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AGRICULTURAL TECHNOLOGY

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Technology has played a key role in driving major agricultural advancements in the West and in Asia over the last century. The Netherlands, for example, ranks as the second biggest exporter of food in the world despite its relatively small land area. It leverages technology and sustainable agriculture with the goal of producing twice as much food using half as many resources. In Asia, China's agriculture industry is modernizing at its fastest pace ever, using more technology to scale up, meet higher standards and ensure food security.

In Africa, agricultural technology is still at its infancy. Farming still mostly takes place on small-scale subsistence farms using rudimentary and archaic methods. Productivity levels are low, leading the continent to spend an estimated \$68 billion annually on food imports. Key findings from the United Nations (UN)'s 2017 Population Prospects revealed that 54% of the 2.4 billion people to be added to the world's population by 2050 will come from Africa. Technology is a critical enabler needed to transform Africa's agricultural sector to provide abundant, quality, affordable, and nutritious food to its growing population, by enhancing farming systems, increasing crop efficiency and strengthening value chain integration while ensuring environmental sustainability.

According to Policy Horizons Canada, emerging technologies that could accelerate growth in the agriculture sector in the years up to 2025 include Sensors, Food and Engineering (Bioengineering), and Automated Technologies. Mobile technologies could also drive disruptive agricultural transformation in the coming years.

These four technologies would be discussed in this article:

- **Sensors:** enable the application of big data and analytics in agriculture. By providing farmers with real-time information about the state of their crop, livestock, soil or farm machine, sensor technologies ensure greater levels of consistency and reliability in decision making to optimise production.
- **Automated Technologies:** include drones, unmanned aerial vehicles (UAVs), robots and artificial intelligence (AI) used to perform agricultural processes accurately and with limited involvement of humans.
- **Bioengineering:** applies the principles of biological and physical sciences to manipulate or impact the genetic traits of a crop to improve its performance and nutritional content. This creates an agricultural ecosystems that fosters efficient management of agricultural resources, while increasing productivity and food safety.
- **Mobile Applications:** encompass solutions that leverage mobile infrastructure to meet farmers' information needs, build their capacity and increase their access to finance and to markets. Mobile applications are increasingly gaining momentum in transforming the sector in Africa.



Sensors are devices that detect events or changes in the environment and send the information to other processing systems for further analysis, providing useful insights to aid decision making. In agriculture, sensors are used to gather real-time data about different farming activities to provide precise and timely responses and solutions to optimise farm operations. Some sensors used in agriculture include the following:

- **Hyperspectral and Multispectral sensors** are used to collect electromagnetic and gamma rays to monitor crops' nutrient availability, water stress, diseases, insect attack and overall plant health. This helps provide information for a more precise application of chemicals and fertilizers on farms. The benefits of these sensors compared to traditional scouting methods include simplicity of use, rapid assessment, consistency in results, higher accuracy levels and cost effectiveness.
- **Weather sensors (stations)** provide data on a variety of parameters such as air and soil temperature, precipitation, barometric pressure, wind speed and direction, radiation and leaf wetness. Automatic weather stations usually work on Internet Protocols like GSM/GPRS/3G/4G technologies to send data to a server for real-time monitoring and storage. Weather sensors are useful in crop management by accurately forecasting harvest dates,



preventing catastrophic frost damage, and tracking chilling requirements during crop dormancy.

- **Motion sensors** are used on farms to detect and monitor the movement of livestock and intruders (pests, animals or humans). Data from the sensors can be used to increase efficiency (e.g. precise application of pesticides), avoid trampling and destruction of crops (e.g. sending out notifications/alarms to restrict unwanted animals), and prevent theft (e.g. triggering alarm systems to restrict unauthorized humans). Motion sensors can also be integrated with Radio Frequency Identification (RFID) tags to ensure livestock are accounted for within a closed farming system.
- **Biosensors** are designed to detect the presence of chemicals using living organisms or biological molecules as sensing receptors. Biosensors are important in agriculture and food sectors to control production processes, food quality and safety. They are helpful in the detection and control of potential food contaminants and used as indicators in product acceptability, in Hazard Analysis and Critical Control Points (HACCP), in the detection of heavy metals, bacteria (like salmonella, listeria), contaminant residues and pesticides.



Adoption of sensors by smallholder farmers across Africa has been low due to a lack of awareness, limited access to finance to purchase these technologies, no technical know-how and a view that they have little benefit.

Company Spotlight

There are a number of agricultural technology companies providing innovative sensing services across the agriculture landscape in Africa. Some of these companies include Zenvus and SoilCares.

Zenvus is an intelligent farm solution designed by Nigeria-based FASMICRO Limited. Founded by Ndubuisi Ekekwe, Zenvus uses sensors to collect soil data such as moisture level, soil nutrients and pH level, and wirelessly transmits the data to a cloud server where it is analysed using algorithms to provide insights to farmers on best and appropriate farming practices. The data generated also helps to make lending, insurance and commodity trading services available to farmers.

SoilCares, a company with a global reach and its African operations coordinated from Kenya, is transforming agriculture in Africa by enabling precision farming. The start-up, SoilCares collects, tests and analyses soil data in its laboratories and provides its farmers with relevant information to inform their operations.



The Sahel Consulting team engage with Dr. Christy Van Beek, Chief Agronomist of SoilCares on June 19, 2018 to gain deeper insights into the business operations of SoilCares on the African continent.

- **Can you briefly discuss how SoilCares is changing farming experience in Africa?**

The SoilCares technology enables farmers to have visibility into the soil condition. Previously, farmers were aware of soil degradation but could not actually see or measure it. With the SoilCares Scanner, a farmer can know the status of the soil in an instant. This is revolutionary, and it is changing the mindset of farmers. From an unknown production factor, soil now becomes a production factor with a performance status and management options.

- **How will you describe the adoption of SoilCares in African countries you operate in?**

At the moment, SoilCares operates in six countries across Africa; Burundi, Ivory Coast, Kenya, Namibia, Rwanda and Zambia. As it is the case with any innovation we have our early adopters, laggards and everything in between. It is also expanding operations to Nigeria in 2018.

- **What has been the most evident impact of SoilCares since your launch?**

We consistently see yield increases. We have conducted several trials and farmer surveys. The problem with these kinds of trials is the definition of the control. In our case, we used as control an experimental farm, which already had quite high yields without using our technology. We found average yield increases of 25%. Farmers however through surveys, often report much higher yield increases, because their reference point (based on current practices) is lower.

- **How do farmers pay for your services and how affordable are they?**

We develop the technology, we do not provide the service. We sell the technology to our partners who offer it to their end users (farmers). We do not set the end users' prices, but we know from experience that it is about 10 Euro (12 US\$), which is much more affordable compared to other approaches/lab tests.

- **What has been the most persisting challenge(s) you have faced in penetrating the agricultural landscape in Africa?**

What we introduce can be classified as a disruptive innovation. It changes the entire agricultural practice and, of course, this causes reactions from stakeholders. We have faced all the challenges typically associated with innovations, including "not invented here" and "too good to be true" responses. However, seeing is believing and we are increasingly seen as a trustworthy and reliable partner, though it takes a lot of effort and investments.

The Sahel team had a conversation with Mr. Aaron Baldwin, Head of Agronomy and Farms at Flour Mills of Nigeria Plc, on the company's efforts towards commercializing SoilCares technology in Nigeria. Aaron shares his insights.

Flour Mills of Nigeria Plc (FMN) is looking to commercialize SoilCares technology in Nigeria. FMN is currently gathering soil samples across three focus states; Kaduna, Kano and Niger.

The samples collected will be sent to SoilCares laboratory in The Netherlands for further analysis. The technology will be commercialized in two phases:

- The hand-held test device that can be used to diagnose farmlands remotely and provide on-the-spot recommendations to farmers.
- Establishment of a full-blown soil test laboratory for deeper analysis and tests.

Current efforts are geared towards gathering a statistical representation of the focus geography (Kaduna, Kano and Niger) and collecting about 50 - 100 soil samples in targeted states.

One of the key challenges experienced in gathering the soil samples is having to travel to the states to gather samples which is time consuming and potentially delays the path-to-market process.

The technology will be formally introduced in Nigeria by October 2018 and an immediate increase in production yields of about 25-30% is expected upon its introduction. This increased yield would be driven by farmers being able to use more targeted approach for fertilizer application.





Automated Technology is the use of digital electronics and intelligent systems to operate and control processes, activities and tasks across different economic sectors with minimal dependence and interaction with humans. These digital systems include drones, unmanned aerial vehicles (UAVs), robots and artificial intelligence (AI) technologies. Automated Technology offers scalable alternative solutions from which more complex systems can be developed to reduce cost and the intensive-labour associated with agricultural activities from production to processing, packaging and delivery to end users.

Automated Technologies are combined with thousands of microscopic sensors to carry out farm functions without human intervention, thereby enhancing farming systems efficiency and effectiveness. Available automated technologies can be classified as follows:

- **Drones and UAVs** are high precision technologies deployed for aerial land surveillance and mapping. They are often combined with satellite imagery and advanced sensors to efficiently and effectively monitor the growth of crops, livestock and fishery, and provide real time information on various environmental factors such as diseases, weed, and weather condition that impact agricultural activities in a farm.
- **Robots** are used to inject fertilizer at precise depths, automate seed spacing based on soil fertility and plant crops depending on the soil structure and farm history. They are also applied as water sprayers to feed plants with



respect to their soil moisture level, as automated feeding systems in livestock farming or to harvest fish from their habitat without obstructing the aquatic ecosystem composition.

- **AI technologies (AI) technologies** are used in self-driving tractors, bulldozers, irrigation systems and a host of improved traditional farm equipment to enhance various agricultural tasks which includes plant disease detection, and autonomous seeding, planting, irrigation, tillage, harvesting, post-harvesting and processing activities through navigating systems, activity analysis, knowledge transfer and timely decision making.



The penetration of Automated Technology in Africa is low, as revealed by PricewaterhouseCoopers (PwC)'s 2016 Africa Agribusiness Insight Survey, which shows that only 12% of the respondents have invested in Artificial Intelligence (AI) to aid production. However, efforts to increase adoption are increasing. For example, the National Space and Research Development Agency (NASRDA) in Nigeria developed an automated machine that would assist farmers to irrigate their farmlands to boost food production across planting seasons. According to the NASRDA's Head of Instrumentation, the equipment could function without the involvement of the farmers as it has been programmed to stop when the farm is adequately irrigated.



Company Spotlight

A few agricultural technology companies across Africa providing automation services to farms include Aerial Industries Nigeria Ltd, Syecomp Ghana Ltd and Beat Drone.

Aerial Industries Nigeria Ltd is a technology and software company founded by Ndubisi Arinze Eze that focuses on providing aerial robotics for agriculture mechanisation through intelligent manufacturing processes and embedding crop data computing software to improve farming systems while reversing environmental challenges.

Syecomp Ghana Ltd, founded by Solomon Elorm Allavi, is a startup that specialises in the acquisition, processing, analysis and synthesis of imagery from remotely sensed satellites and multi-spectral image data from drones to monitor field crops/vegetative status and identify and mitigate potential diseases across fields in Sub-Saharan Africa.

Beat Drone is a growing Nigerian company that procures drones from Western and Eastern countries to provide services to local farmers.



On June 14, 2018, Sahel Consulting had an interview with Confidence Odionye, Founder of Beat Drone on how automation is reshaping the face of agriculture across Africa.

- **Can you briefly discuss how Beat Drone is changing farming experience in Nigeria?**

Beat Drone deploys drones to enable farmers to efficiently map their farmlands and carry out crops supervision. We also provide farmers with accurate data on crops' health performance and aid better precision in the spraying of chemicals in order to maximise yields.

- **What has been the most visible impact of Beat Drone since its launch (with respect to agriculture)?**

Since our launch in January 2017, we have operated on over 5,000 hectares and have signed over 35,000 hectares till date; by year end, we will have signed 1.2 Million hectares of serviceable farmland, thus improving the harvest yield of farmers and making food affordable to 500,000 Nigerians.

- **What has been the most persisting challenge(s) you have faced as a start-up in penetrating the agricultural landscape in Nigeria?**

In Nigeria, the major challenge is the lack of feeder roads that lead to the farmlands, and the lack of quick access to drone parts for equipment maintenance.

- **How can these challenges be addressed?**

Local production is the key to price reduction. Creating assembly plants and manufacturing plants will go a long way in reducing drone prices and drive more sustainable growth in Nigeria, and across Africa.

- **How will you describe the adoption of drones in Nigeria ?**

The use of drones in Nigeria is relatively new but growing exponentially. Farmers, agri-businesses, agro-financial institutions and ministries of agriculture are beginning to adopt and fund the adoption of the technology for day-to-day farming operations.

- **What is your perception of the future of drones in Nigeria's agriculture?**

In the nearest future, drones will drive almost all activities on the farm, from planting, to spraying, irrigation, and crop supervision, thus reducing the risk in the sector and maximising harvest yields.

- **In addition, what is your opinion on the future of drones helping Africa attain food security and what are the success factors required?**

Drones are driving improved harvest yields, thus making African countries such as Nigeria gradually attain some level of food security and reducing the cost of food drastically. To date, farmers who have adopted the use of drones have increased their harvest yields. Last year, the 1,800 hectares of farmlands we serviced which planted mostly rice, cassava and maize recorded 85% harvest yields, the highest in over 4 decades. This represents an increase from 60% crop yield previously achieved by the farmlands without drones. Drones are truly a driving tool for food security and affordability in Nigeria and Africa at large.



Bioengineering is one of the fastest growing subdivisions of agricultural technology. Due to the high impact of bioengineering in addressing malnutrition at scale, this article focuses on biofortification, a bioengineering process of increasing the density of vitamins and minerals in a crop to improve the nutritional status of the consumers. This method is a sustainable way of reducing micronutrient deficiencies on a large scale. There are three, non-mutually exclusive methods used to develop biofortified crops including:

- **Agronomic Biofortification:** utilizes fertilizer to impact the genetic traits of a crop to improve its nutritional qualities.
- **Conventional Plant Breeding:** is the deliberate interbreeding (crossing) of closely or distantly related crops to produce new crop varieties or lines with improved nutritional qualities.
- **Genetic Engineering:** is the direct manipulation of an organism's genes using biotechnology.

The commonly used biofortification techniques in sub-Saharan Africa are agronomic biofortification and conventional plant breeding because they safeguard the genetic properties of a crop while enhancing its nutritional and/or agronomic qualities. Genetic engineering, which results in Genetically Modified Organisms (GMO) is a less popular method due to the controversies surrounding the technology. Organizations that advocate against GMO describe it as an alteration of the genetic material (DNA) of a crop that can result in human health issues. However, GMO promoters, counter-argue that there is little evidence of health or environmental hazards of GMOs.



Biofortification interventions target smallholder farmers in rural areas, who subsist on staple crops and have limited access to commercially fortified foods. Some of the prominent biofortification activities in Africa include:

- **Vitamin A Biofortification:** Vitamin A deficiency (VAD) is a form of malnutrition that lowers immunity, impairs vision, and may lead to blindness. In Nigeria and Zambia, respectively 30% and 54% of children under 5 are estimated to be vitamin A deficient. Due to this high rate of VAD in sub-Saharan Africa, several crops are biofortified including provitamin A maize, yellow (vitamin A) cassava and orange fleshed sweet potato (OFSP). The crops are enriched with beta-carotene (Pro-Vitamin A) which is converted into vitamin A in the body upon consumption. Upon fortification, the crops present a yellow to orange color. According to HarvestPlus, vitamin A maize and cassava provide 25% and 40% of daily vitamin A needs of consumers.



Iron Biofortification: Iron deficiency, which causes anemia, is associated with significant loss of cognitive abilities, decreased physical activity and low resistance to disease. In Uganda, almost 50% of non-pregnant women and 50% of children under five are anemic, while in DRC, 60% of Congolese children under 5 are estimated to be iron deficient. This spurred the need for iron rich foods including iron beans, which are widely consumed, protein-rich crops that, when biofortified, provide up to 50% of daily iron needs of consumers.



In Africa, the challenges with biofortification technology are less about the methods used and more about farmers' and consumers' acceptance of the resulting crops. These challenges include low adoption of the new varieties, limited production at scale and low household consumption. These challenges stem from the difference in the appearance of the biofortified crops (color), the lack of knowledge about the agronomy (yield, stress resistance), and about the nutritional value of the biofortified crops compared to conventional crops.

Biofortification Initiatives Spotlight



HarvestPlus works across Africa to catalyse the adoption, production and consumption of vitamin A cassava, iron bean, PVA maize and OFSP. HarvestPlus focuses its biofortification efforts in several African countries including Nigeria, Rwanda, the Democratic Republic of Congo, Uganda and Zambia.

In Nigeria, the organisation works with the public, private sector and international partners such as International Institute of Tropical Agriculture (IITA), to multiply vitamin A cassava stems and distribute to farmers for planting. It is also creating and strengthening demand by supporting commercial processing of vitamin A cassava into local food products such as *garri* and *fufu*. It has launched several awareness campaigns, leveraging the mass media, and curating a short film with the Nigerian entertainment industry, to educate Nigerians on macronutrient efficiencies and the benefits of vitamin A cassava.

HarvestPlus has developed innovative strategies to promote the adoption and consumption of vitamin A cassava using a one-stop shop model where consumers can buy vitamin A cassava stems, tubers, and ready-to-eat products such as pies, cakes and fufu.

Great strides have been achieved in Rwanda with the introduction of about 10 varieties of iron beans to farmers. Beans are a staple of the Rwandan diet and have been leveraged to introduce the improved variety. In Rwanda, nearly half a million Rwandan farming households have grown at least one high-iron bean variety since the crop was first introduced in 2010 in the country.

Building Nutritious Food baskets (BNFB)

Program: BNFB is a 3-year (2015-2018) program of the International Potato Center implemented in Nigeria and Tanzania. The objectives of the program are to accelerate and support scaling up of biofortified crops for food and nutrition security and to help reduce hidden hunger by catalyzing sustainable investment for the utilization of biofortified crops at scale. One of the key crops of the program is OFSP. Key activities of the program include capacity building of the farmers, private sector engagement to build a sustainable value chain for OFSP and focus on women entrepreneurship as OFSP is majorly grown by women.



MOBILE APPLICATIONS IN AGRICULTURE



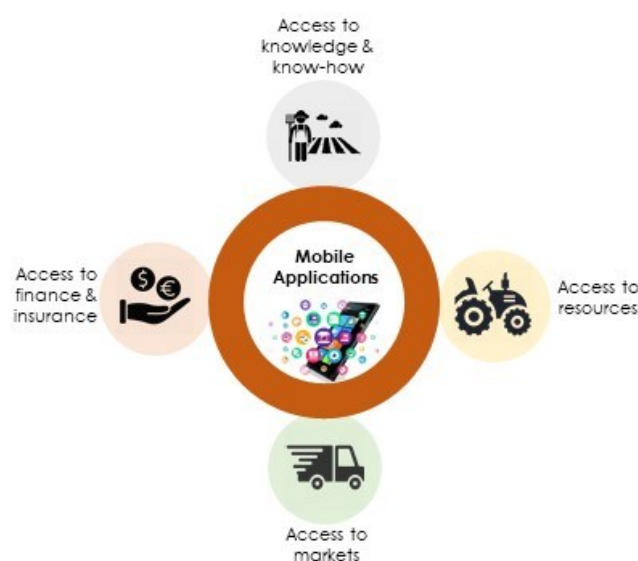
The introduction of mobile application technologies into agriculture has provided a wide range of solutions that enhance knowledge-sharing mechanisms, bolster farmer-to-market connectivity, raise food value chain efficiency, offer financial services, reduce transaction costs and improve the livelihoods of farmers. For instance, a farmer in a remote village in the countryside can access information about the prices of crops in different markets so that he is able to negotiate for better prices and increase his income.

Mobile technologies have focused on addressing four main challenges of farmers as highlighted below:

- **Access to Finance and Insurance Products:** Smallholder farmers face significant challenges accessing funds and insurance products as they are considered high-risk profile clients, with climate-dependent production cycle and with no collateral. Mobile application technologies are providing financing solutions for farmers in the form of crowd funding and affordable crop insurance.
- **Access to Resources (inputs and equipment):** Most smallholder farmers lack access to high yielding inputs (seeds, fertilizers and pesticides), and to equipment (e.g., tractors) to support farm operations. By leveraging mobile technologies, start-ups are offering marketplaces and sharing platforms, through which farmers can be linked to inputs suppliers and equipment service providers covering their geographical area.
- **Access to Knowledge and Technical Know-How (business and agronomy):** Farmers reside mostly in rural areas where they have limited access to vital information that would enable them maximise the

possibilities of modern agricultural practices. Hence, a knowledge sharing system that enables access and adoption of current best farming practices is a necessity for agricultural growth. Mobile applications have been designed and developed to address this challenge by providing farmers with access to real-time agriculture news, announcements, market information, agricultural tips, and region-specific weather forecast.

- **Access to Markets (logistics, commercialization, transformation):** The food supply chain, in Africa, is dominated by middlemen who often take advantage of smallholder farmers' limited market connectivity to exploit their margins. Mobile technology solutions are spearheading breakthroughs that connect farmers directly to the consumers, while providing improvements in their operating efficiency and stock control to deliver significant cost savings.



Source: Sahel Research and Analysis 2018

Company Spotlight

Some start-ups leveraging mobile application technologies to provide agricultural solutions include FarmCrowdy Ltd, AgroSpaces, Mobbinsurance and FarmFunded.

FarmCrowdy Ltd is Nigeria's first digital agriculture platform founded by Onyeka Akumah. It allows Nigerians to participate in Agriculture using their online technology. Through Farmcrowdy, individuals can commit an agreed sum to own a minimum farm space, start and complete a farming cycle. *Farms partners* on the platform can sponsor any farm of their choice including maize farms, poultry farms and cassava farms. They get bi-weekly updates about their farm's progress including pictures and videos from the farmers.

AgroSpaces, founded by Jim Bakoume and based in Cameroon, provides a marketplace system that connects farmers, buyers, consumers and other agro-actors to share information and form valuable connections. The platform provides farmers access to agriculture news, announcements, market information, agricultural tips, and region-specific weather forecast.

Mobbinsurance is a start-up company based in South Africa that is focused on offering farmers with affordable crop insurance using the mobile application. The Kudzai Kutukwa-founded start-up, Mobbinsurance also utilises satellite data and satellite technology to insure against weather-related risks that cause crop failure.

FarmFunded is a crowdfunding start-up based in Nigeria that provides financing solutions for farmers to scale-up their operations. Usually at the end of the farm-cycle, the farm products are sold, and proceeds are used to pay funders their initial principal and expected returns on investment.



The Sahel Consulting team held an interview with Joshua Ajisope, CEO of FarmFunded (on June 19, 2018) to gain more insights into ways through which the start-up is leveraging on crowdfunding as a platform to transform agricultural practice in Nigeria.

- **Please, can you briefly discuss how FarmFunded is changing farming experience in Nigeria?**

We are changing the narrative of farming in Nigeria by funding the activities of farmers through crowdfunding. Hence you grow your funds and your food. We are also providing access to mechanization, best agronomic practices, high yielding varieties of seeds, herbicides,

insecticides and the ready market that farmers need to scale-up their farming operations.

- **How will you describe the adoption of FarmFunded in Nigeria across the states you operate in?**

We have been able to reach farmers in Osun, Oyo and Rivers State, Nigeria. We are working on penetrating Ondo State at the moment.

- **What has been the most persisting challenges you have faced as a start-up in penetrating the agricultural landscape in Nigeria?**

There are insufficient machines for farmers to work with. Also, some farmers are not honest about the yield on their farm. Another challenge is securing off-takers for farmers' produce. These three challenges have been some of our headache.

- **What is your perception of the future of FarmFunded in Nigeria?**

The future is bright. We are optimistic that, in no time, we will be able to collectively work to achieve food security, not only in Nigeria, but in Africa. We have a long-term plan to not only fund the activities of farmers but to also be able to fund processing companies who already have the necessary equipment and machineries but have limited working capital to scale-up their operations. The idea is to support food processing companies and industries to readily absorb farmers' produce.

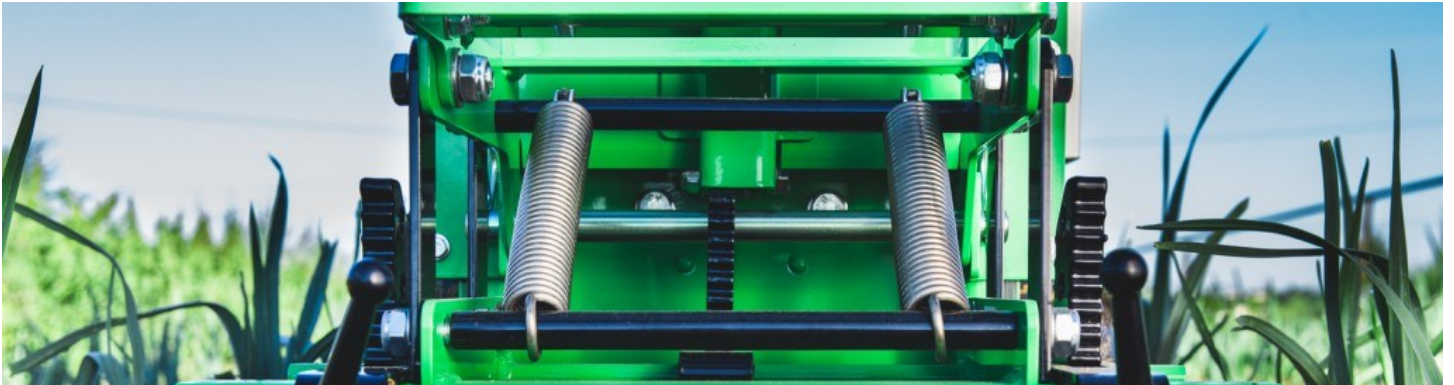
- **What are other challenges faced in adopting and scaling ICT solutions in Africa and how can these challenges be addressed?**

Change is constant but the inability of people to accept change is one problem facing the adoption of ICT solutions. I believe the absence of an enabling environment needed for these solutions has also been a hindrance to adoption. Acceleration and incubation programs as well as co-working spaces have been helpful, but we believe that further efforts targeted at improving the existing structures and systems should be put in place.

- **In addition, what is your opinion on the future of agricultural technologies in helping Africa attain food security?**

Technology is drawing the attention of young innovative minds to opportunities in Agriculture. As they constitute the majority of the population, their involvement would hasten our journey to food security.

KEY CHALLENGES, DRIVERS AND RISKS ASSOCIATED WITH INCREASED AGRICULTURE TECHNOLOGY ADOPTION



Despite substantial investments in promoting modern agricultural technologies to improve yields and food security around the world, the adoption rates of these technologies remain relatively low in many African countries due to their high costs to farmers; limited access to affordable finance; limited awareness about these technologies, their benefits and uses; and other constraints around conducive policies, available support infrastructure etc.

Key drivers to increase adoption of agriculture technologies include:

- **Enabling policy environment:** Supportive policies and regulatory frameworks need to be put in place to create an enabling environment and foster the development of technological innovations adaptable to the African environment. These policies also need to boost private sector participation and investment and promote technology adoption by smallholder farmers.
- **Funding availability:** Farmers need financing and credit to access and procure most of these technologies. Service providers also require financing to procure, operate and increase the availability of agricultural technologies such as drones and robots.
- **Support Infrastructure:** Investments are needed to develop infrastructure such as rural transport systems, water supply, electricity, and telecommunication facilities that will support these technologies.
- **Education, Awareness and Capacity Building:** Farmers need to be made aware of available technologies and of their benefits before they can be convinced to invest in them. In addition, the use of technologies such as smartphones require specific skills that farmers need to learn. Furthermore, investments need to go into higher education and research to produce more engineers, programmers and scientists to drive

innovation and tailored technologies in the agricultural sector. Farmer groups and cooperatives can also support the successful dissemination and adoption of agricultural technologies. This is because they can share transaction costs among their members, facilitate efficient information flow, and reduce both farmers' risk aversion toward new technologies and income shocks through collective risk management.

Some potential risks attached to increased adoption of agricultural technologies include:

- **Job displacement:** The adoption of agricultural technology could lead to job displacement in areas of agriculture previously supported by human labour. However, it would also create new employment opportunities in agriculture and in emerging support industries such as the repair and provision of services for automated equipment. The educational system, therefore, needs to incorporate relevant courses such as practical software use and software development skills into its curricula to meet emerging industries' needs.
- **Technological Hazards:** New technology could also introduce threats and hazards to farmers, part of which would be as a result of farmers' limited experience. This could lead to injuries, property damage etc. This can be addressed through proper education and strengthened extension services on how the farmers can maintain adequate health and safety procedures, and also properly operate and maintain the adopted technologies.

- **Environmental Impact:** Farmers and other stakeholders who come in contact with air, water and soils polluted by technological accidents may face negative health consequences. It is critical to ensure appropriate measures are put in place to minimise potential environmental hazards.

In spite of these risks, with the growing demand for sustainable food, the benefits of agricultural technologies far outweigh the threats that come with its adoption.

IMPACT OF AGRICULTURE TECHNOLOGY ON WOMEN AND YOUTH



Women and youth are key actors in driving agricultural transformation in Africa. Women comprise 70% of Africa's agriculture workforce, while youth are the future of the sector, with the median age in Africa being 19 years.

Women in Agriculture

The capacity of women to effectively manage farm tasks is hindered by their limited access to the technology required for critical farming operations.

Challenges specific to women adopting agriculture technology include institutional and cultural norms and their limited access to finance.

Mainstreaming the empowerment of women through agriculture technology will reduce their labour burden, cut down unproductive time, increase yields and enable them to generate increased income and improve their livelihood. Mobile applications, for instance, provides the means to link women farmers to markets from their homes and turn their farming activities to business ventures.

Youth in Agriculture

Unlike the current generation of farmers who are used to old farming techniques, African youth are more likely to appreciate, learn and adopt modern technologies needed to transform the sector.

Young people typically perceive the current agriculture lifestyle as archaic. Technology can thus be used as a tool to change their perceptions and attract them to the sector. Mechanization, automation, digitization and information technology in agriculture opens attractive and innovative opportunities across value chains. For example:

- **Climate smart agriculture:** Youth can use internet-based applications to foster sustainable agriculture.
- **Agri-related information & Improved yield solutions:** Young entrepreneurs can use open-source software, cloud computing system and connectivity to deliver solution such as improved yields and to program agronomic information for farmers.
- **Finance and risk solutions:** Youth can use on- and offline mobile applications and social media platforms to share information on financial services and risk management solutions with farmers.
- **Digitalized agriculture:** Youth owned start-ups can develop infrastructure critical to digitalize agriculture in Africa such as a comprehensive soil map with soil data and information to facilitate precision farming.

SAHEL CONSULTING SPEAKS

Consultative Meeting with the Federal Government; Lagos, Nigeria

Ndidi Nwuneli, Managing Partner, served as a panelist during the Consultative Meeting on Alignment of Research and Delivery towards Agricultural Policies of the Federal Government held in Abuja on April 10, 2018.

TAMS Summit 2018; Lagos, Nigeria

Ndidi Nwuneli gave the keynote address at the TAMS Summit 2018 which focused on 'Youth Engagement and Empowerment in Corporate and Public Workplaces a Priority as a Catalyst for National Growth'. The event was organized by SB Telecoms and held at the Muson Centre in Lagos on May 17, 2018.

Scaleup Lab Agribusiness Accelerator Programme; Lagos, Nigeria

Temi Adegoroye, Manager, spoke on Agribusiness Ecosystem Mapping at the Scaleup Lab Agribusiness Accelerator Programme organised by FATE Foundation on May 22, 2018.

FT Nigeria Conference; Lagos, Nigeria

Ndidi Nwuneli served as a panelist on the Production Panel – 'Going Local to Realize Global Ambition' at the FT Nigeria Conference. The event was convened by Financial Times and took place on May 31, 2018.

WEConnect International Annual Conference; Lagos, Nigeria

Ndidi Nwuneli gave the keynote speech at the WEConnect International Annual Conference on 'How Women Win – The Role of Leadership, Technology and Society'. The event was conveyed by WEConnect International in conjunction with Accenture and Procter & Gamble. The event brought together about 150 women business owners from around Nigeria was held on June 6, 2018.

Africa Convergence Conference; Dakar, Senegal

Nathalie Ebo, Associate Partner, spoke at the Africa Convergence Conference in Dakar, Senegal on June 21, 2018.

Aspen Idea Festival; Colorado, United States

Ndidi Nwuneli gave a Moth talk at "Undaunted: Stories from the Front Line" and also spoke on the "Imperiled Food Supply" at Spotlight Health, the opening segment of the annual Aspen Ideas Festival organized by Aspen Institute on June 22, 2018.

SAHEL CAPITAL SPEAKS

African Private Equity and Venture Capital Association ("AVCA") Conference; Marrakesh, Morocco

Mezuo Nwuneli, Managing Partner, and Niyi Oladejo, Operating Partner, attended the 15th Annual AVCA Conference in Morocco April 23 — 24, 2018.

BusinessDay Agribusiness Food and Food Security Summit 2018; Lagos, Nigeria

Mezuo Nwuneli spoke on 'Practical Access to Finance' at the BusinessDay Agribusiness Food and Food Security Summit 2018 on 'Evolving Actionable Models to make Agribusiness more viable' on April 27, 2018.

Ghangeria Rising Conference 2018; Accra, Ghana

Mezuo Nwuneli spoke on 'Leveraging Agriculture and Agribusiness Support Systems in Ghana and Nigeria for Inclusive Growth' at the Ghangeria Rising Conference on May 10, 2018.

African Development Bank Annual Meeting; Busan, South Korea

Mezuo Nwuneli attended the 53rd Annual meeting of the African Development Bank held this year in the Republic of Korea between May 21 — 25, 2018.

Akindelano Legal Practitioners Seminar; Lagos, Nigeria

Olumide Lawson, Partner, was a panelist at the Akindelano Legal Practitioners (ALP) Seminar on 'Transforming Nigeria's Agriculture and Agro-Allied Industry' that held at The Oriental Hotel, Victoria Island, Lagos on June 21, 2018.

Lagos Business School Debate and Award Ceremony; Lagos, Nigeria

Deji Adebuseye, Vice President, was a panelist at the Lagos Business School Debate and Award Ceremony held at the Lagos Business School Campus on June 23, 2018.

CAREER ADVANCEMENT AT SAHEL

We congratulate some of our team members as they commence their graduate education in top tier business schools around the world. We are confident that they will continue to make the Sahel family proud!



Temi Adegoroye
Lagos Business School,
Pan-Atlantic University



Uzoma Ikechukwu
Stanford Graduate School of
Business, Stanford University



Chuka Madubunyi
Judge Business School,
University of Cambridge



Damilola Olagunju
Harvard Business School,
Harvard University

Contact Information

Management Consulting

Sahel Consulting Agriculture & Nutrition Limited

Office Address:

34a Fola Osibo Street
Lekki Phase I
Lagos, Nigeria

Phone:

+234-1-628-2670

Website:

www.sahelcp.com

Email:

info@sahelcp.com



Contact Information

Private Equity

Sahel Capital Agribusiness Managers Limited

Office Address:

34b Fola Osibo Street
Lekki Phase I
Lagos, Nigeria

Phone:

+234-1-279-7320

Website:

www.sahelcp.com

Email:

fafin@sahelcp.com