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LEVERAGING TECHNOLOGY TO ACHIEVE FOOD SECURITY IN NIGERIA

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ABSTRACT

In Nigeria today, hunger prevalence is on the rise and in paying attention to the country's food production level, the difficulty experienced in meeting domestic food needs and the challenge in exporting our local products, it is easy to conclude that Nigeria is food insecure. The petroleum based economic model of the Nigerian economy has made it lose its force as an export led economy and as the government makes effort to diversify the economy towards achieving food security, it is important to learn about how technology can help achieve this objective. This paper reviews recent attempts by some Nigerian innovators to leverage technology to disrupt the food production and Agriculture sector and examines how public private partnership can foster holistic development in the sector. It is hoped that this study will inform agricultural development practitioner about how technology can end hunger and achieve food security in Nigeria.

INTRODUCTION

The United Nations Committee on World Food Security defines Food Security as the condition in which all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life and like International Food Policy Research Institute, economic growth is only sustainable if all countries have food security.

This paper intends to explore food security issues and how technology can end hunger in Nigeria and to start with, we must understand that from the outset, Nature favors Nigeria with rich soils, good temperature and evenly distributed rainfall for the ease of Agricultural production making her less prone to extreme natural disasters that could threaten lands, crops and livestock except for recent trends including and not limited to desertification, erratic rainfall all caused by climate change.

Climate change is a threat to global food security, others are growing global population, rising food prices. The world population will reach 9.1 billion by 2050 (FAO), and to feed that number of people, global food production will need to grow by 70% on the 60% World's Arable land. Africa itself will double her population attaining about 2.1 billion people, the world will depend on Africa to meet her food needs because she has the youngest population in the world.

As food insecurity rises, hunger prevalence also rises globally. According to projections from FAO, about 795 million people worldwide-roughly one in nine-are estimated to be chronically undernourished in 2014-2016 (FAO, IFAD and WFP 2015). As of 2013, 161 million children-approximately one in four-were stunted, and 51 million children suffered from wasting (UNICEF, 2015 b).

In Nigeria, the population growth rate is at a geometric progression and yet food production is threatened by low farm productivity worsened by climate changes, crude farming, rural-urban migration that deprives farming communities of young people. The combined effects of climate change causing aridification in the Northern part of Nigeria has induced the herdsmen to move southward looking for pasture for their cattle.

According to FMARD, Nigeria still imports about \$3 to \$5 billion worth of food annually, especially wheat, rice, fish and sundry items, including fresh fruits. Nigeria is no longer a major exporter of cocoa, groundnuts (peanuts), rubber, and palm oil. The Cocoa production is stagnant at 180,000 tons (approx.) annually which used to be 300,000 tons (approx.) some 25 years ago. There has been a huge decline in groundnut and palm oil production even in poultry production, it has reduced from 40 million birds annually to about 18 million even the land tenure system of Nigeria does not encourage the long-term investment in technology or modern production methods. As a result, Nigeria is not food secure. Wastage levels remain high in production areas, reducing supply of feedstock to processing factories, requiring them to keep importing supplies.

The net effect is limited job growth across the agricultural value chain from input production to market systems, and continued use of limited foreign currency earnings to import vast quantities of food.

Ultimately, Nigeria is facing two key gaps in agriculture today: an inability to meet domestic food requirements, and an inability to export at quality levels required for market success. The former problem is a productivity challenge driven by an input system and farming model that is largely inefficient. The latter challenge is driven by an equally inefficient system for setting and enforcing food quality standards, as well as poor knowledge of target markets. (FMARD, 2016)

KEY ISSUES THAT AFFECTS THE NIGERIA'S AGRICULTURE SYSTEM

Climate Change: Climate change, also known as Global warming is a threat to food security and it is an increase in average global temperature. It has been scientifically proven that global warming is caused by release of carbon dioxide and other greenhouse gases into the air. Agriculture and deforestation contributes 30% of greenhouse emission. The effects range from persistent droughts and floods, off season rains, drying of lakes, reduction in river flow in arid regions, desertification.

Information Gap: Smallholder farmers are very important, one-third of the world's 7.4 billion people are smallholder farmers and their families produce nearly 70% of all consumed food on 60% of world's arable land, which means there are 2.5 billion people who live and work on 500 million smallholder farms each with less than 2 hectares. Lack of quality market information to enable identification of market opportunities, coordination among market actors and transparency, Poor understanding of the lifecycle of contamination of crops from early stage soil preparation to post-harvest handling. The inability of the farmers to embrace these practices affects crop yield and overall productivity of farmlands.

Financing: According to the World Bank, demand for food will increase by 70% by 2050, at least \$80 billion annual investments will be needed to meet this demand. Access to finance is a challenge to many smallholder farmers due to the high risks in Agriculture. De-risking Agriculture is very important and necessary and can be facilitated by public private partnership.

Post-harvest losses: The term "postharvest loss" - PHL refers to measurable quantitative and qualitative food loss in the postharvest system (de Lucia and Assennato, 1994). This system comprises interconnected activities from the time of harvest through crop processing, marketing and food preparation, to the final decision by the consumer to eat or discard the food.

In many African countries, the post-harvest losses of food cereals are estimated at 25% of the total crop harvested. For some crops such as fruits, vegetables and root crops, being less hardy than cereals, post-harvest losses can reach 50% (Voices Newsletter, 2006).

Going forward, as the government of Nigeria makes effort to diversify the economy, and elevate its debased Agriculture sector, we must not forget that the sector has been ridden with multiple challenges, some of which are highlighted above which poses a threat to food security on the long and short run.

Agriculture in the 21st century cannot continue to be practiced with hoe and cutlass, it must move from crude systems and transit to further leverage on the global technological advancements, what the World Economic Forum regard as the "Fourth Industrial Revolution". The next section seeks to explore how technology can make Agriculture better.

Farmers can achieve more productivity by this means and Agribusiness practitioners can have a massive returns on investment if they deem it necessary to capitalize on technology and that's exactly what the next part of this paper will be about.

HOW FARMERS CAN LEVERAGE ON THE FOURTH INDUSTRIAL REVOLUTION

There is really no gainsaying about the fact that technology has come to stay in Africa considering the renaissance it has generated across different sectors in Africa. This piece will explore the developments that technology offers Agriculture and how Nigerian farmers can capitalize on its nuances towards revamping the economy.

Shall we consider what fourth industrial revolution really means?

The fourth industrial revolution is already at our door, how we get to deal with it matters on the long run for us as individuals and for the African continent. We cannot explore the beauty of the fourth industrial revolution without essentially taking a sneak peek at the industrial revolutions that preceded it.

The first industrial revolution used water and steam power to mechanize production. The second used electric power to create mass production. The third used electronics and information technology to automate production and here we go, a fourth industrial revolution, with an exponential evolution against the linear trend. The possibilities of billions of people connected by mobile devices, with unprecedented processing power, storage, capacity and access to knowledge are unlimited. And these possibilities will be multiplied by emerging technology breakthroughs in fields such as artificial intelligence, robotics, the internet of things, autonomous vehicles, 3-d printing; nanotechnology, biotechnology, materials science, energy storage and quantum computing. (Klaus Schwab, 2016).

IoT, Cloud Computing and Precision Agriculture

One of the peaks of technological advancements is the Food and Agriculture renaissance. Modern Agricultural practice has proven to be of positive benefits to farmers globally and one of such practice is the Precision Agriculture otherwise known as Satellite farming. Precision Agriculture essentially collect data through satellite and aerial imagery and aggregate these data for precise planting. PA fosters traceability, i.e. recording through RFID tags, barcodes, movement of product and steps within production process (Fact Sheet, 2007).

PA also makes use of drones also known as UAV4Ag (Unmanned Ariel Vehicle for Agriculture). Drones can help farmers achieve increased crop productivity and efficient monitoring of crop growth. Farmers need to upgrade to using drones to increase productivity. Drones can do soil and field analysis for irrigation and nitrogen-level management, drone-planting system can plant at an uptake rate of 75% and reduced cost of 85%, irrigate, provide crop health assessment amongst others. (PWC, 2016)

Today, it is easy to connect devices, vehicles, home appliances with sensors, connectivity et al and exchange data across the board. The internet of things has created opportunities for more direct integration of the physical world into computer-based systems (Satucci, 2016) and with little human efforts, efficient and accurate connectedness, data sharing happens. What this means for Agriculture is that farmers can use biochip transponders on farm animals. Biochips enable researchers to quickly screen large numbers of biological analytes for variety of purposes, from disease diagnosis to detection of bioterrorism agents. (Rosa, 2009). Diseases outbreak recorded in past years could have been managed, from Lassa Fever, to Monkey Pox etc.

Cloud computing has made it easy for farmers to access knowledge-based repositories with key information on farm management for useful implementation on their respective farms. FAO has a repository known as e-agriculture with useful resources just on an internet-enables mobile phone. It is important to note that there is so much data being produced from the use of all the above technology and this is against the backdrop of insufficient data provided by crude farmers due to insufficient capacity to manage their farms. UAV or drones can patrol fields and alert farmers to crop ripeness or potential problems. RFID-based traceability systems can provide a constant data stream on farm products as they move through supply chain, from farm to the compost or recycle bin. Individual plants can be monitored for nutrients and growth rates. Analytics looking forward and back assist in determining the best crop to plant, considering both profitability and sustainability (Tim, 2017) and according to Lloyd Marino, “big data in conjunction with the internet of things can revolutionize farming, reduce scarcity and increase our nation's food supply in a dramatic fashion”.

ICT FOR AGRICULTURE

Information communication technologies (ICTs) such as mobile phones and SMS are changing the way farmers track weather patterns, access market information, interact with traders and government agencies and get paid for their crops (Sara Gustafson, 2016). It has been known to provide innovate solutions to the many Agricultural challenges and it essentially fosters communication and learning process between actors involved in Agriculture (Cecilia, 2012) and Since

the transitioning from Web 1.0 to Web 2.0, knowledge sharing and collaboration has never been this awesome. Web 2.0 has offered amazing opportunities to more timely information from efficient tools like wikis, blogs, social networking, and podcasting such as Wikipedia, YouTube, Facebook, and Flickr.

Digital technology has provided a leeway for ICT for Agriculture to thrive. In the past, youth consider Agriculture as rural and for the old people in the local communities, ICT4Ag offers an amazing opportunity for youth to use digital technologies-the internet, their mobile phones amongst others to collect, store and share digital information at an amazing speed and this predicated on the Nigeria's internet base of 147 million people according to NCC.

ICT4Ag is a key to scaling up agricultural innovations and improving small holder farmer's access to markets, information and financial services (Thompson, 2017). Farm management software that increase farmers access to funding and investment opportunities are ubiquitous and because farmers need credit to survive, ICT offers digital financial services and with the advent of block chain, the opportunities are endless.

Obviously, Nigeria Agricultural sector is mostly run by smallholder farmers who are fully operating on a subsistence base and accompanied with a lot of challenges including low productivity due to poor seeds, insufficient fertilizers, poor diseases control measures, lack of finance and information, poor marketing, etc. Farmers can now access information accurately and timely at a reduced cost to help them build a highly profitable farm, digital extension services has relegated analog way of information dissemination, so farmers can leverage mobile to access weather information, get expert recommendations towards achieving higher productivity of farms and most especially be schooled on Climate smart Agriculture, a sustainable means of farming amongst others. Sales has become easy too, as farmers don't really bother much about storage facilities, so they can easily sell their farm produce to their customers via mobile. MyFarmbase bridges the information gap for farmers by using its website and social media platforms to educate tech savvy farmers on farming best practices. Farmcrowdy leverages on digital technology to get a lot of Nigerians to participate in Agriculture. Interested investors can select farms they want to sponsor, their funds are used to purchase lands, plant, insure the farms and then the investors get returns. Growsel.com, ThriveAgric.com and Phambook.ng follows almost the same model.

FINTECH

While the FG through NIRSAL (Nigeria Incentive based risk sharing system for agricultural lending) is working at derisking agriculture and fostering public-private partnership to share agribusiness related credit risk, farmers now see a need to use technology to access financial services, and even access markets for inputs and outputs and Cellulant's agrikore.com offers these services and the beautify part of this is that they leverage block chain technologies to safeguard the ecosystem and with over 17 million farmers, 2,714 agribusinesses, 11,000 extension workers, 4 donors and 3 Federal Government, Cellulant is disrupting the Agric sector. Vogue pay also makes it easy for farmer to send and receive payment. Other alternatives include Paystack, simple pay and Cashenvoy

ECOMMERCE

Releaf.ng is an online marketplace that connect buyers and sellers of agribusiness to trustworthy customers and their unique revenue model involves getting their income via investments, data-gathering, partnership with multinationals, and providing premium features (profile, access to more details, contents, information) to users on the platform (Techpoint.ng). Ogafarmer.com, Agromerchants.com also make sales and marketing of agric product easy, agromerchants.com is an agricultural commodity and grocery online store and a one stop shop for retailing and wholesales of agro-products, food items and agro-allied products.

Traditional farm technologies: These are machines produced for use on farms to help with farming. A well-known examples of agricultural machinery is the tractor, they are powered by gasoline, diesel engines and tractors are essentially used to do majority of farm works from tilling the ground to planting seeds and many others. Today, it is still very difficult to get access to tractors and many modern agric tools especially for commercial farming, HelloTractor.com, a digital application bridges this gap.

HYDROPONICS TECHNOLOGY

This is a high-tech method of growing plants in water rich in mineral nutrients instead of soil. It beats the challenge of searching for fertile lands for crop production and viz-a-viz greenhouses and multilevel buildings, crops can be grown with ease. With hydroponics technology, plants have direct access to nutrients, they are healthier and with higher yields, pests and disease can be easily controlled and with easy harvesting. Fresh direct Nigeria, an eco-friendly social enterprise produces premium organic produce through hydroponics and community action and with advanced technology, they improve agricultural yields.

AGRICULTURE BIOTECHNOLOGY

The prospect in GMOs and GM Crops seems to be high giving credence to the records of this in developed countries and even our dear India which was least known in agriculture that has now become world largest producer of cotton. According to a vanguard reports, biotechnology has done well for Nigeria's cassava production with more than 20 GM Cassava varieties with an average yield of 25-45 tons per hectare, although Nigeria has embraced biotechnology but it is largely coordinated by the public sector through the National Biotechnology Development Agency. This innovation is largely untapped by the private sector and in coming years, it would be a great spot to capitalize on.

Software technology

Farm software are quite ubiquitous today and smartphone penetration has made access to these software easy, most of my previous highlights and cases are as a result of the .com bubble and as web applications continue to be on the rise, it is noteworthy that companies like Probit farms make it easy to adapt software to Farm Management and accounting for the sake of managing farm operations. With the provision of a full suite of accounting tools, agroinfotech.org, zenvus.com also provide software services to help farmers raise capital, document farm activities, insure their farm, access real0time produce prices, and even sell their products.

Suffice to say that the efforts of the Nigeria government is insufficient towards strengthening ICT structural framework in rural areas as connectivity is still a big challenge, although there is high penetration of mobile phones and reduced cost of data globally, Nigeria needs to work at further reducing the cost of accessing internet for local farmers. Content can only fly and get to farmers when network connectivity is good, there is need for public private partnership to strengthen the bandwidth and connectivity framework of the rural areas. There is also a challenge of content, accuracy of information which can on the long run be determined by farmers upon validating from many different sources providing the data.

The startup ecosystem needs to concentrate on what Eric Ries refer to as validated learning in his best seller, “the lean Startup” which according to him is a rigorous method of demonstrating progress when one is embedded in the soil of extreme uncertainty and this will require that you figure out the right thing to build, the right thing the customer want and will pay you for and can be best summarized as figuring out the problem that needs to be solved and then developing a minimum viable product.

Innovators must avoid the temptation of designing a farm products that they think farmers want. The farmers who are the customers should be involved in the process of designing. Content creators must note this as well, that farmers are in need of information that meets their real time needs, and this principle must guide them as much as possible. This is essentially because information and data governs the activities of the fourth industrial revolution, content creators and data analyst cannot afford to provide maladjusted information and data for farmers' and agricultural entrepreneurs to consume.

The Sustainable Development Goal 2, i.e. end hunger, achieve food security and improved nutrition and promote sustainable agriculture by 2030 is central to our existence as a nation and it is pertinent to indicate that technology can help us achieve this goal if its potentials are properly tapped however financing would obviously be a potential challenge.

International development organizations like the FAO, AFDB, IFAD, WFP, IITA amongst others must commit to providing development financing to foster public private partnership. Private sector led innovative technologies need

some form of blended financing as an emerging market that it is. This emerging markets require some financial instruments to thrive and with the aid of grants or grant-equivalent finance, agritech projects can be financially viable and/or sustainable. Other innovative financing mechanisms can be explored to offer reliable and predictable financing for agriculture, more concerted efforts should be made to catalyze investments into the agriculture sector of Nigeria to capitalize on the industry that is expected to be valued at 1 trillion dollar by 2030.

The fourth industrial revolution focuses on the end-to-end digitization of all physical assets and integration into digital ecosystems with value chain partners. Generating, analyzing and communicating data seamlessly underpins the gains promised by Industry 4.0, which networks a wide range of new technologies to create value. (PWC, 2016). For farmers to enjoy the benefits that 4IR offers, they need to up skill themselves on digital skills and acquire a wide range of knowledge on digital Agriculture and how they can use it effectively.

It is important to note that food loss and food waste will be very abated with the use of technology and farmers will attain high level productivity and increased returns on investment if they apply digital technology to their farms in the various forms I have itemized, from precision Agriculture to ICT for Agriculture, the potentials are endless.

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