

# IMPORTANCE OF THE USE OF INFORMATION SYSTEMS BY FARMERS IN AFRICA

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Joshua Chibuike Sopuru, Management Information System (MSc)  
Girne American University, Mersin 10 via Turkey, Email: [sopuru.joshua250@gmail.com](mailto:sopuru.joshua250@gmail.com)

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Articles

**Abstract.** The desire of every nation is to provide goods and services that can actually satisfy citizens and also be enough for export in order to acquire foreign exchange. Due to scarce resources and diversity in human behavior, proper strategizing and planning built on Positive and negative science need to be considered. Human behavior cannot be determined with concrete certainty; we can only make assumptions based on certain conditions or occurrences. These assumptions help managers in managing limited resources. This goes a long way in helping a nation plan its production in matters of; what to produce, the quantity to produce and whom to produce for. The task of decision making, a must for every nation is one of the most difficult and unpredictable task faced by managers. However, with the advent of information Systems supported with decision support tools, managers can now to a greater extent make proper decisions.

Information system is a collection and integration of components for data collection, storing, and processing in order to deliver information, knowledge, and digital products. Businesses and cooperation rely on Information systems to carry out operations, manage staff, and even lead customers. There is no doubt information systems have revolutionized virtually every sector of the economy it has been applied in. For example, in developed countries like the USA, Information systems have decongested highways through traffic management. Despite all the success stories resulting from the implementation of information systems, Agriculture in developing countries still struggles with implementation of information systems. With the design of several Farm management information systems (FMIS), one should have predicted an end to the shortage of Agricultural products in Africa, mismanagement of the farm or an end to the high rate of loss in agricultural commodities as a result of disease outbreak. However, this is not the case in Africa because; the implementation of information systems in Agriculture is faced with numerous design/implementation problems ranging from designer's ignorance to end-users illiteracy.

We are interested in uncovering the importance of information system in Agricultural farms in Africa and

highlighting some limitations facing its implementation.

**Keywords:** Activity diagram, data, Information, management Technology.

## 1. INTRODUCTION

In this present age of Technology, it will be off place to discover a sector in the economy that is totally eluded from benefiting from the advantages of information technology. A major importance of technology to any sector is the efficiency in production. This information technology seeks to achieve. The unstructured nature of farm lands in Agriculture makes it difficult for information technology to be easily applied. Agriculture (farming), is however not the only sector that can be seen as unstructured. The Transportation sector, which witnesses the mass movement of people from different startup locations to different destinations, moving in patterns that are difficult to predict can also be seen as unstructured. Despite limitations of its unstructured model, information system has been successfully implemented. The product of this implementation can be seen from the use of Global Positioning Systems know as GPS, the InSync adaptive traffic control system which enables traffic signals adapt to actual traffic demands, traffic signal presumption that allows normal flow of traffic light to be preempted, etc. Because of these technologies, there is a resultant change in traffic and human behavior (responds) to traffic. The transportation sector also has witnessed significant transformation resulting from the implementation of Information technology different from the ones mentioned above. One may argue that the transportation sector is not as unstructured as the Agricultural sector is. So, therefore, a better comparison in relation to the unstructured na-

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Corresponding Author

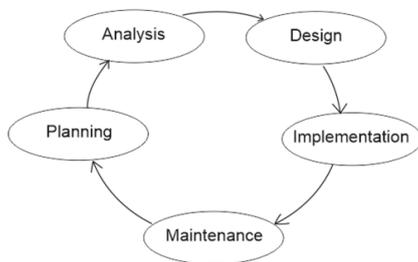
Joshua Chibuike Sopuru, Management Information System (MSc), Girne American University, Mersin 10 via Turkey

Email: [sopuru.joshua250@gmail.com](mailto:sopuru.joshua250@gmail.com)

ture of the farm would be the ever flabbergasting dynamism nature faces. No matter what we compare the farm to, a proper understanding of the problems facing the implementation of information system to the farm, would result in a solution for better design and implementation which will in turn lead to overall efficiency. This article aims at uncovering the importance of IS systems to agriculture and highlighting possible reasons that have led to the poor implementation of information technology in Agriculture, especially in Africa. To achieve this, we will work following the traditional methods of system design and implementation processes.

### 1.1. Brief Explanation of traditional system design and implementation Processes

In system design, the system development life cycle (SDLC) methodology has been followed over the years. The primary cycle involves a five (5) step process consisting of Analysis to the implementation process. **Figure 1.** show this cycle.



**Figure 1.0** System development life cycle

Using this cycle, we will discuss an example of how a simple fund transfer system can be designed and implemented. This is done in order to create an understanding of how this cycle works. We will focus on the analysis stage of the SDLC.

#### Example 1: design of a simple online account balance access system.

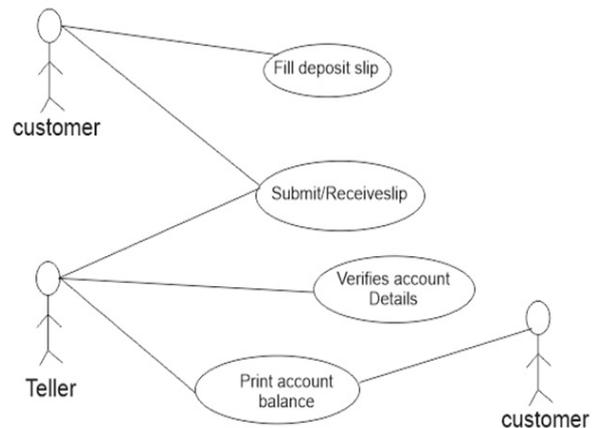
*This system will provide end users the functionality of accessing funds online.*

**Phase 1: Analysis:** Under analysis, we seek to discover the needs of the users. That is, what users expect of the fund transfer system. These requirements are analyzed and translated into logical patterns as understood by the

computer.

User needs: Pay in money into a bank account – access funds balance online

Here the needs of the user are clearly defined. No complicated situations are referenced. Thus, a user case diagram can be easily created as shown in **figure 2** below.



Also, User's abilities are also considered here. For example, user language, educational level, ethical variations, etc. When these factors are successfully considered, and Analysis of system requirements is done based on these factors and many others, an essential knowledge of system requirement have been developed. A fundamental process that is important in the analysis of system is referred to as the business process.

The business process lists and links as simple as possible the internal and external logics behind the system development. In precise terms, a business process can be seen as steps to achieving a solution. For example, if a robot were to be programmed to pull out a bad electric bulb, the business process would be the steps needed to be followed by the robot to achieve its mission. Successfully defining the business process is a problem half solved.

For our above example, the business process can be defined based on two (2) different headings; these headings are derived from the users' requirements:

- Pay in money into a bank account
- Access fund balance online

Pay in money into a bank account:

In practice, the steps in paying money into the bank involve all or some of the following:

1. Customer fills a deposit slip
2. Submits the slip to a teller
3. Teller collects and verifies the money and records the information on the slip against the stated account number.

#### **Access fund balance online:**

To access funds balance online, several things need to be considered. This includes the banks processes of accessing funds balance (not online). Using this as a base, the designer can then create a business process on accessing funds balance online. First knowledge on how fund balances are accessed in banks:

1. Customer fills an account inquiry slip (balance)
2. Submits the slip to a teller
3. Teller accesses customer's account (using account number, name, etc.)
4. Presents account balance to the customer on a slip

With the successful analysis of these business processes, the logics behind how the systems should work can now be quickly developed.

#### **Process A**

Access fund balance online (System Logic)

Interpreting business process to enable coding:

1. Customer fills an account inquiry slip (balance): A digital mind slip is generated that will be filled online by customers
2. Submits the slip to a teller: account slip on completion is presented for query
3. Teller accesses customers account (using account number, name etc): Based on successful queries, account details are retrieved.
4. Presents account balance to the customer on a slip: System outputs account balance to the customer on screen.

**Phase 2 to 5:** Based on the business process, a flowchart is designed, and subsequent coding is carried out to achieve the logics defined by the enterprise process. After these stages, the developed system is implemented with maintenance performed as required.

As observed in the example above, generating a business process is the bedrock to the

successful design of a system. However, this is not the only determinant to the successful implementation of a system. Other factors that include behavioral, educational, cultural, social, structural, etc. can determine to a great extent the success of a system especially in relation to different sectors. The Agricultural sector is one of these sectors.

Developing a business process for the Agricultural sector is quite different from the process developed above. This difference is greatly because of its unstructured pattern as we shall discuss below. With this knowledge, one can infer the reasons for implementation problems in Agriculture.

## **2. FARM STRUCTURE, PRACTICES AND BUSINESS PROCESSES**

Most farmlands in Africa are managed as family businesses. This method results in an extremely unorganized system of management. Over the years, farming has many been carried out on subsistence levels. The idea of producing food for just once immediate family has made farm practices nothing different from food cooking. Despite the evolution of farming from subsistence to commercial agriculture, most farmers still retain the unstructured farming practices developed over the years. Some of these unstructured farming processes include planting decisions; land usage, resource allocation, etc.

Most Commercial farmers in Africa farm at large scales. Large quantity of output is gotten from farm lands with varying quality. Yield (quantity and quality) prediction is near impossible because of the varying farm practices applied as a result of this structure. This also leads to the unavailability of Agricultural information as farmers do not know the farming method that worked best since different farming methods are applied at random. This limitation of the availability of agricultural information limits the rising agricultural productivity among small scale holders [1]. However, information and communication technology (ICT) provides a possible pathway to ameliorate this scenario.

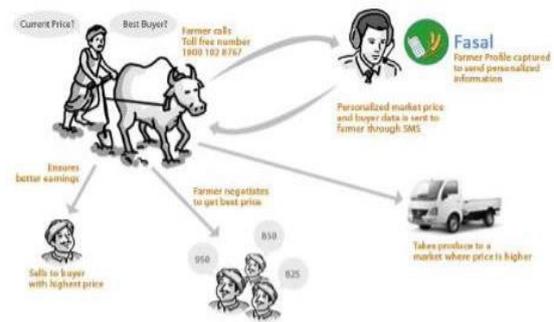
## 2.1. The role of information system in Agriculture

As population increase and the need for agricultural products raised, the importance of proper management of agricultural produce and real-time information access by agriculture stakeholders have become paramount. Information is very vital in modern farming as a marker is to a lecturer. Due to illiteracy and lack of sensitization, information access, and proper dissemination is still a significant problem for stakeholders in agriculture especially in Africa. Information system plays a vital role in agriculture as it aids in providing and delivering information to stakeholders in agriculture. A focus on the importance of information management in agriculture, as it relates to economic development, has been carried out by researchers.

According to Masters Williams, 2009, Agricultural yields have only shown slight increases in sub-Saharan Africa and Latin America since the 1960s [2], despite advances in agricultural innovations during that time. In addition, data collected using improved agricultural technologies paint a picture of low levels of adoption in developing countries.

The low rates of adoption in developing countries have been adequately documented, and there is widespread theoretical and empirical literature identifying the determinants of agricultural technology adoption in different contexts [3]. Poor Information management practices have led to poor performance of agriculture in the economy.

According to Cristina Echevarria (A three-factor Agricultural production function) [4] agricultural production function implies that farmers need information on several topics, at a variety of stages, before adopting a new technology. **Figure 3** shows the information access of a farmer with the help of an information system in place [5].



Farmers have different types of information needs during each stage of the process. This need ranges from pest attacks, weather forecasts, cultivation practices, inputs, pest and prices and disease management. Information systems are designed to provide farmers with these information needs.

Farmers can obtain information from a number of different sources, including, among fellow farmers, trial and error, members of same social network, etc. While traditional economic theory assumes that information is costless, information is rarely symmetric or costless in developing countries. This is partly due to the high cost of obtaining information via traditional means, such as travel, radio or newspaper. As a result, information asymmetries can be a significant barrier to agricultural technology adoption in developing countries. The role of IS in agriculture is also to address information asymmetries and create a level playground for stakeholders.

Information system plays a imperative role in coordinating the activities of agriculture extensions and providing reliable information from reliable sources to farmers.

Agricultural extension has been put forth since the 1960s as a means of reducing information asymmetries as it relates to technology adoption in different countries. In general, agricultural extension is the “delivery of information inputs to farmers” (Anderson and Feder 2007) [6]. The general extension approach uses specialists to provide different services to farmers, ranging from technology transfers to advisory services and human resource development. In some cases, it provides a platform that connects researchers directly to the farmer in order to ensure that new

technologies are better targeted to the specific conditions of agricultural communities.

Agricultural extension models can take several forms. The most common approaches are Training/Visit (T&V), Farmer Field Schools (FFS) and fee-for-service [6]. In Training and visit plan, specialists/field staff provides technical information and village visits to communities selected. In many cases, field agents train and work with contact farmers, or farmers who have successfully adopted new technologies and can train others. World Bank promoted T&V and applied in more than 70 countries between 1975 and 1995 [6]. Farmer field schools (FFS), designed specifically to replace integrated pest management (IPM) methods around Asia. FFS also utilize contact farmers, relies on participatory training methods and builds farmer capacities. Fee-for-service extension comprises both public and private initiatives and public funding. Farmer groups contract extension agents with accurate information and service requests.

## ***2.2. Areas of application of information system in Agriculture***

Information Systems can be applied in various fields of agriculture as researched by many researchers. Some researchers have come up with different lists of areas of IS application in agriculture. Some of these fields are:

I. IS should be used for demand and supply monitoring in the field of agricultural inputs. Based on the annual crop plan, the requirement for the agro-inputs can be estimated, and accordingly supply can be monitored. The information on availability of seeds, fertilizers and pesticides in a different region can be made available to the farmers. This will help him in speedy procurement of inputs at a cheaper rate.

II. Information on availability of quality planting material of horticultural species at various government nurseries and Agriculture Universities should also be regularly made known to farmers through IS

III. Agriculture Universities and other National Institutions are regularly releasing improved varieties of different crops. The es-

sential features of these varieties such as its performance, disease resistance and adaptability should be made known to farmers through IS.

IV. The prompt identification and control of pest and diseases of the cash crops is essential in reducing further damage to the harvest. Audio-visual clips of the causative organism and affected/diseased plant part with its control measure should be made know to farmers through IS. This would assist the farmers in remote areas to identify the pest/disease and take corrective action.

V. Weather plays a significant role in incidences of particular pest and diseases. A disease-forecasting module for advance intimation on likely occurrences of pest and diseases and preventive measures to be taken needs to be developed to reduce the economic loss.

VI. Soil survey section of many Agriculture Department possesses around 28000 soil survey maps, which need to be digitized to preserve them permanently and for extracting needful information using GIS technique.

VII. Primary data pertaining to agriculture can be generated through remote sensing & GIS where attributes such as ownership, soil fertility, cropping pattern, etc. can be attached to the survey numbers in maps. This data could be integrated and analyzed at different levels to help decision-making. This data could also be shared with various line departments.

VIII. Integrated information systems for various components of watershed development programs needs to be developed for making active Watershed development projects assisted by the Agriculture Department and these can be monitored at different levels if appropriate monitoring and evaluation software is developed.

IX. Use of satellite imaging data analysis for forecasting agriculture related information should be adopted for forecasting rainfall, area under different crops, yield estimations, and soil properties.

X. Interactive module needs to be prepared to assist farmers in preparing crop budget, which will help them in documenting data on cultivation cost and make them aware of the profitability.

According to Christian Fuchs, 2008, a sustainable information society is a society that makes use of ICT and knowledge for fostering a healthy life for all human beings of current and future generations [7]. He advocates the structuring of information systems that would stand the test time.

### 3. SUMMARY OF FINDINGS

Implementation of Information Systems has always been an issue of concern in agriculture in Africa. Ever since the discovery of farming, whether people are growing crops, raising livestock or fishing, people sought information from one another on better ways to perform their farming. Information on the most efficient planting strategy, where to buy improved seed or feed for animals; how to acquire the land title, the highest price in the market, funding from government's credit program, etc. It is usually very difficult for farmers to find answers to such question. Time taken in search of answers to these issues also amounted to waste of resources, if somewhere replied to in a given year; different similar issues arise every year but might have different answers in different year due to time and seasons as it relates to farming.

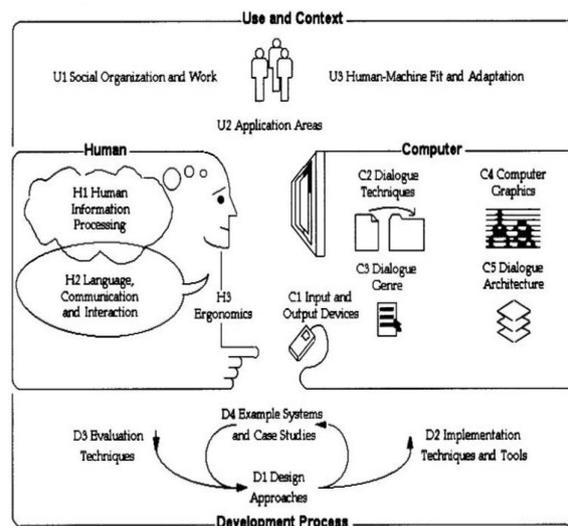
With an effort to tackle the problem of information systems and improving production, different methods have been proposed and designed. It is observed that most systems designed for agriculture have not been fully implemented. With a critical review of works done in this area, we found that most development is centered on programming logic and not on the clients. For example, the structure used in the design of an IS system for a top business organization should not be the same structure that is used for industry full of uneducated employees. With this knowledge, it is appropriate that designers should focus on the human aspect of the design of an IS system for agriculture to aid in implementation feasibility.

The Human-computer Interaction (HCI) guides system analysts/designers in modeling systems that can interact appropriately with humans [8]. Systems are designed for easy

adaptation by man. Figure 2.3 describes HCI approaches that can be used in modeling an IS system. This system will focus as much as possible to satisfy the following HCI conditions:

- Safety
- Utility
- Effectiveness
- Efficiency
- Usability
- Appeal

This will as much as possible ensure the usability of IS systems. Usable for all class of farmers: Ranging from the most educated to the least educated.



Using the HCI approach, developers are more concerned with the way users view and interact with the system. Cultural differences, languages, social status/classes are all put into consideration in designing systems. Ease of learning and ease of use are major concerns for developers using this approach. Questions like: Can I use the basic functions of a new system without reading the manual? Does the software facilitate us to learn new features quickly? Etc. are significant questions that must be answered before a software is considered Human-friendly. The poor attitude of farmers in using Information Systems could be enhanced by the complexity of IS systems compared to the educational level or language of the end users. We believe that if systems are structured as simple as possible, many of the limitations to the implementation of Information Systems in agriculture in Africa will be

handled.

### **Conflict of interests**

Author declare no conflict of interest.

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