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Online Agriculture Information System for Uganda

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Abstract: Over the last decade, agricultural output in Uganda has generally been declining yet the population is rapidly growing. This implies that interventions by government and other development partners through: improved seeds, advisory services, loans, animal grants and agro-processing services, have had negligible impact. In addition, information about performance of individual farmers is not known, making it difficult to implement initiatives that leverage their potential. This paper presents an information system for managing agricultural output data of individual farmers for effective decision making. As part of the information system, a novel "seed banking" idea is implemented, whereby farmers deposit harvested seeds in the seed bank and in return withdraw improved seeds for planting. The paper maintains that as seed banking is adopted, farmers will be assured of improved seeds for planting in all seasons, thereby empowering them to make realistic plans for future expansion without regard to uncertain interventions from government or other development partners.

Keywords: Agricultural production, decision support, information technology, seed banking.

1. Introduction

The agricultural sector is the default and the largest employer as well as a major contributor to Uganda's GDP. This has over the years attracted great attention by government and development partners as the sector is believed to have potential to stimulate economic growth and poverty reduction. However, the growth rate in agriculture has been volatile over the last decade, with growth in agricultural output declining from 7.9 percent in 2000/01 to 0.1 percent in 2006/07, before improving to 1.3 and 2.6 in 2007/08 and 2008/09 respectively [6]. In contrast, Benin et al. [2] envisage that if agriculture in Uganda is to grow at the average rate of 2.8 per cent per year, as experienced in the period 2000-2007, the poverty rate would be reduced to 26.5 percent by 2015. The poverty rate would further reduce to 17.9 percent if the growth rate increases to 5.9 through greater investments.

A review of the state-of-the-art literature on agricultural sector performance in Uganda reveals several salient issues. These relate to the following three underlying questions:

- How can extension services for holistic farmers' empowerment be achieved? (cf. [5],[2]);
- How can quantitative data of individual farmer's performance be managed for effective design of policies that leverage farmer's strength? (cf. [3],[6]);
- How can farmers be organised to concurrently engage in production and marketing? (cf. [7]).

These questions underscore the need to develop new information systems to monitor the performance

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individual farmers and the agricultural sector as a whole. As such, the information system presented in this paper comprises of three sub-systems, each corresponding with one of the questions above, i.e.,

- Advisory sub-system for providing advice to farmers on agricultural best practices using an up-to-date agricultural knowledgebase;
- Data management sub-system for decision support;
- Seed banking (considered in detail in Section 6) sub-system for production and marketing support.

In contrast, the deployment of the agriculture information system (AIS) is dependent on two main factors: a) computer literacy of the target users (farmers, extension workers, civil, political, cultural and religious leaders) and b) access to computers and Internet. Therefore, AIS has been developed on the assumption that government will remain committed to extending Internet connectivity to rural areas through rural telecentres. In addition, AIS extends the perspectives for which information and communications technologies (ICTs) can be used to propel rural development.

2. Problem

The growth rate in agriculture in Uganda has been volatile and below the National Development Plan (NDP) annual growth target of 5.6 percent. Over the last decade, growth in agricultural output declined from 7.9 percent in 2000/01 to 0.1 percent in 2006/07, then improved to 1.3 and 2.6 in 2007/08 and 2008/09 respectively ([5],[6]). At the same time, the crops sector has had its equal share of uncertain patterns with an increase in production for some crops and a decline in other crops ([3],[9]). Furthermore, the supportive polices such as Plan for Modernisation of Agriculture (PMA) has registered debatable success [5]. Apart from research, the other pillars of PMA including: advisory services, agricultural education, rural finance, processing and marketing, have generally had patchy success. While this may be attributed to low funding of the agricultural sector, more cost effective interventions involving use of ICTs need to be explored.

3. Aim

This paper presents an agriculture information system developed to stimulate growth in the agricultural sector by:

1. Continuously collecting performance data from individual farmers and translating it into action areas for effective intervention by government and other development partners.
2. Supporting farmers to make their own decisions towards improving production and profits.

In the short term, the system provides farmers' performance results to enable government and development stakeholders take innovative actions on agricultural practices that are more competitive and more profitable. As the rural population becomes computer literate and access to computers and Internet is guaranteed, the system will provide information directly to farmers to support their own decisions on improving production and profitability. To articulate the purpose of this research better, Table 1 gives the roles and relevance of the system to its core stakeholders (the farmers, government and development partners).

Table 1: Analysis of AIS's relevance to its stakeholders

Stakeholders	Role	Relevance of AIS
Individual farmers	Provide periodic data on their farm output	- Benefit from government interventions for individual farmers - Benefit from interventions targeting farmers' groups - Access information on ways to improve productivity and profitability, i.e., technologies, research discoveries, best practices and markets. - Earn more and save more through seed banking
	Form farmers' groups for concerted development	
	Provide information on specific challenges faced in every season	
	Provide information on their own experience/innovations for the benefit of other farmers	
	Sell their surplus produce at competitive prices and preserve seeds for future planting through the seed bank	
Government & development partners	Facilitate training of farmers on use of computers and available Agriculture Information Systems	- Use the system to train farmers on computer applications - Use information provided by the system to design effective intervention strategies to farmers and farmers' groups - Realise the "prosperity for all" initiative through seed banking
	Provide access to computers and information through rural telecentres	
	Develop electronic content for agriculture management	
	Support the establishment of seed banks in rural sub-counties	

4. System Design

The system is conceptualised in three subsystems: data input and analysis sub-system, advisory sub-system and seed banking sub-system.

4.1 Data Management Sub-System

Individual farmers information managed by the system include: family size and age range, address (sub-county, parish, zone/village/LC), phone contact, size of land owned, crops grown per season and quantity obtained per size of land used, quantity of surplus crops per season for sale, types and numbers of livestock and birds owned, membership of farmers' group, type and size of external support received, and specific challenges faced. In context of this paper, data was provided by World Vision in Tororo District area[i]. The data analysis as presented in section 5 is based on data from Kirewa Sub-county in Tororo District, where the first seed bank has recently been established.

4.2 Advisory Sub-System

Advisory information for real-time advice on crops, livestock and investment issues in the agricultural sector is provided. This sub-system is designed with a knowledgebase from which specific information is searched. The knowledgebase contains information on crops such as:

- Suitable places for growth of specific crops
- Best practices in planting through to post harvest
- Pests and disease control

- Measures for improving productivity
- Available financial services
- Available consultancy services
- Guidance on cost of food production by region

Similarly, information on livestock in the knowledgebase includes: disease diagnosis and treatment, feeding formulae for domestic animals and birds, productivity improvement approaches, and cost management methods in keeping livestock for profit.

Additional information on cross-cutting technologies for farm productivity such as: available agro-processing services by region, labour saving technologies, post-harvest techniques, soil conservation methods, rain water harvesting technologies, and floods control techniques, are also provided by the knowledgebase.

5. Decision Support

The system (AIS) supports decision making by providing answers to the core agricultural performance questions in form of graphs, tables and pie-charts for easy analysis.

5.1 Specific Questions Addressed by the System

Several practical questions on agricultural performance can be answered by the system. These include:

- Who are the leading producers of predominant crops at local council, parish, sub-county and district level? Why are they leading? How much surplus food is available for sale per person? How can they be supported to improve production?
- Who are the least producers of predominant crops at local council, parish, sub-county and district level? Why are they trailing? Do they have any surplus food for sale? How can they be supported to improve production?
- What are the categories of interventions by government (e.g., through National Agricultural Advisory Services - NAADS) and others (e.g., World Vision)? Who have benefited from these interventions? How have these interventions been helpful? How should the farmers be helped in future?
- What types of farmers groups exist? What are the groups engaged in? How are the groups being supported? Which organisations are supporting the groups? What challenges are the groups facing?
- What are the highest, lowest, and average productivity levels (quantity produced per unit land area) per crop by local council, parish, sub-county and district?
- What are the common challenges to crop production at local council, parish, sub-county and district levels? How should the challenges be addressed?
- Which foods are cheaper, where and when?

The results/answers to some of the questions outlined are provided in the following subsections.

5.2 Analysis of Foods Grown and Their Purposes

The pie-charts in Figure 1 show the trends in quantity of foods grown versus quantity of surplus foods for sale. It is clear that while cassava and millet are the largest produced foods as depicted by Figure 1, groundnuts is the largest food grown for sale, followed by maize.

Since farmers are already engaged in growing groundnuts and maize for sale, greater support in this area could increase their profits. In retrospect, a more effective solution is envisaged when other factors such as: productivity (quantity of yield per unit land) and source of food for planting, are explored.

This is the subject of the subsequent discussions.

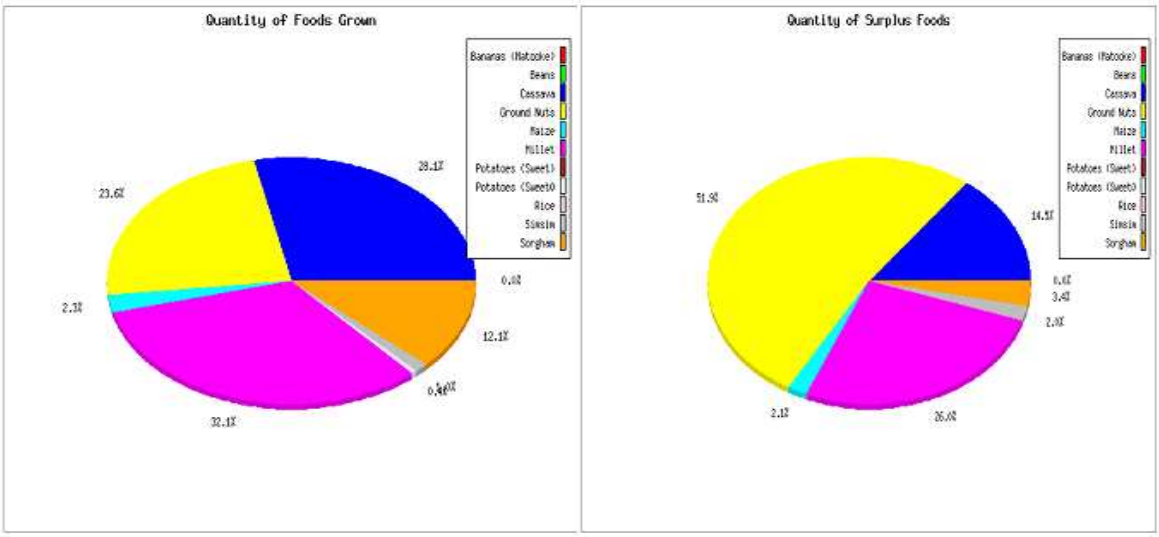


Figure 1: Analysis of quantity of food grown and quantity of surplus food for sale

5.3 Production and Productivity Analysis

Following from the foregoing discussion, it is important to establish actual quantities of the major crops produced and their yields per acre over time so as to design strategies for improving production and productivity by comparing with known standards. This is demonstrated in Figure 2.

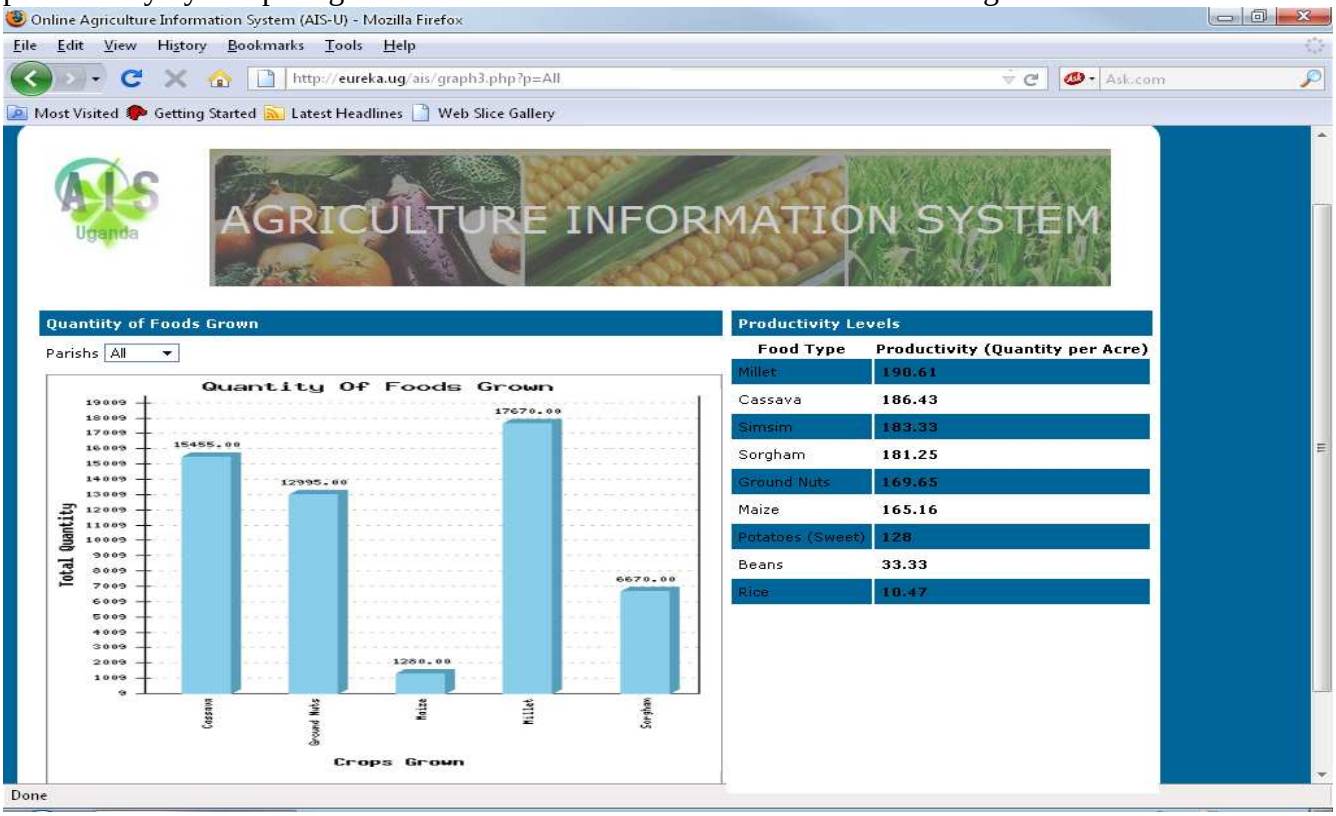


Figure 2: Analysis of quantity of crops grown and average quantities produced per acre

As shown in Figure 2, the yield per unit land is low across all the crops. This may be generally attributed to lack of improved seeds. The lowest reported yields for rice and beans cannot be associated with poor seeds factor alone but also delayed rainfall. As new data for future seasons are available, more conclusive insights will be made from production and productivity analysis.

5.4 Food Security Analysis

Food security involves a number of factors including, family size and land owned, source of seeds for planting, soil fertility, labour costs and other sources of income. The information system developed in this research keeps track of such food security data and provides analysis reports. For presentation purpose, an analysis on trends in source of seeds for planting is given in Figure 3.

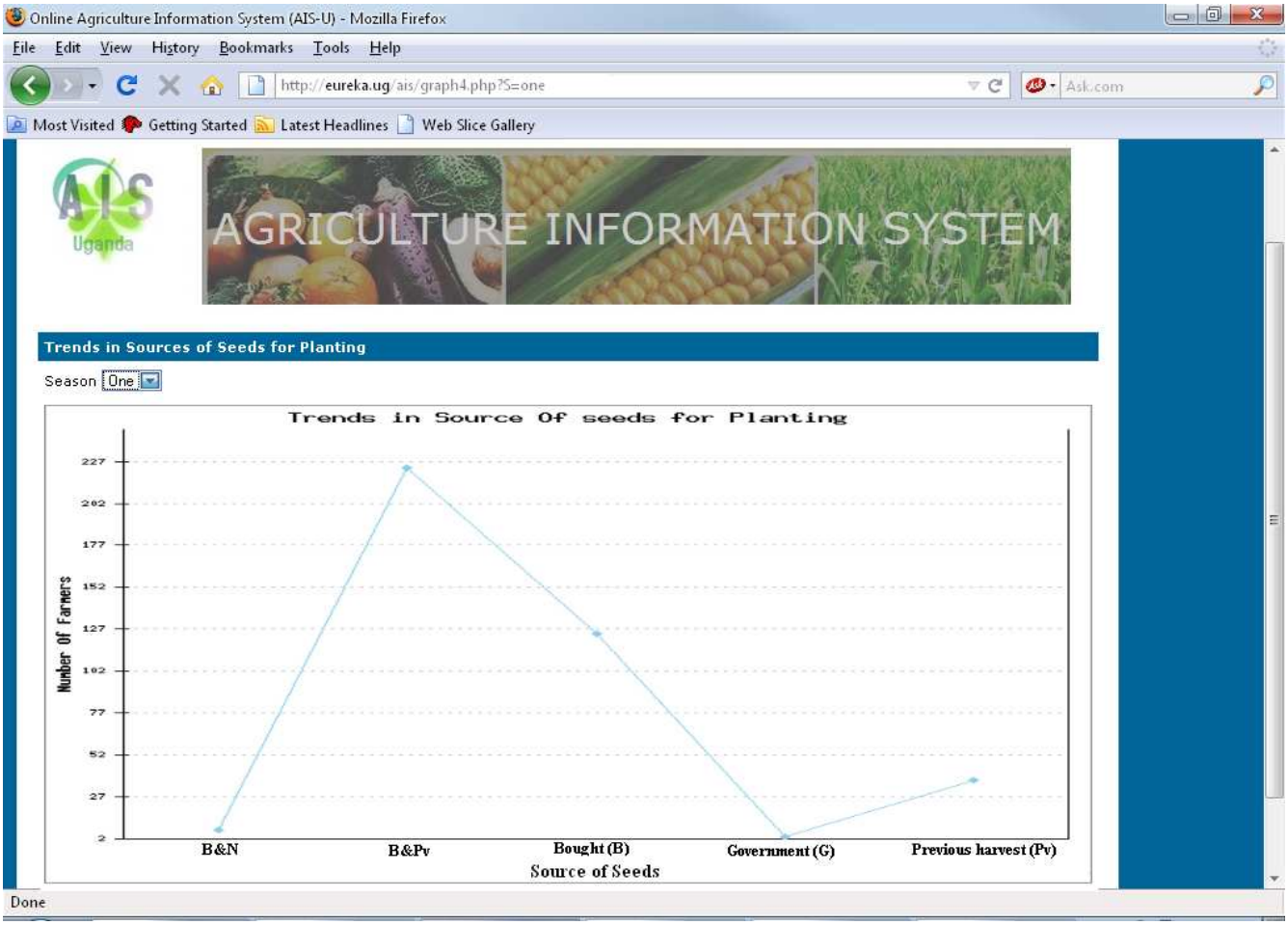


Figure 3: Analysis of source of seeds for planting

As depicted in Figure 3, majority of the farmers bought seeds (B) compared to those who preserved seeds from previous harvest (Pv) during season one planting period of 2011. Aware of the fact that farmers are always without any savings, it is likely that less quantities of seeds for planting were bought which is concordant with the declining trend in food production in Uganda over the last decade. To ensure that seeds are always available at the time of planting, new initiatives such as seed banking must be urgently explored. This is the subject of the next section.

6. Seed Banking

Seed banking is a new idea which refers to the practice of preserving seeds for future planting by depositing available seeds/crops (e.g., maize) after harvest in the seed bank and withdrawing improved desired seeds (e.g., rice) during the planting period. A seed bank is a community based organisation that is not only engaged in seed banking, but also offers agro-processing, agricultural produce marketing and extension services. Preferably, the seed bank should be managed by a group of the most successful farmers within a sub-county, and the data management sub-system can provide this statistic. Through computerisation, the seed bank clients (farmers) are able to bank/preserve their seeds for future planting as well as trade their crops for cash and save the money with the seed bank. In essence, the seed bank buys harvested crops from farmers, processes them and sells the processed crops for profit. An agreeable sum of money is retained by the seed bank that is converted into improved seeds and is provided to the farmers during the planting season. Farmers can even be loaned seeds for planting provided a guarantor with the equivalent seeds banked is willing to stand surety. This section illuminates specific activities in seed banking including: seed deposit, seed withdrawal and seed loan.

6.1 Seed Deposit

To perform a seed deposit, data on client's account number (Farmer's ID), type and quantity of seeds to deposit, and type of seeds to withdraw, is entered into the seed bank's deposit application. The application then computes the equivalent sum deposited and actual quantity of seeds deposited if the seeds deposited are different from the seeds to withdraw. Figure 4 illustrates the seed deposit component of the seed banking system.



Figure 4: Demonstration of seed depositing

As shown in Figure 4, the seed banking system is highly flexible, giving farmers a choice on whether to withdraw seeds only or seeds/cash, making it an initiative for seed preservation and cash savings simultaneously.

6.2 Seed Withdrawal

Data for seed withdrawal component include: account number (Farmer's ID), and quantity to withdraw/transfer. In order to minimise freud, a withdrawal transaction is effected against verification of the client's photograph and signature/thumbprint. A screenshot in Figure 5 shows the withdrawal function.



Figure 5: Screenshot for withdrawal application

A cash withdrawal has similar interface - seed quantity available is replaced by sum available.

6.3 Seed Loan

As part of the seed banking services, a seed loan is necessary when natural disasters such as severe drought, floods and hailstorms destroy crops and farmers may not have sufficient harvest from which to preserve seeds for future planting. The seed bank loans farmers with seeds under such circumstances with approval of loan guarantors who have the equivalent amount of seeds/cash saved with the seed bank. A local non government organisation (NGO) or CBO are also considered as guarantors.

7. Conclusion

The challenges to performance of the agricultural sector are numerous and so are the dimensions of addressing them. While government and development stakeholders have taken necessary actions in a number of critical areas, there seems to be no progress because other innovative interventions have not been tried. From the presentations in this paper, it has emerged that information technology plays a central role in propelling growth in the agricultural sector by supporting three cardinal areas: extension services, data management and decision support, and production and marketing. Focussing on these areas promises more effective interventions that could balance agricultural production per capita with population growth. In particular, AIS supports the following:

a. Analysis of farm yields' data per season for each farmer and dissemination of the findings to government and development partners to enable more effective interventions into the farmers' specific challenges.
b. Advice to farmers on agricultural best practices using an up-to-date agricultural knowledgebase.

c. Production and marketing of crops through provision of improved seeds during planting season and offering best prices for harvested crops.

In terms of future work, the advisory sub-system should be extended with document enrichment capability whereby, search results are returned as one enriched file comprising of merged sections from different documents in the knowledgebase corresponding with the search keywords.

Acknowledgement

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References

[1] Benin, S., and Thurlow, J. (2008). Agricultural Growth and Investment Options for Poverty Reduction in Uganda. IFPRI Discussion Paper 790. Washington, D.C.

[2] Benin, et al., (2007). *Assessing the Impact of the National Agricultural Advisory Services (NAADS) in the Uganda Rural Livelihoods.* Washington, D.C.: IFPRI.

[3] Kraybill, D., and Kidoido, M. (2009). Analysis of relative profitability of key Ugandan agricultural enterprises by agricultural production zone.

[4] Ministry of Finance, Planning and Economic Development (MFPED). (2004). P*overty Eradication Action Plan 2002/03-2008/09*. Kampala: Author.

[5] Mukiibi, J. (2008). *Food Production in Uganda: Challenges and Opportunities.* Paper presented at the 8th Annual Conference and General Meeting of the Uganda Academy of Sciences on Status of Food and Nutrition Security in Uganda, Kampala, ISSN 1819-7078.

[6] National Development Plan (NDP). (2010). *Macroeconomic Framework, Investments and Financing Options 2010/11-2014/15: Final Draft.* Kampala: Government of Uganda.

[7] Plan for the Modernisation of Agriculture (PMA). (2009). A market research study on rice value chain in the Acholi and Lango sub-regions of Northern Uganda. May, 2009. PMA. Kampala, Uganda.

[i] World Vision is a Christian relief, development and advocacy organization dedicated to working with children, families and communities to overcome poverty. Tororo District is one of the oldest Districts located in Eastern Uganda.

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