ICT-Based Framework for Improved Food Security in Nigeria

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Abstract

Hunger has plagued mankind throughout history and still remains a critical problem especially in Nigeria. This paper has analyzed the government and individual farmer's effort to improve the lot of agriculture in Nigeria and discovered that enough has not been done on the issue of embracing ICT tools as a needed foundation for improved agricultural productivity. This paper has modeled an ICT based platform that if adopted by stakeholders, shall greatly pull Nigeria out of the mess of food insecurity. This framework incorporated a national internet host that will drive the information flow amongst the various stakeholders in agriculture. The six regional decision support systems in this model is a comprehensive database of agricultural information generated from research findings and innovations, inputs from agricultural extension officers, farmers, consumers, marketers, agricultural agencies via the interactive websites, radio, television, computers, personal digital assistants etc. The result of this research is a holistic ICT platform that if adopted, will ensure precision farming which shall improve food security in Nigeria.

Keywords: Food Security, Interactive websites, National Internet host, Precision farming, Regional decision support systems.

1.0 Introduction

Nigeria spends 60% of her total earnings from crude oil revenue on food importation [1]. aThis is a disturbing trend in a largely mono economy such as Nigeria. The implication here is that if the crude oil stops flowing for one year Nigeria will plunge itself into more severe food crisis and its attendant consequences. The above scenario indicates clearly that Nigeria does not have food security for its citizens.

The United Nations Food and Agriculture Organization (FAO) defines food security as "a situation that exists when 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."[2]

Famine and hunger have plagued mankind throughout history and still remain a critical problem especially in the developing world. Most recently, attention has been focused on the problem of food security, which has become one of the main issues on the global agenda. Concerns over food security have been prompted by the impact of climate change, sharp rises in food prices in many countries, and energy policies, in particular the issue of biofuels. The magnitude of the problem of hunger and food security is alarming. Every six seconds, a child dies from hunger and related diseases. The Food and Agriculture Organization (FAO), a specialized agency of the United Nations, estimates that more than 860 million people in the world today suffer from hunger. Of these, about 830 million live in developing countries, the very countries expected to be most affected by climate change. As the lead UN agency for ICTs, the International Telecommunication Union (ITU) is playing a key role in promoting the use of ICTs to address emergency situations and food security. Increased access to and use of ICTs can be beneficial to farmers and the agricultural

industry. Nonetheless, efforts to date to employ these tools have not been uniform or sufficiently widespread. There are many factors (policy, legal framework, technology, knowledge, markets, research, etc.) to be considered when addressing food security, but in all of them information and communication technologies (ICTs) can act as catalysts [3].

Information and communications technology (ICT) is an umbrella term that includes any communication device or application, encompassing: radio, television, mobile phones, computers and network hardware and software, satellite systems and so on, as well as the various services and applications associated with them, such as video-conferencing and distance learning. [4]. ICT is attractive as a means of achieving the goal of food security because it creates room for market transparency, mobility, E-collaboration, interactiveness and distance neutrality.

The greatest tool that a farmer should have is access to adequate information that will help him improve farm yield, crop storage and access to the right market for his farm products, this needed information can be accessed through various ICT platforms.

Governments in Nigeria have made several efforts to improve the fortunes of agriculture. These efforts include; the 1962-1968 development plan which laid emphasis on farm settlements, cooperative plantations, supply of improved farm implements, the National Accelerated Food Production Program NAFPP of 1972, establishment of River Basin Authorities in 1976, Operation feed the Nation (OFN), Green Revolution Program of the 1980's, the Agricultural Development Program (ADP) , the establishment of agricultural research institutes, and . Nigeria's National Fadama Development Project (NFDP), the national space research and development agency (NASRDA) uses Global positioning system (GPS) that will help farmers in decision making for precision farming. The national information management system for agriculture in Nigeria initiative is aimed at disseminating price information on agricultural products to all stakeholders in agriculture. The e-wallet initiative in Nigeria is also aimed at sending information directly to the farmers via the mobile phone.

The trend to improve agriculture in Nigeria is centered around training of farmers on farming techniques and giving them access to loans to embark on farming. However, these trainings are not ICT driven, and where a modicum of ICT is involved there is no sustainable platform to ensure its coordinated success. There is no radio station in Nigeria that has up to four hours daily program dedicated for agricultural activities. There is also no mobile telephone network that offer adequate subscribed information relating to agriculture. This is very worrisome in a country such as Nigeria that is already facing food crisis

Meanwhile, it is generally accepted that ICT will drive the transformation of Africa, with Nigeria in the forefront, from an agricultural to knowledge society. Rather than wait for 2030, we can invest in ICT, not as a panic measure as we did in 2006 and 2011 salvaging the voters' registration exercise by importing, assembling, and deploying over 120,000 laptops and data capture machines in a few weeks. In the process we overwhelmed the volunteer workforce that INEC had engaged for the exercise. Come to think of it, we tend to have a special liking for panic measures as was recently played out in the now controversial attempt to buy 10 million GSM phones valued at N60b for rural farmers in Nigeria. Whether our development as a nation is pegged to any timeline or not, the sober thing for us to do today would be to adopt a long-term ICT strategy to ensure that we are ready to leap when opportunity calls. There are key objectives that ICT professionals must pursue in 2013 as our contribution towards creating a character for the ICT industry while refocusing this nation [5]. This research is an effort to create an appropriate ICT model that when adopted shall greatly improve the present food crisis in Nigeria.

2.0 ICT Trends in Agriculture

The application of ICT in agriculture is an evolving phenomenon. During the 1990-2000, agriculture enjoyed the platform of electronic business. However farmers could only visit agriculture websites to extract or read information which they apply to improve their fortunes. The websites were static and so, farmers could not give feedback information neither were they able to transact business

through these websites. Things improved in the 2000-2005 with the introduction of electronic agriculture (e-agriculture). This gave the farmers opportunity to enjoy interactive websites through which they are able to transact agricultural business such as payments, ordering of farm inputs and sale of farm produce using the interactive websites and electronic payment options. The year 2005 till date has witnessed a revolution in mobile agriculture characterized by its portability and ubiquity. Farmers connected to the internet can get information via the mobile phones, laptops, personal digital assistants (PDAs) anywhere and every time.

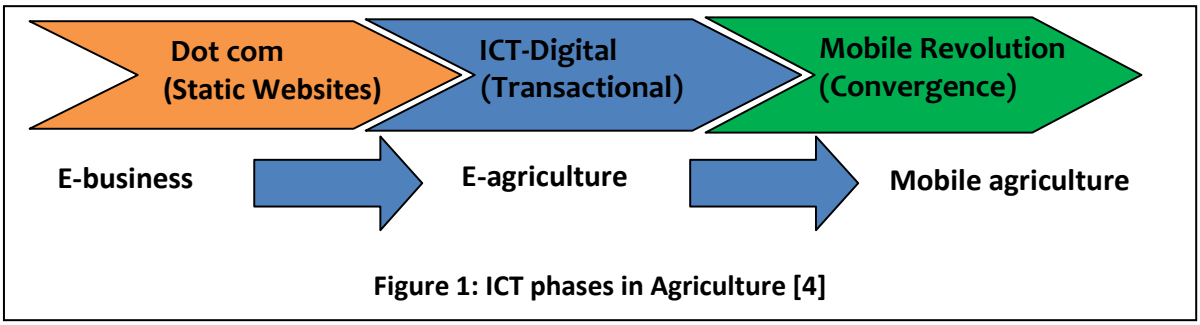

Figure 1: ICT phases in Agriculture [4]

3.0 Importance/Impact of ICT on Food Security

The use of ICT in agricultural practices is inevitable. This is because it provides very important tools and platforms for improving the fortunes of farmers. ICT provides information to the farmers which help them in decision making and also improve on their farming techniques. A well informed farmer has a great potential to becoming a successful farmer because he knows when and how best to farm, where and when to sell his products, where and when to obtain loan or grants for his farm. The following are some of the importance of ICT in food security.

a. Radio/Television

Farmers can connect to radio stations to get information that will help them improve their farming methods and productivity. The radio can also give a guide on current seed and farm product prices. Radio receivers are very cheap to afford and maintain and so majority of our rural farmers can afford it. An average world receiver radio costs N700.00 in Nigeria markets. Television can also be used because it affords the farmers opportunity to visualize the demonstration of experts in the field of agriculture; by so doing the farmer better understands and also becomes better equipped.

b. Mobile Phones

Because of the rapidly increasing use of mobile phones in developing countries, they have become another major means of disseminating information. With the short message service (SMS), farmers and fishers can receive information directly on their phones, and in their local language For example, e-Choupal in India offers services that help farmers achieve better yields and secure better prices. TradeNet, based in Accra, Ghana, has created a platform where farmers and traders across the world can share market information via mobile networks and the Internet. Such services help to avoid food being wasted, too. A study in Kerala, India, showed that by using mobile phones while at sea, fishermen are able to respond quickly to market demand and prevent wastage caused by over-fishing. [2]. Other examples are DrumNet in Kenya which increases the bargaining powers of farmers on market prices, MarketMaker in the USA which enhances access to market information and the e-wallet initiative in Nigeria aimed at sending information to farmers through the mobile phones. About 80% of Nigeria population is made up of youth, majority of them clad mobile phones. So reaching out to them through the mobile phones will create awareness to the youths about the profitability in farming, this will greatly encourage them to take farming as occupation.

c. Improvement in food supply chain

Wastage of food can be minimized if there is a good communication amongst the farmers, marketers and consumers. Radio frequency identification (RFID) tags can be attached to farm produce to ensure that they are kept in good condition and also to track inventories to ensure optimal supply of farm produce. Geographic positioning systems (GPS) can be used for fleet management for agricultural product distribution

d. Monitoring and Early Warning

A systematic monitoring and creation of database of farm outputs and its consumption rate will go a long way to enhance food security. Computer networks and databases can be used to collect and analyze information. Use of mobile phones and the internet can go a long way to ensure that information reaches to the farmers about impending disasters. High resolution radiometers and satellites can be deployed for remote sensing of agricultural resources.

The deployment of ICTs in the field can help to improve food yields and enable farmers to better forecast crop yields and production. The use of ICTs to share data increases the number of farmers profiting from the information.

One example is provided by the COMMON Sense Net project (Community-Oriented Management and Monitoring of Natural Resources through sensor network). COMMON Sense Net is used for agricultural management in the rural semi-arid areas in Karnataka, Southern India (See Figure 2). The project consists of a wireless network of ground-sensors that periodically record the state of the soil (measuring salinity and humidity), the air temperature, the volume of precipitation and other parameters. A second network of subterranean sensors is used to monitor the level and quality of ground-water. A different example of soil mapping is provided by a new project of the African Soil Information Service. This project combines remote satellite imagery and soil science to produce the first detailed digital soil map of sub-Saharan Africa. [3]

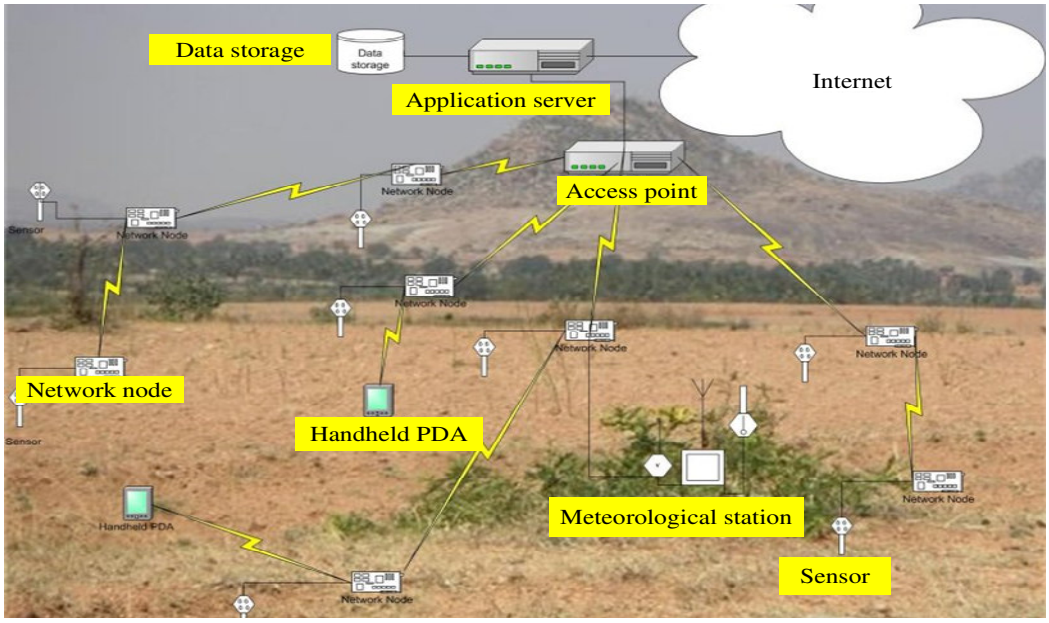

Figure 2: Example of a wireless network scheme to monitor agriculture parameters
Source: COMMON Sense net, http://commonsense.epfl.ch/

e. Automation of Farm Production

Farming methods can be automated for improved efficiency. E-record keeping through appropriate software is deployed for proper inventory. Statistical tools and computer applications can be used for proper budgeting (e-budgeting). Automation apart from ensuring that wastage is reduced also ensures that farmers are adequately informed about the prospects and pitfalls ahead.

For example, the following ICT for development (ICT4D) innovation have been

found in Taiwan; a rice germination electronic cooker, a robotic tubing-grafting system for fruit-bearing vegetable seedlings, and an air bubble machine and multi-functional, ultrasonic machine for fruit cleaning [6]

Other examples of importance of ICT in food security includes; e- banking, use of internet social media for promotion and marketing, online farmers market for e-ordering and delivery and e-learning / training for farmers through the internet

4.0 ICT Model for Improved Food Security

This conceptual framework is based on establishment of a national ICT/Internet Host that will house the comprehensive information database of agricultural research findings, the best farming practices, technology and farming opportunities which shall be easily accessible by all stakeholders in an interactive and ubiquitous manner

a. Regional Decision Support Systems

Linked to the national host is the regional decision support system (RDSS). The decision support system is a unique database system that receives input from various universities, research institutions, federal, states and local government agencies and NGOs. This information shall be transmitted electronically through a network infrastructure to the RDSS. The content of the RDSS shall form the primary source of information for agricultural experts, legislators and government agencies that are directly involved in agricultural policy formulation and decision makings spread across the region. It should be noted that each of the six RDSS shall be accessible to each other for information sharing purposes. The farmers who gets information from the various state agencies, LGAs, farmers cooperative societies, agric extension officers also gives feedback to the research institutes, and the states and LGAs about their performances and challenges via the ICT tools (radio, websites, telephones, computers, PDAs.(see fig 3) RDSS is also linked directly to the national host. Both the national host and the

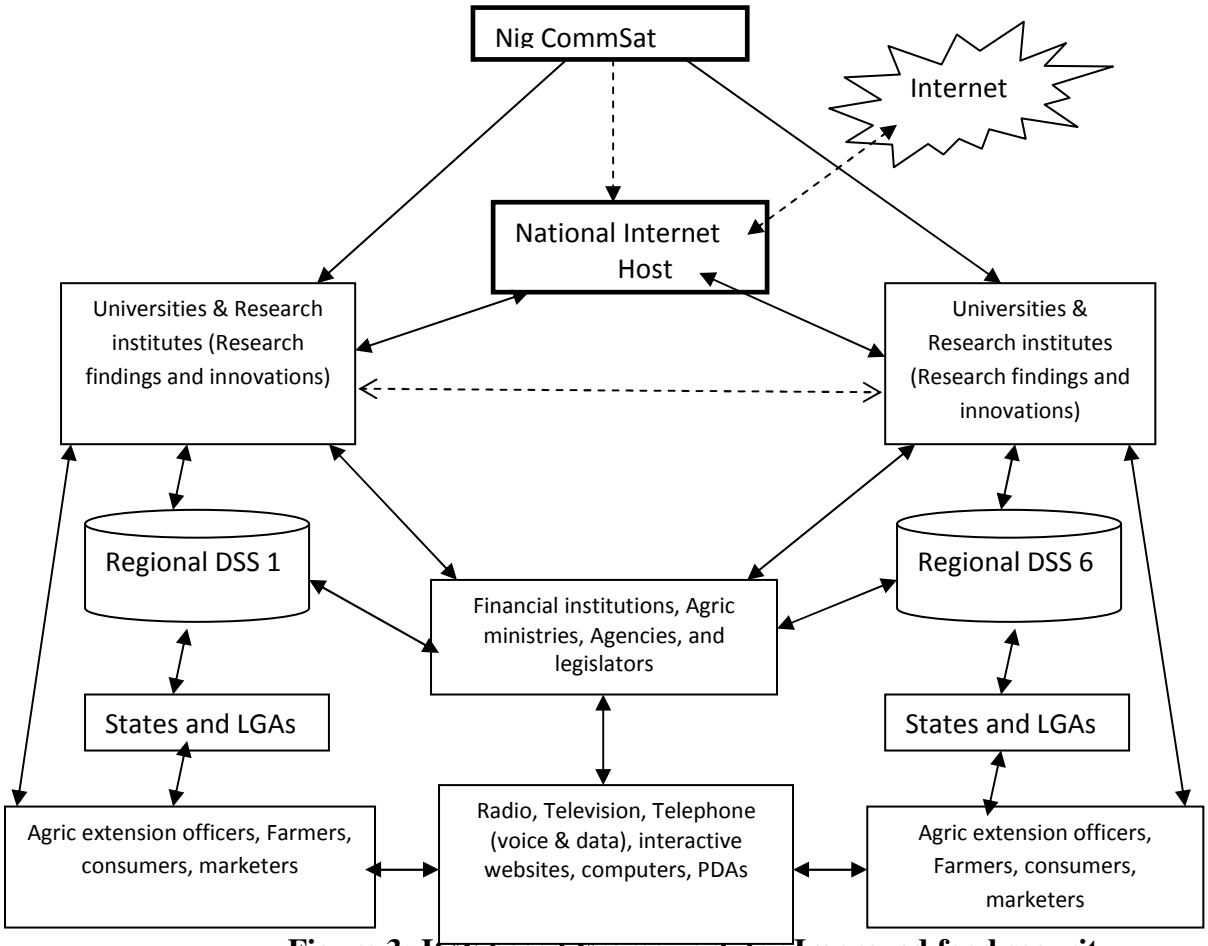

Figure 3: ICT-based Framework for Improved food security

5.0 Why a National Host is Required

The Internet is a network of networks. Each of the interconnected networks has one or more HOST computers which coordinate information flow among the network subscribers. Any level of protection can be given in terms of supply or retrieval of information, to or from a HOST. If data security is required at a national level, then reliance on foreign based hosts may not be acceptable. A National HOST and a National Intranet (ie within the nation network, also connected to the Internet) are required in order to control effectively, access to classified data of national interest, and at the same time provide access to Internet for all other purposes [7]

6.0 Conclusions

This paper has analyzed the government and individual farmer's efforts to improve the lot of agriculture in Nigeria and discovered that enough has not been done on the issue of embracing ICT tools as a needed foundation for improved agriculture. The result of this has led Nigeria to over dependence on food importations.

This paper then presented an ICT based model, which if adopted by all stakeholders in agriculture shall be a good platform for addressing the problem of food security in Nigeria.

References

[1] Sunday Newswatch, July 6, 2013 page 24

[2] The importance of ICT in food security. Retrieved on 7/7/2013 from http://www.itu.int/net/itunews/issues/2009/08/25.aspx

[3] ICTs and Food Security. ITU-T Technology watch July 2009. Retrieved on 6/8/2013 from *www.**itu**.int/dms_pub/**itu**-t/oth/23/01/T230100000B0001PDFE.pdf*

[4] Emerging ICT Applications in Agribusiness Value Chains: Market Linkages, Food Security and Research Directions retrieved on 7/7/2013 from *ciifad.cornell.edu/downloads/MaumbePresentation.pdf*

[5] http://www.businessdayonline.com/NG/index.php/analysis/columnists/52115-nigerias-ict-sector-in-2013-a-preview. Retreived on 7/7/2013.

[6] Wikipedia retrieved on 6/7/2012 from http://en.wikipedia.org/wiki/ICT_in_agriculture

[7] H.C. Inyiama and C.C Okezie, ICT Assisted Industrial Information Flow model towards a accelerated Technological Development- The Journal of Information, Communication and Computing Technologies p10 October, 2005 Maiden edition