Agra Innovate West Africa

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Developing the Agricultural sector via Technology, & The Impact on Food Economy and Farmers Livelihood in Africa

Agriculture is continuously changing through innovation in science and technology. However, the agriculture industry continues to be called upon to produce more with finite resources. A major way to improve traceability, sustainability, and quality of food to achieve food security is through the adoption of technology. The importance of agriculture as a major sector cannot be overemphasised, agriculture plays a unique role in reducing poverty through the use of new technologies as technology is shaping the world, improving lives, making things easy and transforming the continent. Throughout history, scientific and technological advances have greatly impacted the agriculture industry. Early farmers improved their crop production by inventing the first hoes. Today, farmers improve crop production through the use of global positioning systems (GPS).

With food insecurity on the rise in Africa, smallholder farmers are turning to new technologies to improve food production and marketability. A lot is being done to improve seeds and increase production which will help in restoring increased production of food in Nigeria. The tendency to succeed as a farmer in recent times is high if farmers are exposed to Information and Communications Technology. As a primary production sector, agriculture has to be modernized in order to achieve the much-needed increase in the productivity of the sector. In Africa's most populous country, Nigeria, food insecurity is on the rise; almost 8 per cent of the population was found to be undernourished in 2015, compared with 6 per cent in 2007, according to the World Bank's development indicators. This presents both a challenge and an opportunity for smallholder farmers, and those seeking to invest in them, with the UN's Food and Agriculture Organization (FAO) predicting that the agricultural market in Sub-Saharan Africa will grow from US$200 billion in 2015 to US$1 trillion by 2030. The US is the biggest agriculture exporter in the world, followed by

Netherlands, whose success hinges on technology and innovation, with focus on farming without unnecessary waste, toxins, and with conscious anticipation of our changing planet. With a land mass of 41,543 sq. km, and population of just over 17 million people, which is the population of Lagos state, Netherlands is the 2nd highest agriculture exporter in the world. Netherlands is the first to come up with the concept of floating dairy farms—a small herd of well-fed dairy cows standing on a $2.9million waterborne contraption in Rotterdam Netherlands.

The global population is predicted to grow by 2 billion by 2050 and with more than half of that growth coming from Sub-Saharan Africa, addressing food insecurity has become a matter of urgency, because as the population grows and climate change worsens, food security is a major challenge.

How Technology Plays a Role in Agriculture

And increasingly, farmers practising subsistence agriculture are migrating to new technologies to increase productivity and marketability. These range from using social media to connect with others in the sector, to partnering with companies that provide drone technology and remote sensing. Nigeria's population of around 200 million translates to high demand for farm produce, and entrepreneurs, corporations and governments are working together to achieve the Sustainable Development Goal 2 to "end hunger, achieve food security and improved nutrition and promote sustainable agriculture".

Modern Agricultural Technology Practices and the Potential impact on Food Economy and Farmers livelihoods in Africa.

1. Mechanization

The era of farmers using crude farm implements like hoe, sickles and cutlasses is slowly fading away. Painfully, many farmers still use these tools in their farming operations, the effect? Low supply of farm products, poor efficiency and sustenance of products. Mechanized form of farming involves the use advanced technological machines, tools and techniques in rearing plants animals, this will:

- reduce energy exerted in the agricultural process
- improve productivity
- improve life span
- regular supply of farm produce
- enhance economic growth

Nigeria faces a lot of challenges in this area. For example, the land use decree (1978) makes acquisition of land difficult in a way making it difficult for peasant farmers to acquire sufficient land mass to practice mechanized farming, Unavailability of infrastructural facilities like good road network, communication facilities and transport system, Illiteracy among farmers and sufficient funding. The use of tractors, boom sprayers, ploughing machine and pumps are mechanized tools that will help reshape the agriculture sector and help farmers. A revision of the land use decree of 1978 will help farmers acquire more acres of land to practice this form of farming. The use of agricultural machinery has drastically cut down the time it takes to perform farm activities and farmers are more productive than ever. To illustrate, it took farmers an average of three to five hours to till an acre of land manually using shovels or hoes. Today, using a 154-horsepower tractor and a chisel plough, a farmer can till an acre in five minutes. When professional tools are used for farming, more farm produce can be harvested and it makes farming easier and faster.

2. Agricultural Biotechnology

Simply put, agricultural biotechnology is the manipulation of crops and animals or their parts for the production of value-added goods and services for man's use. It is being used to address problems in all areas of agricultural production and processing. This includes plant breeding to raise and stabilize yields; to improve resistance to pests, diseases and abiotic stresses such as drought and cold; and to enhance the nutritional content of foods. Despite reservations about GMO plants, security and regulatory agencies have stood up to defend advantages of these plants. South Africa for example has recorded remarkable increase, remaining till present the leaders in Africa in the use of biotech crops. In an interview with UK MP Owen Paterson by SASHNEE MOODLEY, South Africa as realised an economic gain of $1.15 billion between 1998 and 2012 from the use of genetically modified (GM) crops or biotech crops. Sudan has also increased its biotech cotton hectares by almost 50% to 90 000 ha. Nigeria can definitely increase its crop production through the use of biotech plants, having them available, educating rural farmers on how to successfully maximize profit and strengthen the food growth of the country like other African countries like South Africa and Sudan.

3. Integrated farm management platform.

Farmers can now, with the help of advancements in agriculture, maximize land and water resources while delivering the most nutritious food to the world's ever-growing population.The concept of an integrated farm management solution (FMS), based on information technology, is an effective way to manage natural resources while realizing modern sustainable agricultural development.Technology advancements on the farm, like an integrated FMS, extend a farmers' overall capacity, automate routine tasks normally done by people, and give farmers more time to do things computers can't. It's not a means to replace the personalized care farmers put into creating resources essential to human life, nor will the

FMS determine the root cause of a problem in the field. A good FMS will include one-on-one expert support in farm management, crop marketing and agronomy.

4. Digital Farming

Digitizing agriculture is essentially the use of digital technologies, innovations, and data to transform business models and practices across the agricultural value chain and address impediments in productivity, postharvest handling, market access, finance, and supply chain management to achieve greater income for smallholder farmers, improve food and nutrition security, build climate resilience and expand inclusion of youth and women.

A few years back, it would have been impossible to imagine a scenario where people could farm using their mobile phones and laptops without having to be on the farm or doing any of the farm work and still earn while at it. Now, farming has been made easier with the birth of digital agricultural startups. With the aim of putting an end to poverty, getting more people involved in agriculture and increasing the level of food production, these companies operate on a digital platform where people can sponsor farms and earn healthy returns while at it. These farms are sold at a given price which is used to fund the farming cycle and after harvest, the profit earned is shared with the farmer, the sponsor and the company.

Some of these startups includes Farmcrowdy (Nigeria), Pork Money(Ghana & Nigeria), Thrive Agric (Nigeria), Farm Kart (Nigeria), CowTribe (Ghana), Twiga Foods (Kenya), Hello Tractor (Nigeria), UjuziKilimo (Kenya) and a host of others.

5. Seed Development

There have been a lot of breakthroughs in the field of seed development. A more recent seedling breakthrough by the International Institute of Tropical Agriculture (IITA) is the planting of yam leaves to produce millions of healthy high yield stems. According to Yam Seed System Specialist, IITA, Abuja, Dr. Beatrice Aighewi in an interview with The Guardian said “The aeroponic system is used to produce clean yam. It’s like growing yam in the air. What we plant is yam vine popularly called ‘stem’, to produce tubers for farmers to plant. We want seed companies to use this technology to produce seedling for farmers in large quantity. The advantage is that instead of losing a lot of tubers during planting, farmers can approach seed companies and get a bag of seedling to plant on a vast land.” Technology and technological processing will continue to play a big role in seed development which has a direct effect on the agriculture industry.

6. Affordable and Accessible Farm Education

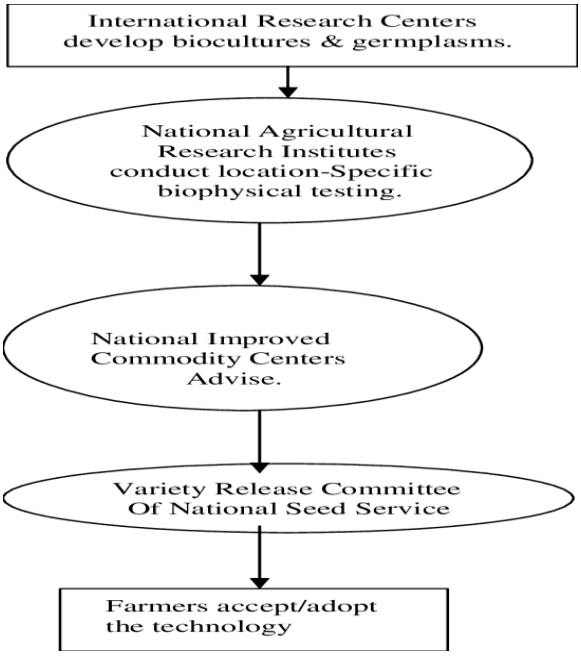
Technology has made educating farmers easier. People are more enlightened about farming as a profession, and it has shifted the perspective of considering farming as a profession for people in rural communities or for people who have nothing else to do, to a profession that holds exciting prospects. Since more youths are participating in Agriculture, they are able to get farming information on their mobile devices, regardless of location. While it may still be difficult to pass information to some rural farmers due to barriers like language, several farmers have seen the kinds of yields they can get from using modern farming techniques and are more open to exploring new options. With technology, farmers can be handed devices that are pre-installed with farm training and can be watched over and over again.

7. Genetic Engineering

Plants have been engineered to survive in drought conditions with the introduction of traits into existing genes with the goal of making crops resistant to drought and pests.

8. Information and Communications Technology

IT (Information Technology) can be used a tool for direct contribution to agricultural productivity and an indirect tool for empowering farmers to take informed and quality decisions which will have positive impact on the way agriculture and allied activities are conducted. The main objective of ICT (Information and Communications Technology) application, from a development perspective, is that of empowering people through knowledge. It increases the effectiveness of their development efforts through informed decision making and through their capacity to harness science and various forms of knowledge to achieve the objectives of poverty eradication,
food security and sustainable development. This would be an effective tool for the very large uneducated populace farmers in the country and also help foster a better understanding of farming practice and marketing among the youths who are eagerly delving into farming today. Communication is probably the greatest improvement that technology has caused across all industries. Back in the days, farmers could only communicate with farmers in their community or at most, share ideas with farmers in neighboring villages who come to sell their farm produce. With the advent of technology, farmers can create Whatsapp groups and learn from each other, share experiences, advertise their products, source for loans and do more.



Process of agricultural technology transfer from developers to farmers in Nigeria Source: Ikpi (2002)

9. Animal Farming Technology

Meat and poultry outlook: China's desperate need for pork began showing in US pork export data in the middle of 2019.US pork exports to China Hong region alone rose to 61,062 metric tonnes which is 165% up on 2018 figures.USDA's economic research says pork will be the no one protein exported in 2020 by the US at forecast of 7.100 lbs valued at $6.7billion USD vs 6.200lbs valued at $5.5billionUSD in 2019. Broiler chickens will be no 2 protein exported by US at 7.425billion valued at $5.2billionUSD vs 7.040 billion lbs in 2019***.*** Beef will be no 3 protein export from the US in 2020 at 3.305billion lbs . Beef exports though smaller in quantity will have the largest value at an estimated $7.6billionUSD***.*** All the above enumerated revenues are possible due to technology powered agriculture."

- Poultry Farming Engineering; Hatchery automation, Ovo technology, Feed milling for sustainablity, vaccine technology to reduce bird mortality and increase profitability.
    - In Ovo vaccination in Poultry: In Ovo vaccination is carried out by machines. These machines perform a number of actions to ensure good vaccination of the chick inside the egg. Benefit of In Ovo vaccination include avoidance of bird stress, controlled hygenic conditions, and earlier immunity with less interference from maternal antibodies. In Ovo vaccination is relatively new procedure of mass vaccine delivery to poultry. Commercial egg-injection machines deliver the vaccine into the amniotic fluid of most eggs. The vaccine viruses do not adversely affect hatchability of eggs or performance of hatched chicks.

- Pig Farming Engineering: Biological treatment plants are now used for the purification and composting of manure in pig farming. Solar thermal and photovoltaic panels are installed in the farm houses provide most of the hot water and electricity used at the farm. Electricity can also be generated by biomass boilers that run on sustainably sourced wood pellets. Salgot Organic research hog farm in Spain practices and uses above technology to produce premium quality at reduced costs for higher profits. This is also possible due to technology, powered agriculture.

10. Food Inspection technology

Applications that assist in preventing the contamination and poisoning of food products. Examples are metal detecting technology pre and post processing of agricultural produce.

11. Agricultural Logistics Technology

Artificial Intelligence and food safety Track and trace technology - 40% of agricultural production is lost to waste between farmgate and consumers table. Food companies can publicly pinpoint source of food contamination from farm to fork with speed and can minimize damage to brand. Modern supply chain tools that can manage inputs distribution, warehouse receipt systems for grains and crops, and the cold chain of perishable goods particularly poultry and livestock require heavy investments in training, computer infrastructure and communications, which developing countries may not be able to afford due to inefficient power supply, and high capital costs.

12. Waste Management Technology

Food waste is a big problem and, as such, a big opportunity. Waste occurs throughout the supply chain — on the farm, at the processors factory, in transit, at the retailer, and with the consumer “Big data and advanced analytics technology can be used to optimize waste management. Food waste causes economic losses, harms natural resources, and exacerbates food-security issues. About a third of food produced for human consumption is lost or wasted every year in a world where 795 million people — a ninth of the population — go hungry. Cutting post-harvest losses in half would produce enough food to feed a billion more people.”. Logistics obviously is the major player in reducing food waste which inhibits food security and economic development.

Psaltry International Ltd Oyo state Nigeria, a cassava processing company, recycles cassava peels into pellets for powering wood boilers in the [production factory. Technologies such as modern irrigation ensure farming all year, humidifiers prevent produce from perishing, and temperature-controlled shipping containers tackle the common problem of food wastage. The use of these new technologies, from aeroponics to modern transportation systems, is gaining traction in Nigeria. There is a community of people enthusiastic about these methods of agriculture and passionate about deploying them in pursuit of the Sustainable Development Goals.

Technologies that will impact agriculture the most in 2020?

There are four main technologies that are really starting to make waves globally. They're going to gain pace and see a huge amount of adoption.

1. Renewable energy. We're seeing huge solar and wind projects popping up all over the world. There are solar panels that can live on stilts above crops.

2. Sensors. Technology has made it possible to put the internet of agricultural things into the field, onto cattle as wearable devices, and embedded into farm equipment. These sensors harvest data from the environment and give farmers a new view of their operations. That gives them a lot of power.

3. Data. Farmers are becoming more data savvy in a number of different ways. They are applying analytics, employing data science teams to help them unlock value, and working with agronomists.

Role of Digital Technology In the Transformation of Agriculture In Nigeria

Digitalizing agriculture in Nigeria is a game-changing trend. The demand for digital solutions in agriculture is easy to appreciate, especially, in a country like Nigeria where farming stays mainly at the subsistence or smallholder level with huge inefficiencies defining the practice, giving rise to a fragmented and often poor agriculture economy. The need to introduce a greater level of efficiency and transparency into the sector is leading some experienced and newer-entry stakeholders to seek out solutions for the sector that can best be defined as digital. With Nigeria earning a score of 4.5 out of 9 in the World Bank's Enabling the Business for Agriculture (EBA), ICT Index Score, there is a bit of an improvement in the efforts to create a more conducive digital environment through laws, regulations and policies. The GSMA Mobile Connectivity Index (MCI) also has the country doing well on such indices as affordable prices for handsets, reduction in mobile specific taxation and the creation of gender equality in terms of labour and market

Photo Credit: *Farmforte*

5 Key Drivers for Digital Transformation In Agriculture In Nigeria

- Evolving customer behaviours and preferences
- Growth opportunities in new international markets
- Increased competitive pressure (sector-oriented competition)
- New standards in global regulatory and compliance requirements
- New emerging technologies to reduce waste in produce and human capital for enhanced profitability.

Technology is reducing barriers to trade, offering a window of opportunity to African youth entrepreneurs who are digital-savvy and at the vanguard of innovation applied to different economic sectors. All of the key drivers for digital transformation mentioned above can be applied to the agriculture sector in Africa, which is starting to show improved economics with a handful of players beginning to develop viable businesses with attractive financial models. With over 250 million smallholder farmers and pastoralists in Africa with the need for improved and meaningful livelihoods, digital solutions for agriculture come as a game-changer in supporting and accelerating agricultural transformation across the continent.

Applying digital solutions to agriculture has the potential not only to support agricultural transformation but to do so sustainably and inclusively. This involves driving greater engagement in agriculture from women and young people and creating employment opportunities along the agricultural value chain as well as helping to build resilience to climate change. The potentials also include supporting and sustaining agricultural transformation through digital tools that improve market efficiency, transparency, aggregation and integration.

Nigerian Companies Embracing new Technologies

Soilless farming

One such company is PS Nutraceuticals. It employs aeroponics farming, a method that involves suspending the roots of crops in air and applying mists. The method, which takes place in a controllable environment, has numerous benefits such as requiring minimal water, electricity and labour. Crops are also quick to harvest and there are limited pests. Founded in 2016 by Samson Ogbole and O.P. Okocha, the company hopes that by setting up farms which use this technology, it can help ensure food security in Nigeria.

PS Nutraceuticals uses aeroponics farming, which involves suspending the roots of crops in air and applying mists to help them grow. Credit: *PS Nutraceuticals/Samson Ogbole.*

The method has been tested on more than 200 crops, including tomatoes, ginger, onions, rice and even flowers. Food can be produced at any time of year and the spacing system enables higher productivity. As well as being environmentally friendly, the method attracts investment from banks and individuals. Government is also tapping into the entrepreneurial spirit. PS Nutraceuticals is in partnership with Lagos state in a scheme to grow rice and tomatoes to feed the growing population. The company is using aeroponics and vine-cutting technology in collaboration with the International Institute of Tropical Agriculture on YIIFSWA-II**,** a project that seeks to provide affordable, high-quality seed yam tubers for

smallholder farmers in Nigeria and Ghana. It has recruited 40 local farmers in Oyo and Ogun states to work on the project.

Envirogro farms in Epe, Lagos state also practices soilless farming for tomato and pepper production. A major way to improve traceability, sustainability and quality of food to achieve food security and profitable farming is through the adoption of technology.

Sources & Related Links:

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