Current Status of e-Agriculture and Global Trends: A Survey Conducted in TransNzoia County, Kenya

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Abstract: *Information Technology (IT) has long been viewed as having great potential for improving decision making in agriculture. In all phases of the agricultural industry, information technologies are vital to the management and success of a business. The development of agriculture depends on how fast and relevant information is provided to the end users. e-Agriculture is a recent term that defines a global community practice, where people from all over the world exchange information, ideas, and resources related to the use of information and communication technologies (ICT) for sustainable agriculture and rural development. Although a lot of research has been conducted in this area, minimal research has been conducted to ascertain the penetration of e-Agriculture in TransNzoia County. The main aim of this paper was to investigate farmers' awareness, usage and perception of e-Agriculture in TransNzoia County. The study used quantitative survey design technique to collect data from farmers in TransNzoia County on awareness, perception and usage of different e-Agriculture techniques such as m-Agriculture and e-Commerce. The results obtained indicated the level of awareness in terms of deployment and adoption of e-Agriculture. This study found out that while majority of farmers in TransNzoia County were aware of e-Agriculture practises, deployment and adoption is still a pipedream. The findings of this study provide a framework to be used by different stakeholders in agriculture in TransNzoia County to implement an e-Agriculture platform that supports marketing of agricultural produce.*

Keywords: Information Technology, Agribusiness, e-Agriculture, m-Agriculture, TransNzoia County.

1. Introduction

e-Agriculture is a recent term in ICT that defines a global community practice, where people from all over the world exchange information, ideas, and resources related to the use of information and communication technologies (ICT) for sustainable agriculture and rural development. A study conducted by (Epstein, 2008) found that majority of farmers in Kenya are not able to sell their produce at market price due to lack of sufficient information available. This makes them to sell their products at throw away prices which lead to losses and food insecurity. For such farmers to produce and sell their products at market based and competitive prices, information communication technologies (ICT) tools have be availed to them. This is because the development of agriculture depends on how fast and relevant information is provided to the end users.

The main aim of this paper is to investigate farmers' awareness, usage and perception of e-Agriculture in TransNzoia County. The study concentrated in Trans Nzoia County since it is the bread basket of the entire country. Although a lot of research has been conducted in this area, no research has been conducted to ascertain the awareness, adoption, legislative and regulatory framework, and to determine the current research trends in the use and adoption of e-agriculture of e-Agriculture in TransNzoia County. The implementation of e-agriculture in Trans Nzoia in Kenya is timely since the country's economic blue print, the Vision 2030, has identified agriculture as a key enabler to the attainment of the goals and aspirations of the Vision. The thrust of the Vision in the agriculture sector is therefore to convert Kenya into a truly knowledge and information economy by enabling access to quality, affordable and reliable information that enables farmers to access markets for their produce easily at market and competitive prices.

According to (Brynjolfsson, 2009), FAO hosted the first e-Agriculture workshop in June 2006, bringing together representatives of leading development organizations involved in agriculture. The meeting served to initiate development of an effective process to engage as wide a range of stakeholders involved in e-Agriculture, and resulted in the formation of an e-Agriculture Community of Practice Founding Group. Members include: Consultative Group on International Agricultural Research (CGIAR); Technical Centre for Agriculture and Rural Development (CTA); UN Department of Economic and Social Affairs (DESA); FAO; Gesellschaft fur Technische Zusammenarbeit (GTZ); Global Forum on Agricultural Research (GFAR); Inter-American Institute for Cooperation on Agriculture (IICA); International Association of Agricultural Information Specialists (IAALD); International Centre for Communication for Development (IICD); International Fund for Agricultural Development (IFAD); International Telecommunications Union (ITU) and World Bank.

Countries that have embraced e-agriculture have had their economies improve and food security promoted. For instance, a study conducted by (Adhau, 2010) found that India's agricultural sector economy grew by 3 percent after the government encouraged farmers to embrace e-agriculture. In Kenya, the government has no policy towards the implementation of e-agriculture even though the use of ICT tools especially mobile phones has continued to grow at an exponential rate. (CCK, 2010) report noted that in 1999, just 3 percent of Kenyans owned a phone of any sort; today, the figure is 93 percent. The use of mobile phones is ubiquitous in urban areas and commonplace even in remote parts of the country, generating all the obvious benefits. It is the intention of this study to assess the awareness and adoption of e-agriculture in Trans Nzoia County with a view to advising various stakeholders and the government on how best they can utilize ICT tools in promoting food security in

the country. The study also highlighted the major challenges faced by farmers in using e-Agriculture to promote agribusiness in TransNzoia County.

The main objective of this study was to assess the status of e-Agriculture in Trans Nzoia County in Kenya in terms of awareness, adoption, legislative and regulatory framework, and to determine the current research trends in the use and adoption of e-agriculture. More specifically the study set out to:

- To determine the current status of e-agriculture adoption in Trans Nzoia County, Kenya.
- To establish the factors affecting the adoption of e-agriculture in Trans Nzoia County, Kenya.
- To establish e-agriculture research trends in the context of global research trends.

The paper has four parts. First, it reviewed the literature related to e-agriculture and adoption. Then, research methodology is presented and data analysis techniques are discussed. Next, the findings are discussed and summarized. The paper concludes with a discussion on current trends in e-agriculture in Kenya.

2. Literature Review

This section describes the context of e-agriculture in Kenya and specifically in Trans Nzoia County. To understand what e-agriculture is, knowledge of information communication technology is important. Hence the study will begin by providing an overview of ICT in Kenya while linking it with e-agriculture.

2.1 Information Communication Technology

According to (Pretty, Ball, Xiaoyun, & Ravindranath, 2002), information Communication Technology refers to a set of tools that can be used to collect, disseminate, store and disseminate information for decision making. While, (Pretty et al., 2002) defines the term ICT in terms of information collection, storage, dissemination and processing, it does not indicate the ICT tools. A more profound definition can be obtained from (Dewan & Kraemer, 2000) who defines ICT as a collection of hardware, software, telecommunication networks, people, data and procedures that can aid in data collection, processing, storage and dissemination of information.

(Unwin, 2009) argues that due to vast change in ICT technology, ICT based developments provide new opportunities to improve the utilization and performance of livelihood technologies such as agriculture, education, library, health and medical services, and artesian technologies. The research challenge here is to identify the areas where progress in ICT could be used to improve the performance of these services and technologies, and build cost effective ICT based systems that improve the living standards of rural people. In this paper we make an effort to improve the utilization and performance of agriculture technology by exploiting recent progress in ICT. For instance, (Fiedler, Grover, & Teng, 2009) notes that India's food production has improved significantly during last three decades due to all-round efforts such as modernizing Indian agriculture, providing it with modern inputs like improved seeds, fertilizers and pesticides etc, application of modern tools and farm equipment etc.

The agricultural sector has today achieved total food self-sufficiency and also made the country a net exporter of agricultural producer. However, Kenyan agriculture is still facing a problem to maximize productivity. Here we propose a framework of an agricultural information system by integrating both agriculture and information technologies. The proposed system aims to improve agricultural productivity by disseminating expert agricultural advice to the farmers both in a timely and personalized manner. In this system the agricultural experts generate the advice by using both the Modern agriculture is highly knowledge intensive and requires timely, reliable and accurate information on natural resource endowments, their usage pattern at present and technology available for their future utilization and other information about markets, weather, insurance, subsidy, etc. It involves considerable time, resulting in inefficient utilization of the capabilities. Therefore, a "single window access" from where all types of data and information can be obtained or collected, will enable the planners to concentrate more on developmental planning, instead of frittering away their time and energy in data collection. Connectivity between data collectors and suppliers and data/information exchange through electronic media can improve the efficiency of this sector. Information and Communication Technologies (ICT) that includes the Internet, satellite communication, remote sensing, and GIS are providing new opportunities to connect people, to obtain and disseminate information and to bring a new revolution in agriculture.

2.2. E-Agriculture

The term e-agriculture is widely used by many individuals, academic institutions, professional bodies, and funding organizations. E-agriculture offers the rich potential of supplementing traditional delivery of services and channels of communication in ways that extend the agriculture organization's ability to meet the needs of its farmers. Benefits include enhanced access to information and resources, empowerment of farmers to make informed agricultural decisions, streamlined organizational processes and transactions, and improved quality, value, and agricultural productivity satisfaction. E-agriculture is now recognized globally as means of empowering farmers make informed decisions on production and marketing of agricultural produce. According to (Meera & Jhamtani, 2004), e-agriculture describes an emerging field focused on the enhancement of agricultural and rural development through improved information and communication processes. More specifically, e-agriculture involves the conceptualization, design, development, evaluation and application of innovative ways to use information and communication technologies (ICTs) in the rural domain, with a primary focus on agriculture. It is a recent term that was coined by United Nations to embrace all Information communication technologies that supports agriculture. In fact, Food and Agriculture Organization of the United Nations (FAO) conducted a survey in 2006 on the usage of the term e-agriculture. The study found that half of those who replied identified "e-agriculture" with information dissemination, access and exchange, communication and participation processes improvements around rural

development. In contrast, less than a third highlighted the importance of technical hardware and technological tools.

(Adhau, 2010) argues that e-agriculture is today affecting all the spheres of human life. We can exploit these advances to design a cost effective system to provide expert advice to the farmers. Here, we explain some of the advances in e-agriculture that can be used to build proposed system.

- During the last three decades database and data warehousing technology had been developed which can be used to store and retrieve large amounts of data efficiently at affordable cost. Mobile phones can be used by farmers to get access to this data on the prices of different products in different town and which varieties of crops to produce.
- Also, due to advances in networking technology we have Internet technology (or World Wide Web), which can be used to send information instantaneously to farming community in parallel.
- The data mining techniques can be used to extract the possible meaningful patterns for a large amount of data that could give potential useful advice depending on the situation. Also, modelling and simulation technology can be used to model an ideal crop situation and predict the crop growth through extrapolation and other techniques by considering a specific crop environment.

(Inklaar, O'Mahony, & Timmer, 2005), notes that with the advent of modern information technology revolution (mainly the database and Web technology), it is possible to provide latest expert advice in a timely manner to the farmer and thereby reduce the effect of the factors that disturb the crop. By exploiting the advances in information technology especially e-agriculture, we can enable the agriculture assistance to get the status of the crop in a cost effective manner. An architecture that depicts the use of e-agriculture can be modelled based on the database available for different products and dissemination of this information to the farmer. Due to the low cost and availability of mobile phones, farmers will use this ICT tools to get the data required. The architecture of proposed system is in Figure 1.
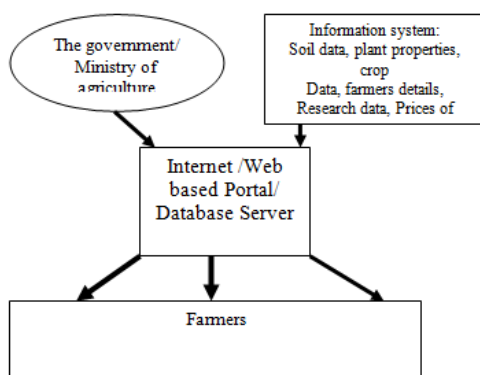

Figure 1: Architecture of Proposed system.
Source: Own

Farmers: Farmers are the end users of the system. They form the bottom layer. They can be illiterate and speak a local language. They are not expected to use the system directly. However, if they are educated and have an Internet connection, they can use the system themselves. Mobile phones will be used to facilitate the dissemination of the information to the farmers.

Information System: It is a computer based information system which contains all the related information. For example, it contains the details of the farmer with corresponding soil and crop information. It also contains information on the status of the crop, which is sent in the form of images and text by the coordinator. Also, from the available agricultural technology, the details of various crops (such as the level of pest resistance, requirement of water, and so on) are maintained. Building of system is the main research task in the system and requires collaborative effort among the researchers from agriculture and information technology. The ministry of agriculture will work with relevant ICT experts to get this data.

Database Server: Contains all the relevant information about Soil data, plant properties, crop, farmers' details, research data and prices of commodities.

3. Methodology

The study employed both descriptive and inferential research design to answer the research questions outlined in chapter one. A total population of 1000 farmers within Trans Nzoia County was considered in this study. This included 500 farmers from Saboti Constituency, 250 farmers from Cherangany Constituency and 250 farmers from Kwanza Constituency. A sampling size of 330 farmers was used to study the entire population. Structured questionnaires and interviews were used in data collection.

Descriptive statistical methods were mainly used for data analysis such as frequencies, percentages and averages. Inferential research design was used to express the relationship between literacy levels of farmers and the implementation of e-agriculture. The main objectives of the research were to:

- To determine the current status of e-agriculture adoption in Trans Nzoia County, Kenya.
- To establish the factors affecting the adoption of e-agriculture in Trans Nzoia County, Kenya.
- To establish e-agriculture research trends in the context of global research trends.
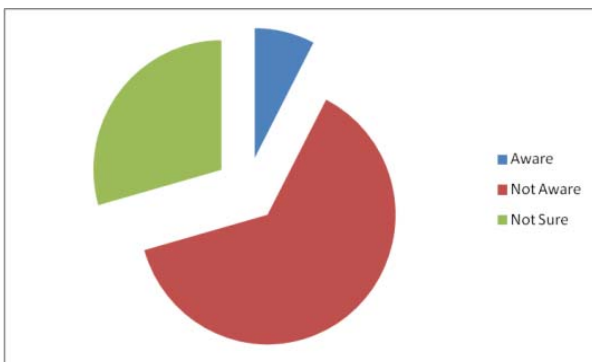
This study found out the following:
- Majority of farmers within Trans Nzoia County were aware that mobile phones can be used to conduct businesses. The study found out that 80% of farmers have access to mobile phones which they can use to conduct business through Safaricom MPESA platform. The pie chart below depicts the results obtained from the survey.
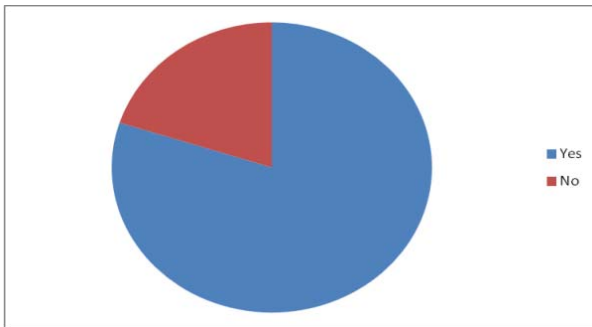
- Few farmers within TransNzoia County have conceptualized the use of e-agriculture within Trans Nzoia County. The study asked respondents whether they have operationalized e-agriculture in conducting agricultural activities. This study found out that 32% of farmers within Trans Nzoia County have used mobile phones to conduct agricultural activities. The pie- chart below shows the results obtained from the survey.

- Majority of farmers within Trans Nzoia County have not operationalized e-agriculture because of lack of awareness. The study asked why farmers in have not implemented e-agriculture. The study found out that 63% of farmers have not implemented e-agriculture because they were unaware. The pie-chart below shows the results obtained from the survey.

4. Conclusions and Recommendations

Based on the results obtained, the following conclusions can be made:
- Majority of farmers within Trans Nzoia County were aware that mobile phones can be used to conduct businesses. Mobile phone costs should be lowered to enable majority of farmers have access to current information about agribusiness within Trans Nzoia County.
- e- Agriculture has not been implemented because farmers in TransNzoia County have not been senstitized about. The government should conduct senstization to create awareness to farmers on how best they can use ICT to conduct agribusiness.

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