

ROLE OF INFORMATION AND COMMUNICATION TECHNOLOGY IN SUSTAINABLE AGRICULTURE IN NIGERIA

Abdulkareem, Ibrahim Babatunde

Director Engineering Services Sub-Programme, Edo State agricultural Development Programme (EDADP), Benin City, Edo State, Nigeria.

kareemdking@yahoo.com, tundet1@gmail.com

ABSTRACT

Agricultural production dominates occupation of most Nigerians and small holder farmers remain the bulk suppliers of food and fibre for her growing populace. Information and communication technology (ICT) in sustainable agriculture in Nigeria has a high potential like any other part of the World. Agricultural Transformation Agenda (ATA) could be facilitated with mechanization and ICT package in agricultural production in Nigeria. ICT adoption level, challenges of e-agriculture in Nigeria and the ICT potentials were reviewed. Some of the phases of agricultural development were presented as sample modules with the view to demonstrate the practicability of ICT application in Nigeria agriculture. A public private partnership tractorization scheme (PPPTS) operation network and Input distribution network were showcased in the paper. Practical steps for e-agriculture in Nigeria and recommendations on pathway to successful ICT for sustainable agriculture in Nigeria were made and which will enhance the challenges of making agriculture profitable to the country poor farmers.

Key words; ICT, Agricultural Production, planning, extension, mechanizations and marketing, SMS alerts, PPPTS.

Introduction

Nigeria is the largest geographical unit in West Africa occupying a land area of 923, 768 square kilometres between longitude 30 and 150 East, and latitude 40 and 140 North. The two main vegetation zones are the rain forest and savannah zones and characterised by two seasons namely, the wet and dry seasons which also are indicators for a fertile zone which makes the country an agrarian nation. At the start of the 1960s, the basis of the Nigerian economy was a well-diversified agricultural sector that supported 75 percent of the population, 78 percent of exports and supplied the people with 94 percent of their food (World Bank, 1996). However oil in the country changed trend and made her become a mono-economy nation solely dependent on the newly found oil. Today Nigeria is about the eighth oil rich country in the World (OPEC report 1999)

Agriculture still remains an important sector in Nigeria with the majority of the rural population depending on it. The sector faces major challenges of enhancing production in a situation of dwindling natural resources necessary for production. The growing demand for agricultural products offers opportunities for producers to sustain their productions and improve their income.

A way to alleviate the negative impact of excess and under application of inputs is the new order in farming tagged 'precision agriculture' (Chinmay Biswas & Subbs, 2000). Precision agriculture according to Kumar (2000) in terms of both time and quality of inputs and agronomic practices, envisage a prospect which can help in increasing the food grains production without increasing the cost of cultivation and not having any adverse effect on soil and environmental health

The questions needing answers are:

- Can ICT better our agricultural production?
- Can ICT be advantageous to the small holder farmers?

- Can ICT help Nigeria to create new generation of farmers?
- How can the ICT be employed to generate empowerment, wealth creation in Nigerian rural communities?
- The challenges of Nigerian e-agriculture
- The pathway to successful e-agriculture in Nigeria

This article explores the potential roles of ICT to a sustainable agricultural production in Nigeria.

The Journey so far

Successful governments have tried to improve agricultural production in Nigeria and have introduced different development projects from 1962 to date. The list includes, the introduction of more modern agricultural methods through farm settlements, cooperative plantations, supply of improved farm implements and a greatly expanded agricultural extension services, establishment of National Accelerated Food Production Programme NAFPP in 1972, River Basin and Rural Development Authorities was established in 1976, Operation Feed the Nation (OFN) in 1977 and Green Revolution Programme was inaugurated in 1980. The World Bank funded Agricultural Development projects, Rural Integrated Agricultural Development Programme (ADP), Agricultural Extension and Research Institutes were established in the mid 80s. Each of the above programmes sought to improve food and cash crop production in Nigeria, but the reports available have shown that all these schemes have not yielded the expected results. Table 1 and bar chart 1 below depict the current agricultural status in Nigeria.

The present democratic administration has introduced Agricultural Transformation Project (ATP) and various crops of comparative advantage are targeted under the transformation agenda. In Nigeria, small holder farmers form over 70% of the total people engaged in agricultural activities. 70% of these farmers are not literate, again 70% are of the age above 60 years and are mostly resident in the rural areas (National Agricultural Survey, 2001).

Farming Activities and ICT

Farming activities in Nigeria are still being carried out by means of non ergonomic tools, crude hand tools like hoe, cutlass and thereby limiting the production capacity of these farmers. Access to farm tractors is mainly through government agencies state or local and rarely serviced 15% of the farming populace annually. Nigerian population increase rate is put at 2% and with a projection of close to 200million by the year 2020. With the aforementioned at the background, it became expedient that any means of rapid and proven agricultural transformation should be sourced urgently and implemented. The identified method is mechanized agriculture and the advantages associated with full implementation of ICT-agriculture (e-agriculture) could be harnessed in the implementation. While mechanization is the prime mover to drive the accelerated agricultural production and processing, the ICT-agriculture is a means of rapid service delivery, a tool to promote various mechanization facilities or equipment, techniques and or technologies. ICT in agriculture has been officially endorsed at the World Summit on the Information Society (WSIS) in 2003-2005. ICT-agriculture covers all aspects including research, planning, monitoring & evaluation (PM&E), engineering and science of production, processing, extension services etc.

Module1; research and planning;

Agricultural research and planning involve step by step spread of activities in agricultural productions. Precision agriculture though requires high tech-ICT facilities to design and execute to cover various aspects of agricultural research planning such as soil data gathering like fertility, depletion, permeability, water holding capacity, water logging, productive,

satellite imagery for productive acreage, crop yield monitoring. It will alleviate all effects of excessive or under application of inputs. ICT will enhance agric research, ease the use of remote sensor which will give accurate data and enable the results to be placed instantly on the internet for assessibility and adoption by deserving agriculturalists world wide.

Module 2: Data collection and monitoring and evaluation (M&E)

Data collection and monitoring and evaluation (M&E) have always been integral parts of development work. Today, it takes millions of dollars and months (sometimes years) to conduct nationally representative household surveys. Beyond expense and time, these surveys (along with those engineered and deployed by development organizations) require strong management skills, qualified enumerators, and systematic design and implementation strategies. The conventional options for disseminating results to local project leaders or communities involved in assistance programs are often ineffective: paper reports often reach these stakeholders late (or never) and only inform select participants. The potential of information and communication technologies (ICT) to improve data collection and M&E activities is striking. Mobile phones, new platforms and repositories, and even software for reporting have reduced costs and time, improved data validity, and increased the ease of implementation. Some studies are showing these benefits. In 2010, nine data collectors used EpiSurveyor to interview beneficiaries in 25 municipalities in a secondary survey (the first one, conducted in 2009, used paper and pen) in a World Bank Conditional Cash Transfer project in Guatemala. Digitization cut the cost of an interview by 71 percent, increased the sample size from 200 to 700 beneficiaries, and reduced the individual interview time by 3.6 percent (World Bank 2011). When a team from Catholic Relief Services used iformbuilder to register and distribute vouchers to beneficiaries in a seed fair in Central African Republic, they saved over a one week prep time and reduced the personnel needed by half. CRS is now developing an entire M&E system using iformbuilder.

With Global Positioning System (GPS), one can describe the exact latitude and longitude of one's farm. This is a way of promoting what is known as precise farming (Hutchinson and Sawyer, 2000). GPS can be used to control costs and boost crop yield. With GPS, farmers can map and analyze their fields for characteristics such as acidity and soil type

Module 3; ICT –agricultural Engineering and science of production, and processing;

ICT adoption in mechanized agrarian involves the use of computer aided machine or equipment in all farm operations starting from land preparation for crop production, irrigation of crops to feeding of animal or livestock. Farmers will book for services online and the service providers respond promptly to farmers request using the necessary facilities be it hardware or softwares.

Considering the Nigerian small -holder farmers will require special package on tractors and equipments ownership for accessibility. We suggest public-private partnership tractorization scheme (PPPTS). Hence government tractorization have failed in Nigeria due to factors such as scatered farms, government bearuacracy, policy change, low return on investment, poor maintenance practices, to mentione but a few. PPTS will involve acquisition of farm tractors with complete set of implement and including planters, harvesters etc and use them to service the rural small-holder farmers.

The PPPTS should be supported by both the federal and state government through subcidy or equity guarantee approach but managed by the private body to service the rural farmers. The scheme will require that farmers are organised into clusters and a government agency like the World Bank established agricultural development programme (ADPs) supservices the scheme and provide logistic support among others to the registered farmers. Government through it agency will assist the farmers through training and retraining needed to produce

high quality products and also source market outlets for their produce or products. PPPTS has potentials to create empowerment, create new generation young farmers, rapid and high employment creation, reduce rural –urban migrations, and improving the living standard of the rural populace in Nigeria. This is possible as some members of the youth will be directly recruited by the service provider, while others will engage on farming which is being carried out by mechanised means and thus the anticipated advantages.

Module 4; e-agricultural input distribution, technology transfer and extension service delivery

Information dissemination on agricultural services are still being carried out through direct contact i.e. visits by the agriculturist extension and education officers, agricultural engineers and other professionals through the intervention of the Government's Agricultural Development Programme (ADP) and related parastatals, Non-Governmental Organisations (NGO) and other international bodies. The means of getting information through periodic half hour extension programmes on the media (radio and television) have remained the major source of updating farmers and processors on new technologies. This is often met with power problems which if available, i.e. the rural electrification having been extended to such rural area, may be epileptic. This reduces the source to only the radio which can be powered by batteries. Most of these and other poverty alleviation programmes in Nigeria are through telephone and radio with other commonly used traditional media including print, video, television, films, slides, pictures, drama, dance, folklore, group discussions, meetings, exhibitions and demonstrations (Munyua, 2000).

Nigerian government introduced ICT in agricultural input distribution across the country in 2012 under the transformation agenda. The programme registered the farmers on state wise basis and uses ICT tool (SMS) to send farmers alerts to redeem their input at various designated centres which has been arranged at the local government areas. The ICT is already playing a promising role in various agricultural activities such as input distribution of fertilizers, improved and quality seeds, agro-chemicals, dissemination of technologies to farmers door steps. It has been used to convey sudden farmers meetings, control measures on dreaded citrus disease to farmers and the need to protect fresh fruits from fruit fly attack and campaign against sun drying of a major staple food made from cassava root (garri). New agricultural technologies presented to farmers has started yielding result and reap better harvest per hectare. Prices of food items are now made available to farmers that have access to mobile phones which has reduced the marketing tragedy often experienced by farmers. A situation where farmers will take their produce to the markets and return them unsold thereby incurring additional cost on transport. Ofuoku *et al.* (2007) found that the level of adoption of mobile phones among poultry farmers in Delta state, Nigeria was about 53 percent and this was found to be significantly dependent on the level of education of the farmers. The technology was used for exchange of information by over 63% of the farmers on issues that are related to health problems, request for drugs, sources of feed and drugs, request for attention of veterinarians, poultry products marketers, current prices of inputs/outputs and information about meetings. ICT has reduced cost of extension service delivery and facilitated production as physical travels of government officials are reduced drastically. Farmers are being trained on how to use their mobile phones to receive and send messages to their counterparts on agricultural related activities.

Advantages of GES System

1. Greater transparency and accountability in agricultural input distribution
2. Improved targeting of farmers, to expand share of farmers getting subsidized fertilizers from 11% to 90% of farmers

3. Private sector will sell directly to farmers, and build their supply chains to reach farmers in rural areas
4. Private sector will have incentive to build demand and meet the needs of farmers (small size packs, demos branding etc)
5. Reduction in cost of distributing inputs to farmers by 50%, as private sector is more cost effective than government distribution systems
6. Empower farmers to buy from suppliers of their choice
7. Achieve clear impact on food security

However, more training are still required and the need to cut down access cost became necessary than ever before to enable the rural poor farmers afford the facility and improve their living standard.

An overview of challenges of inputs distribution in Nigeria has shown that the following are the contributing factors: transportation, knowing the farmers demand per location, which agro-dealer service which farmer, quality and quantity of seed requirement and varieties suited particular agroecology, who decide the selling price of input, issue of branding, seed adaptability, infrastructure requirement, list of agro-dealers per State and locality, which bank or financial institution with agriculture department and fund agriculture at all phases, full value chain which must be packaged approach system to ensure success, distribution chain or network, FGN –State and beneficiary funding pattern ; 25% 25% 50% respectively.

Available ICT Facilities

There are a number of ICT facilities useful in information management, utilization and dissemination in agricultural practices. These include Radio, Television, Video, Computer (CD-ROM, DVD, Video CD etc), Phone/GSM and Internet (Web (www), Web chatting, E-mail, Tele/audio conferencing, Voice over Internet Protocol (VoIP), Digital and Satellite TV, Electronic Library Resources). A network like the one presented in Figure 1 could be used to distribute various input to farmers at different locations across the country to achieve an optimum cost of distribution and enable sales at the same cost across board. ICT-extension could be enhanced through establishment of ICT / public viewing centers in the rural areas. Programme of interest to the rural communities and those that will facilitate production challenges will be relayed on regular basis and other important announcement or information will be transmitted both in descriptive and moving displays. Government agency must then package their technologies to farmers in the appropriate manner and which can easily be understood by their audience. All agricultural technologies for farmers adoption must necessarily be prepared in animation and or practical screen demonstrations of proven techniques and technologies sub-titled in the local dialect/language. This also demands that the agents are adequately trained for this new order for success.

Module 5; e-agricultural marketing (e-agrimart);

With improvement in wireless communications, ICT –agriculture will bridge the digital divide that separates those with and without access to any of ICT facility like internet, GSM. A network will be established and producers in rural communities can market goods directly, find out price, so they know when to bring their goods to city markets and thereby eradicate the incessant market glut often experienced by farmers. ICT, e-agrimart will establish local communication enterprise and transmit information/messages on their agricultural production, health, environment and education of their farming families.

Most of the small scale farmers sell their products to middlemen who now determine the prices to the detriment of the farmers. But with the provision of commodity prices and market information on real time basis available on the internet, the farming community can be provided with choices they lack today. This will ensure better price realization and

bestimulate a drive towards better productivity. Again with e-commerce farmers can sell their products online. In this regard the farmer can sell his product right inside his farm. What the farmer needs do is to register his location and products, to ensure that products ordered online can be traced to a particular farmer (Samuel 2010). This has widened the market for farmers. With ICT, one can get information on market potential of some agricultural products. For instance, instead of selling unprocessed groundnuts you could further add value to it by further processing the nuts into peanut, butter and cooking oil.

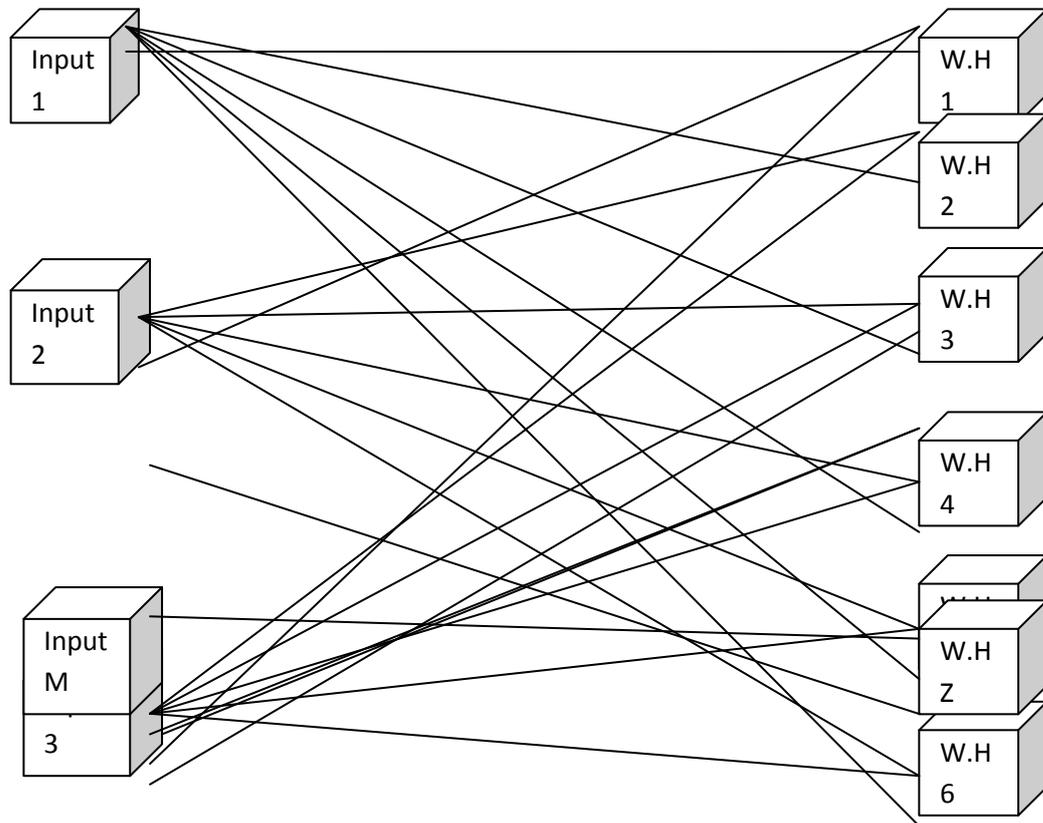


Figure 1. Input Distribution Network

The feasibility of this idea is guaranteed with discovery of new wireless technologies such as MESH and WiMAX, and new- generation of mobile phone networks will provide high speed internet services at sharply reduced costs thereby dramatically increasing internet coverage in rural areas. Access tools are covering, becoming cheaper and more flexible, mobile phones and laptops provide omnipresent access with ample functionality for communications and transfer of information. Very small aperture terminals (VSATs) with shared cost of access can be employed to facilitate communications to remote areas and replicated nation wide. Internet had the greatest impact on the society when compared with all the technologies that had evolved over centuries. The rate of adoption of the Internet exceeds that of all technologies before it (Adeya and Oyelaran-Oyeyinka, 2002). It took the least number of years on record to spread to 25% of the world population becoming popular in 1991 and within seven years became a popular and global technology for information communication (Jasmon, 2004).

ICT agriculture in Nigeria how far;

As at the year 2012, Nigerian government is employing ICT tool in her agricultural transformation agenda like other sector of the administrations transformation programme. Nigerian e-agriculture through GES took the following steps;

- 1st step; captured farmers data (registration of farmers) across the country
- 2nd step; classification of farmers into commodity crop groups (CCG)
- 3rd step; Identification of proven input and their manufacturers/suppliers
- 4th step; registration of input dealers/local agro-dealers
- 5th step; training of agro dealers with input suppliers and farmers representatives
- 6th step; training of supervising agency, federal, state and local government staff
- 7th step; location of Agro service centers/redemption points/center
- 8th step; commence input supply to redemption center on local government basis
- 9th step; commence input distribution to farmers through SMS alert.

The success is above average and highly commendable inspite of being a new innovation of the federam minister of agriculture Dr. Akinwumi Adetunji (GCON). The GES though suffered some setback and farmers initially could not understand but sooner they get use to it and it has removed the bottlenecks involved in getting fertilizer and other certified inputs to small holder farmers. GES is designed for the farmers particularly the small holders and service those only, though the services are not been paid for by the farmers yet but it sustainability lie on the payment for this local services and should be designed for. Nigerian government is expected to build on the gains of GES and expand it e-agriculture in the years ahead if her demand for food supply must be met and guarantee food sufficiency and security.

Challenges faced by ICT in Nigerian agriculture;

The challenges facing the adoption of ICT in agriculture in Nigeria are: Steady electricity power, Low / renewable energy facilities, Local interpretation of technological messages to local languages, Accessibility of the facilities by the small holder farmers, Cheaper ICT facility and access cost, Steady and quality services to sustain confidence by the rural populace, Local trained artificians for immediate repair and maintenance, Total prevention of cyber crimes, Establish effective network of producer-buyer/consumers, Hourly interactive forum between rural farmers and their costumers online, Farmer - farm data, Accurate and timely sms alert to the deserving farmers, and Remote information of agro-ecology.

Conclusions

ICT can bring new opportunities for all stake holders in agriculture irrespective of genders. Many stakeholders in agricultural production are yet to effectively use the new opportunities provided by ICT for networking, exchange of information, business, education media consultation and e-commerce initiatives. The accessibility to ICT tools are still very low especially among the rural poor of Nigeria as many are currently excluded from this new field and opportunities. ICT can bridge the digital divide that separate those with and without access to the internet.

ICT in agriculture in a complete package with mechanization will enable the World creat a new generation of farmers as it has a very high potent to encourage the youths to show interest in agriculture, an empowerment as it creat wealth, foster sustainable agricultural development, and above all guarantee food sufficiency and food security.

ICT in Nigerian agriculture has a high potential like any other part of the World. It adoption depend largely on how fast and how far the ICT experts and other stakeholders can go to provide the needed services in the country, putting into consideration the attendant challenges mentioned earlier.

Nigerian agriculture will require the assistance of all the ICT stakeholders including the World Bank and other donor agency to successfully implement ICT agriculture. NGOs to set up telecentres in remote areas based on very small aperture terminals (VSATs) with shared cost of access. This can be replicated and upgraded at national level.

Appreciation: The author wishes to express a deep and sincere appreciation to the Edo State Agricultural Development (EDADP), Benin, Nigeria. AbdulGaniy Olayinka RAJI (PhD), Department of Agricultural and Environmental Engineering, Faculty of Technology, Director, Management Information System/Information and Communication Technology Unit, Vice-Chancellors Office, University of Ibadan, Nigeria

References

- Aigbe, S. (2006). Making communication work for the rural agriculture in the Niger Delta: the Global Citizen Journey experience. *Proceedings of the 4th World Congress Conference on Computers in Agriculture and Natural Resources, (Orlando, Florida USA)*, Publication Number 701P0606. (Eds. F. Zazueta, J. Kin, S. Ninomiya and G. Schiefer), *American Society for Agricultural and Biological Engineering (ASABE)*.
- Adeya, C. N. and B. Oyelaran-Oyeyinka (2002). *The Internet in African Universities: Case studies from Kenya and Nigeria*. United Nations University (UNU), Institute for New Technologies (INTECH) Research Project Report.
- CTA (2000). Technical Centre for Agricultural and Rural Cooperation (CTA) Annual Report 2000, Wageningen, the Netherlands.
- CTA (2006). The appeal for agriculture. Spore, A magazine of the Technical Centre for Agricultural and Rural Cooperation (CTA), No 124, August 2006, pp. 16
- CTA (2007). *Information and Communication Technology (ICT) help women producers*. Spore, A magazine of the Technical Centre for Agricultural and Rural Cooperation (CTA), No 130, August 2007, pp. 7
- Duncombe R. and R. Heeks (1999). *Information, ICTs and Small Enterprise: Findings from Botswana*. University of Manchester, Institute for Development Policy and Management, Working Paper 7, 1999.
- FAO (2000). *The role of information and communication technologies in rural development and food security*. Sustainable Development Department of the Food and Agricultural Organisation of the United Nations (SD FAO). Posted November 2000 on http://www.fao.org/sd/KNdef_en.htm.
- George, T., Morin, S. and J. Quiton (2002). *The missing last mile in the delivery of knowledge to the rural agricultural sector*. Paper No. 9 - Occasional Papers: Issues in Training. Training Center IRRI International Rice Research Institute.
- Hutching and Sawyer (2000). *Computers, Communications, Information: Users Introduction*, New York, Irwin McGraw Hill, P. 4.27.
- Jahns, G. (2006). *The history of information processing*. In The International Commission of Agricultural Engineering (CIGR) Handbook of Agricultural Engineering, Volume VI, Information Technology. Volume Editor, Axel Munack, St. Joseph, Michigan, USA: pp. 1-18.
- Mobolaji E. A. (2004). Some Issues in ICT for Nigerian Development. Paper presented at an E-contribution to an ICT Advocacy Forum/Workshop in Abuja (Oct. 16, 2004).
- Mundy, P. and J. Sultan (2001). *Information revolutions. How information and communication management is changing the lives of rural people*. Technical Centre for Agricultural and Rural Cooperation (CTA), Wageningen, The Netherlands.

- Munyua, H. (2000). *Application of information communication technologies in the agricultural sector in Africa: a gender perspective*. In Rathgeber, E. and Adera, E. O. (eds) *Gender and Information Revolution in Africa*, IDRC/ECA. pp. 85-123.
- Mukesh P, Deepati T.P and Kanini B (2010). *ICT for Agriculture Technology Dissemination* <http://www.foa.org/tc/qork05/Nigeria ppt.pdf>. Accessed 24/11/2011.
- Nigeria's Agriculture and Food Security Challenges: *ICT Solution Journal of Research and Development*, Volume 3 No 1 December 2011.
- Nigerian National Policy for Information Technology (2001). *Sectoral Applications: Agriculture*. Chapter 6, pp 14
- Obayelu A. E and I. Ogunlade (2006). Analysis of the uses of information and communication technology for gender empowerment and sustainable poverty alleviation in Nigeria. *International Journal of Education and Development using ICT*, Vol. 2, No. 3. pp 45 – 69.
- Ofuoku, A. U., Isife, B. I. and G. N. Emah (2007). Adoption of mobile phone among poultry farmers in Delta State Nigeria. *Journal of Engineering and Applied Sciences*, 2(1): 10 - 16.
- Odachi G.N (2008). Enhancing the Attainment of Millennium Development Goals Through ICT, *Journal of Science Education*, Vol 9, No, 1, 2008
- Okoh R. N. (2004) .Nigerian Non-oil Export Mix and the competitive Global Market place. <http://www.unionbanking.com/Okoh.pdf>. Accessed 5/12/2011.
- Ozowa V.N (2011) Information Needs of small scale farmers in Africa: The Nigerian Example(<http://www.worldbank.org/html/cgiar/newsletter/june97/9nigeria.html>). Accessed 23/11/2011.
- Samuel A.I (2010) Using ICTs to Bridge the Agricultural Extension Gap and in Providing Market Access for Rural Farmers in Nigeria: A practical Approach (www.goole.com." ICT in agriculture in Nigeria"). Accessed 24/11/2011.
- Talabi S.O and Onasanya O. (2011) Nigeria Agriculture- Introduction ([http://www.onlinednigeria.com/inks/agricadv. asp?blurb=480](http://www.onlinednigeria.com/inks/agricadv.asp?blurb=480)). Accesses 24/11/2011.