. To address this problem and provide policymakers and development practitioners with an accurate estimate of trade in Africa, and worldwide, the publication's authors created an analytical database based on the United Nations Commodity Trade Statistics Database. The data provides information on bilateral trade for 195 countries or groups of countries from 2005 to 2017.

Overall, while intra-regional trade is still low compared to other regions of the world, according to the AATM findings, Africa has great potential to expand, especially with investments in trade-related infrastructure and improvements in policy. And, while growth in Africa's agricultural imports has continued to outpace export growth, the agricultural trade deficit has been on the decline since 2012. The report highlights how the AfCFTA has the potential to accelerate regional and continental trade integration and foster industrialisation, thus improving food security, diversifying the production base and helping African producers move up the value chains. ■

Africa Agricultural Trade Monitor 2019
By A Bouët & SP Odjo
ReSAKSS, 2019; 189 pp.
Downloadable as a PDF file from: https://tinyurl.com/yyv597zu

Strengthening sustainability

An optimistic outlook for Africa's smallholder farmers



Recognising that African economies are experiencing unparalleled levels of economic growth, with agricultural growth averaging about 7% per year since 2005, the authors of *Food For All in Africa* have produced a 'book for optimists'. They emphasise that, in the past, maize harvests for smallholder farmers were as low as 750 kg/ha, whereas yields of up to 6 t are now common. This has been achieved, in part, through drought-tolerant maize seed combined with improved fertilisers.

The challenge, however, is to capitalise on these achievements and bring them to scale. *Food For All in Africa* discusses how the concepts and practices of sustainable intensification can lead to better livelihoods for farmers, healthier diets, and viable economic opportunities for the rural poor. A 'virtuous circle' is envisaged where greater yields result in farmers becoming more prosperous, which benefits the rural economy and leads to other boons, such as improved investment and better access to markets.

"Much progress has been made over the last decades to address hunger and malnutrition across Africa," states Professor Sir Gordon Conway, co-author of the book. "To sustain and accelerate progress, successful innovations and interventions need to be replicated and brought to scale." Using digital connectivity techniques such as analysis of big data, machine learning and blockchain technology in order to increase agricultural production and food security in a sustainable way is examined, as are the challenges of transforming agricultural policies and developing effective leadership in Africa to address these problems. *Food For All in Africa* may be unapologetically optimistic, but its positive tone is reinforced with solid examples which suggest that a prosperous future for smallholder farmers in Africa is achievable. ■

Food For All in Africa: Sustainable Intensification for African Farmers
By G Conway, O Badiane & K Glatzel
Cornell University Press, 2019; 342 pp.
ISBN 978-15-0174-388-7
€22.50
www.cornellpress.cornell.edu

Are digital solutions sufficient to catalyse women's agribusinesses?

CHERNAY JOHNSON

What do we really know?

Chernay Johnson,
Engagement manager, Cenfri and insight2impact

Digitisation in agribusiness has the potential to unlock greater value for sustainable livelihoods, especially for women farmers, who often fall behind in traditional cooperative structures. But what do we really know about digital solutions catalysing agribusiness in Africa for women?

Digital platforms rising in prevalence as new economic actors shape agribusiness in Africa. Findings from recent research published by insight2impact (http://bit.ly/2r1WBrN) identified 277 unique digital platforms, which provide income-generating opportunities to more than 4.8 million Africans. Only 3% of these platforms operate in the agricultural sector, but nevertheless are found to be contributing materially to economic inclusion of women farmers. For example, Trotro Tractor allows women farmers in Ghana to demand ploughing services more freely than would typically be observed in traditional cooperative structures, where the needs of male farmers are often prioritised above that of women. Moreover, digital platforms operational in the agricultural sector in Africa are found to embed and distribute financial services such as credit, savings and insurance to farmers, allowing for better management of the risks associated with their daily activities.

Digitisation of farmers services resolving Africa's productivity challenge. Digital solutions are found to have a material and positive impact on the challenge of increasing productivity in Africa's agricultural sector. According to the CTA/Dalberg Advisors report, 390 active digital solutions were identified to contribute to a 73% increase in farmer productivity and a 37% increase in farmer income. For example, DigiFarm in Kenya distinctly targets gender inclusion in agribusiness and has reached more than 1 million farmers; 43% are women. DigiFarm's model has successfully digitised the marketplace for farmers to access financial services, farming inputs and other value-added services for women farmers. Farmerline has been rolled out to 200,000 small-scale farmers across West Africa and not only provides information updates to farmers, but also tracks the impact of farmer interventions through surveys. The initiative has been found to have a positive impact on the productivity of women in agribusiness and, by 2020, Farmerline hopes to scale its impact to at least 1 million small-scale farmers.

Digital financial services have an important role to play in supporting women farmers in better managing risk to their livelihoods. Many financial service innovations cut across the entire economy, including the agricultural ecosystem. Digitalisation for agriculture platforms provide case studies to show the value to women farmers through the provision of fit-for-purpose financial services. Mfarm in Kenya offers credit through its platform; in scaling consumer reach and using alternative data, credit is offered to farmers active on the platform in a leaner and more cost-effective way than traditional financial services could provide. In the realm of frontier insurtech applications. Research by Cenfri (http://bit.ly/36ikqvw) has shown that smart contracts, which lower the costs of delivering microinsurance through automation of pay-out processes, are finding use cases for farmers in the agricultural sectors of Malaysia, Mexico, and Singapore, and Africa could potentially learn from these applications.

Economic inclusion is a goal that digital solutions can catalyse for women in agribusiness, but we should remain sober about the unique risks that women face in this sector. Women farmers consistently struggle to access land for farming, be well represented in cooperative systems, and secure the financial resources to effectively implement gender inclusion programmes in agribusiness. These challenges, amongst others, have persistently contributed to gender pay gaps in farming. In Ghana for example, female farmers earn 25-30% less than their male counterparts, and in Côte d'Ivoire this is as wide as 70%. Digital solutions, including digital financial services, which are appropriately designed and distributed to meet women's needs, have a very important role to play in overcoming many of these challenges as early case studies demonstrate. However, our excitement around the facilitation and promotion of innovation in agribusiness needs to be counterbalanced with a sober perspective of what we really know about the risks that women uniquely face in this sector, and the reality that there is no one silver bullet to realising gender equality. ■

RUPERT SCOFIELD

Digital interventions must be paired with complementary, non-digital solutions

***Rupert Scofield**, President, CEO and co-founder, FINCA International*

Digital solutions can provide valuable services to farmers in specific use cases through data-driven insights. For example, Ignitia, a FINCA Ventures portfolio company, provides highly accurate and accessible weather forecasts, helping the 95% of smallholders reliant on rain-fed irrigation to predict tropical weather patterns. Ignitia works with six mobile network operators in West Africa, giving them access to 100 million subscribers. The company's approach emphasises low-barrier entry: forecasts are delivered to subscribers via easy-to-read text messages, meaning no smartphones are needed and are appropriate for those with limited literacy.

Mobile money and digitally-enabled financing options can also help smallholder farmers. A 2016 study found that mobile money services in Kenya reduced poverty, especially for female-headed households, while creating greater occupational choice for women. Additionally, initiatives like FarmDrive offer democratised access to loans and financial services to farmers – ensuring smallholders can apply for a loan and get real-time credit scoring, portfolio management and advanced data analytics from any phone. For women farmers in Africa – many of whom don't quality for traditional bank financing – FarmDrive's alternative credit-scoring model can be a game-changer.

But are digital tools alone sufficient for catalysing women's agribusiness at scale? Not if they don't account for the extensive real-world obstacles women farmers face. Chief among these is uneven literacy – both financial and digital – between genders. According to the International Telecommunication Union, Africa is the only continent whose digital gender gap has widened since 2013. As Scott Graham, FINCA International's director of customer research and field data services, noted, "Women, who are already struggling with a deficit in financial literacy, now need to gain digital literacy in order to keep up with men."

Women are also stymied by local land rights: in Africa, women are significantly less likely than men to own land, which means that women lack the collateral that would unlock access to bank lending and financing. To genuinely assist women, digital interventions must be paired with complementary, non-digital solutions. For example, Meridia works in Ghana and Malawi to ensure equitable land ownership by pairing geo-mapping technology with legal document validation. In Zambia, Good Nature Agro, a FINCA Ventures investee, provides vital extension services – from access to high-quality legume seed inputs, to specialised agronomic training, to guaranteed markets post-harvest – that are tripling smallholder net incomes, while collecting farmer-level statistics using the digital agri-data management tool, Smallholdr.

As these pioneering companies demonstrate, to spur women's agribusiness, we must expand the definition of 'access'. It's not enough to provide a solution without addressing the unique hurdles that women face in product or service uptake and usage, challenges across the value chain, or systemic barriers in society at large. To set a truly catalytic impact for women's agribusiness in motion, social entrepreneurs must be mindful of digital's specific use cases, benefits and limitations. ■

Poll

Are digital solutions sufficient to catalyse women's agribusinesses?

Yes 71%

No 29%

Other debates

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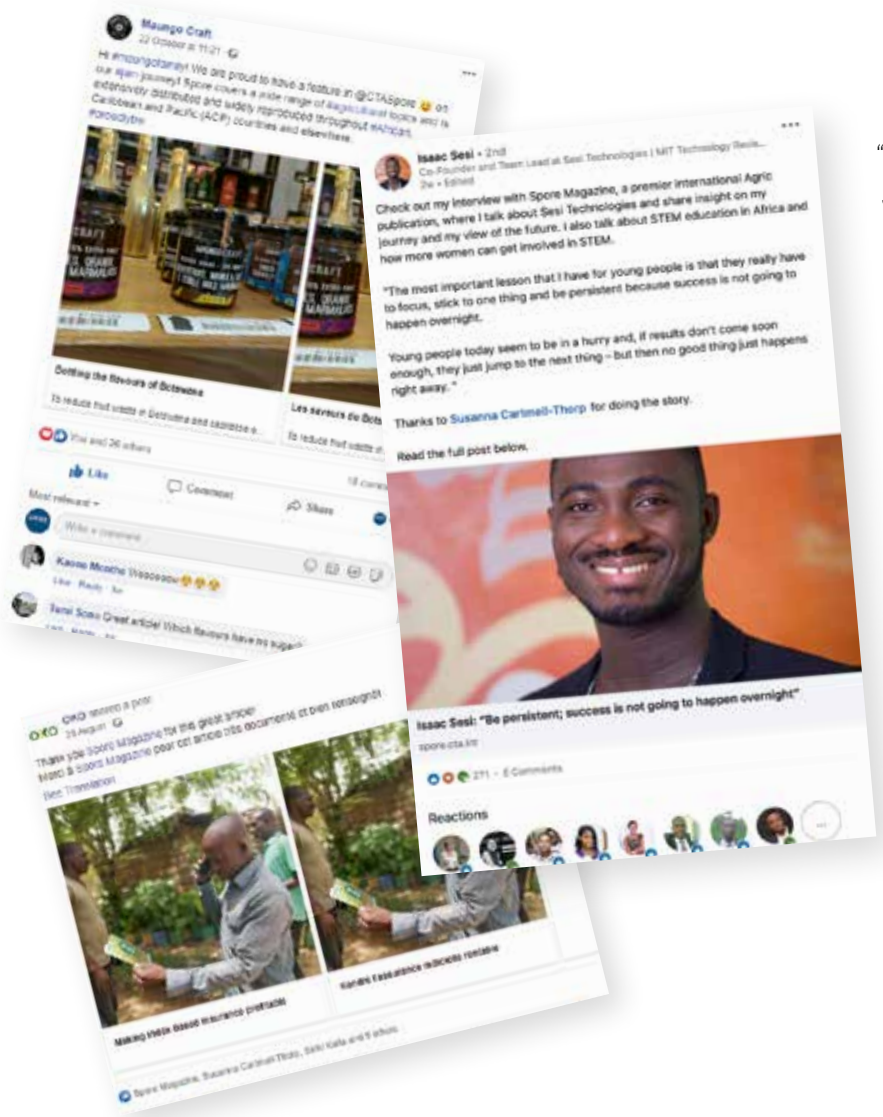

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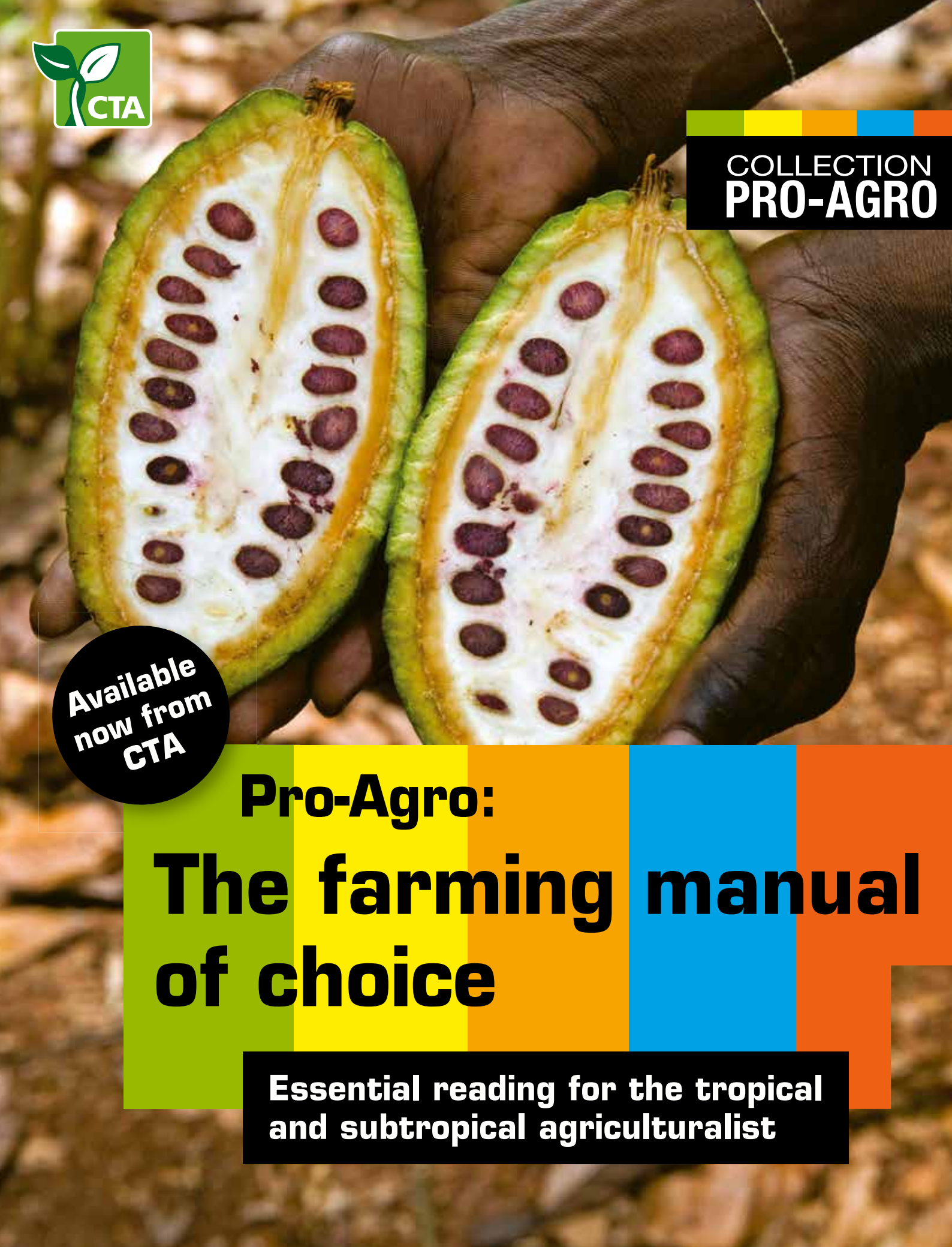
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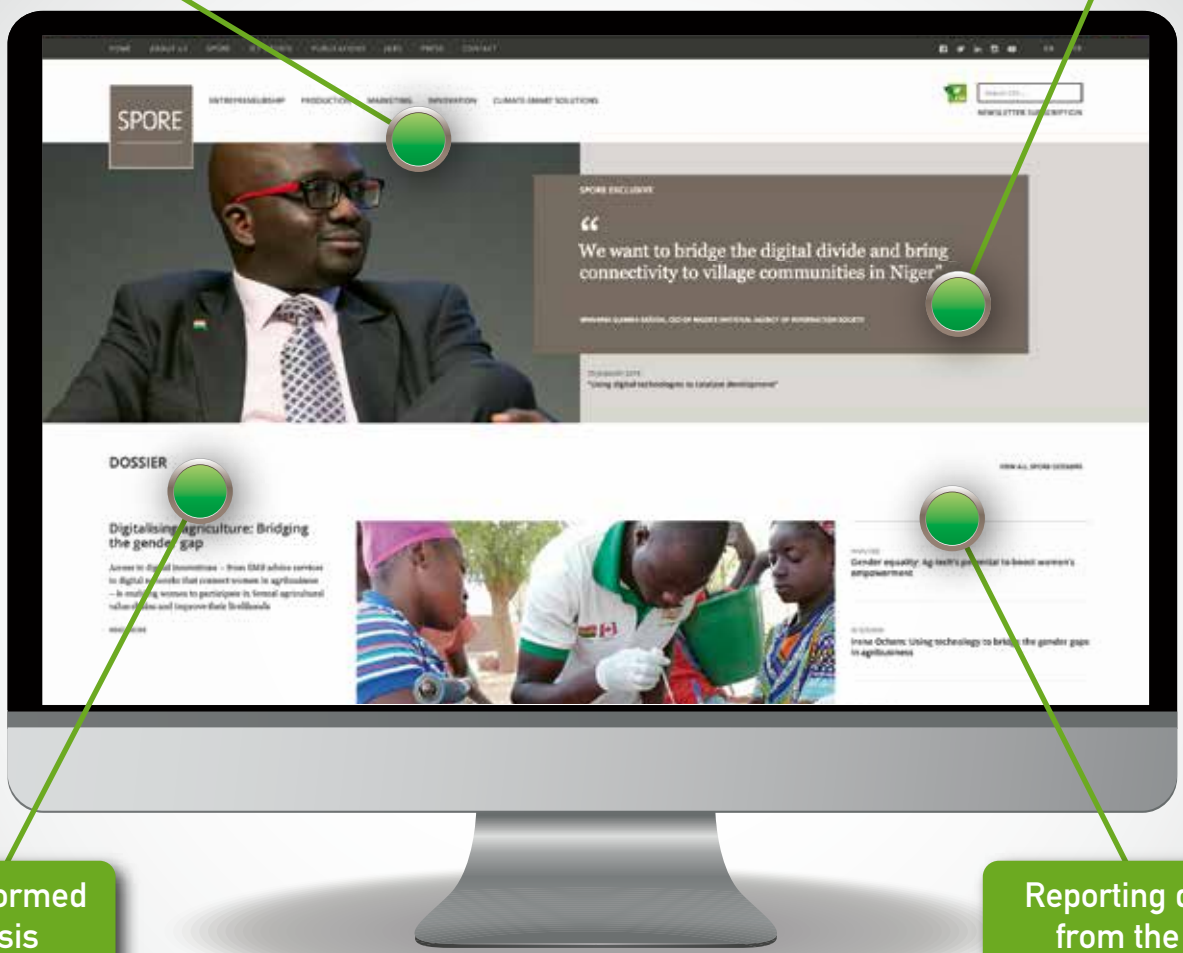

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