ISSN: 1117-5606

Nigerian Educational Digest (NED)

KWARA STATE COLLEGE OF EDUCATION
ILORIN, NIGERIA

Volume 17 Issue 1
June - December 2025

Sponsored by
tetfund
TERTIARY EDUCATION TRUST FUND

(TETFund/UND/DESS/COE/ILORIN/ARJ/2024/VOL.1)
"TETFund Projects 2019-2024"

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"TETFund PROJECT 2024"

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Published by:
kwara State College of Education Press
Ilorin Kwara State,
Nigeria.

ISSN: 1117-5606

Printed by:
MAT PAT Academic Publishers
100, Iworoko Road, Opposite EKSUTH
Ado-Ekiti, Nigeria
mcpatpublishers@gmail.com

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If the study is carried out with humans or animal, consent letter should be on separate page.

Acknowledgement

The source of financial grants (***TETFund***) and another source(s) of funding must be dully aknowledged. The contribution of colleagues and institutions should also be acknowledged.

Thank you.

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AN ASSESSMENT OF ROLES OF INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) IN ENHANCING FOOD SECURITY IN NIGERIA

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Abstract: The need to strive for better access to information and communication technology in order to enhance food production is very important. An increase in rapid technological process now led to variety of new Information and Communication Technologies (ICTs) which have the potentials to address the needs of farmers much faster with far more accuracy than ever before. This paper focused on the overview of the role of Information and Communication Technology needs, along the agricultural value chain. It provides information opportunities for food security and sustainability. Although various challenges remain such as provision of supportive infrastructure, ensuring equitable access, provision of tools at affordable rates. This paper recommends establishment of Bank of Agriculture to assist in training and re-training the staff in order to be able to carry out the use of ICT tools appropriately, as well as extending capacity of extension agents that will help in disseminating technological ideas to the community.

Keywords: Information and Communication Technologies (ICTs), computer, training, devices

Introduction

Information and Communication Technologies (ICT) can be defined as the use of various devices, network and application for collecting, storing, using and sending data electronically (Thomas Dau, 2019). Agriculture, which has been characterized by a high demand for Information and Communication in order to answer this demand, farmers have used different means throughout history Mesopotamian farmers used clay tablets with description on watering crops (Garforth and Lones, 1997). Many centuries later, agricultural newspaper became popular, then the telegraph and later radio and television programmes became available. All these means have provided a valuable means of information and communication for farmers. However, these more traditional forms of information and communication provisions have limitations. In addition, much of the information desired by farmers is highly location specific and many of these technologies could not address this need.

This paper focuses on the use of computer as an application in the teaching and learning Agricultural Science with specific limitations.

Areas of Application

(i) Agricultural Instruction: Computers are widely used in classroom to facilitate instructions and student experimental learning. There are a lot of variety software packages that may be used for instructions in the basic principles of Agriculture. The

use of computer interactively provides a platform for human and machine communication back and forth (Okadili *et al.,* 2024).

(ii) Designing Plans: The use of sophisticated computer software has helped in the facilitation of landscape plan, instead of the traditional method of drawing by hand (Mbow *et al.,* 2019).

(iii) Crop modeling: Crop modeling is a science of predicting a plants response to environment conditions or its productivity in response to levels of input production, with the aid of computer and complex procedures. Scientists have been able to develop models than to estimate a crop's needs to produce a certain response (Olaniyi, O. A. and Ismail. K. O. 2016).

(iv) Communication: In this information age where the world is connected by an elaborate computer network, a wide variety of agricultural information can be addressed via the internet. Computer bulletin boards, post information that growers can use in their enterprises. Public domain software is available to users on a 24 hours basis (Mbow, *et. al.,* 2019).

(v) Sensor Technology: A new generation of equipment is being developed based on sensor technology including machine vision, electrical sensors, nuclear magnetic resonance (NMR) and near infrared (NIR) Spectroscopy. The Geographic Information System (GIS) is a data base of land information that has an increasingly made application (Acquaah, 2005)

The Communication of Agriculture on Internet

The internet is an interconnection of a multitude of computers that one can access over a network (Acquaah, 2005). The concept is not all that new, having been in operation since 1969. It has recently only become a household word, largely because literarily anyone with a computer and the appropriate electronic communication device and access to a phone may participate in this network.

The subscription to internet provides for general services

(1) World Wide Web (www): This consists of protocols and standards (tools) used to access any information, video, text, or audio on the internet.

(2) File Transfer Protocol (FTP): This is used to move files and data from one computer to another. E.g. Download books, software, movie, graphics and other documents.

(3) Telnet: Telnet enables two computers to be connected from a computer to computer interactive use.

(4) Electronic Mail (E-mail): The e-mail function enables customers to send and receive message electronically. Electronic

conferences and group discussions can be conducted using this feature.

Other Areas of Application of ICT

Other areas of application of ICT can be used to better manage the basic factors of production viz.: land, labour, capital and entrepreneur.

Labour: Supervising labour has been a challenge in Agricultural production, because the spatial dispersion of agriculture and the fact that observable outcome (e.g. crop yield) are influenced not only by worker's effort but by other factors beyond his control.

Land: Landmark and reform activities are costly and challenging because the spatial dispersion of farming and information asymmetry which makes keeping land difficult (Biswange and Rosenzweig, 1986) and the governance challenges associated with such reforms. This makes land registration, land valuation and taxation, land management and land reforms challenging.

Agricultural Production: One of the major challenges of agricultural production is the need for highly location specific management knowledge. The development of Global Positioning System (GPS) and sensors has led to the development of precision farming which helps to address the challenge. Precision farming requires agricultural equipment such as tractors, sprayers and combine harvesters to be equipped with positioning systems, a software programme and variable rate technology, which makes it possible to apply variable rates of fertilizers, agro chemicals and other inputs depending on the specific conditions within different parts of field (Heege, 2015). The required data is either collected before hand through satellite imagery or drones or in real time through sensors mounted machinery.

Financial Service: One of the major challenges in agriculture is to provide finance, especially in small holder farming systems of developing countries where farmers lack collateral as they often do not have a land title and as the absent they may own such as livestock are not suitable as collateral. Various ICT applications aim to relax these constraints. A very successful ICT application the mobile payments and mobile saving solution.

Insurance: Agricultural insurance may be part of the solutions in reducing the vulnerability of rural farmers, which may become more relevant with the advent of climate change but providing insurance to farmers is not an easy task. Jensen *et al* (2017).Insurance faces challenges related to covariant risk which is the risk that a large group of insured people may be affected simultaneously by an agricultural disaster such as drought. In addition, insurance faces challenges related to adverse selection monitoring for moral hazard and validating claims from farmers who are often geographically isolated. The application of ICT may help to reduce the cost related to information,

e.g. by using pictures of plant disease including geo tags for loss verifications (Karmel *et al*, 2017) and many data from satellites and nearby weather stations.

Marketing: Knowing who pays the best price for agricultural produce has always matter for farmers (Liu *et al*, 2015). However, market relations have historically been characterised by information asymmetry favouring buyers. Various ICT applications now provide farmers with market and price information consumption with rising income levels consumers tend to demand for improved food safety and quality, which can ensured thorough standards and certification. In addition, consumers tend to become more worried about their health and well-being as their income increases (Liu *et al*., 2015). ICT application may also facilitate group certification.

Conclusion

ICT applications have a tremendous transformative power. They have the potentials to improve food security and sustainability by addressing many challenges of agricultural production both in the developed world and developing countries. In order to ensure wide adoption and equitable access, ICT applications need to be backed up by a supportive staff and conducive environments.

Recommendations

The following recommendations are made by the researcher:

i. Government or Ministries of Agriculture should organize programmes that will enhance the use of ICT tools such as electronic computers or other devices that can be of important in carrying out farming activities both at pre-field and post-field levels.

ii. There is a need to improve activities of extension agents to work in disseminating ideas to the farmers or agric-practitioners on ICT.

iii. Bank of Agriculture should be as well encouraged by organizing training and re-training old and new staff in order to be out the use of ICT tools.

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Volume 17 Issue 1
June - December 2025

Sponsored by

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TERTIARY EDUCATION TRUST FUND

(TETFund/UND/DESS/COE/ILORIN/ARJ/2024/VOL.1)
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