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ICT in Governance Systems: A Case Study of the FISP Farmer Registration System

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***Abstract*—Use of enhanced Information Communication Technology is among the key targets set forth in the 7th National Development Plan. Absence of a rigorous approval process has seen an increase in the number of ghost farmers benefiting from the Farmer Input Support Programme. The lack of a single pool of farmer and marketing information for technocrats makes decision making a near impossible task. This paper proposes a system for the capturing and management of farmer information using cloud infrastructure. Having this information will bring efficiency to the activities of farmer-facing bodies such as the Farmer Input Support Programme and the Food Reserve Agency.**

***Index Terms*—agriculture; cloud computing; farmer registration; governance systems; automation; Information Communication Technology; ICT for Development.**

I. Introduction

Lately, the Farmer Input Support Programme (FISP) has seemed to be synonymous with problems [1] [2]. Time and again, officials from the Ministry as well as farmers have complained of its shortcomings [1] which have not been solved over the past few farming seasons [1] [2] [3] [4] [5] [6]. With the constant stories of ghost farmers [1] and inputs from FISP being sold by recipients, some citizens have grown disillusioned with the programme [6]. Food Security is a combination of availability, access and use [7]. The presence of ghost farmers impacts availability in that subsistence farmers missing out on inputs will have lower yields [2].

Cakmak and Tas [8] concluded that Information Communication Technology (ICT) usage has a huge importance at strategic level. This involves using ICT to provide support in data collection, developing databases and automation of repetitive tasks. This is proof of the role that the implementation of ICT can have on a business. Having a centralized store of data puts real-time data in the hands of decision-makers.

This paper describes a project funded by the National Science and Technology Council (NSTC). The project involved the creation of an agricultural information system to assist in the registration and verification of farmers. The system will also allow officials in the Ministry of Agriculture to closely monitor the state of the farmer register and ensure fraudulent activity is minimized.

The rest of this paper is as follows. In Section II, an overview of the Farmer Input Support Programme is provided. In Section III, related work is listed. Section IV contains the methodology and Section V contains the results and discussion. Lastly, Section VI contains the conclusion and future works.

Project funded by the National Science and Technology Council (NSTC).

II. Farmer Input Support Programme (FISP)

The Goverment of the Republic of Zambia developed the Fertilizer Support Programme (FSP) in 2001 [9] with the view of providing inputs to small-scale farmers and in the process prop up the private sector. It was a three-year programme that involved progressive disengagement. This means that subsidy level would begin at 50% in the first year, before dropping to 25% in the second year. It would then fall to 0% in the third year [10]. In 2009, FSP was reworked and renamed to FISP. Part of the reworking involved reducing the quantities of inputs provided from eight 50kg bags of fertilizer to four 50kg bags and from two 10kg bags of seed to one 10kg bag [9]. This was done to increase the number of recipients.

1) FISP Electronic Voucher: The electronic voucher (e-voucher) system was initially piloted in 2015 [11], targeting 13 districts in Central, Copperbelt, Lusaka and Southern provinces. It was created to augment FISP by providing recipients of the programme a wide number of options of agro dealers they could buy inputs from. In collaboration with the Zambia National Farmers Union (ZNFU) [11] and a number of banks [12] the E-Voucher programme used the existing VISA card system that was used by ZNFU in the LIMA Credit Scheme. Upon completion of the registration and approval process in each farming season, a VISA debit card would be provided to each beneficiary of the input programme. The card would only be activated upon payment of a fee. And as a security mechanism, these cards could only be used at the various registered agro dealers.

2) Ghost Farmers: 'Ghost farmers' [2] [3] [1] have proven to be a recurring problem since the introduction of the e-voucher system. The term refers to individuals registered in the system who are not peasant farmers. It also covers cases where deceased individuals appear [4] in the system. According to a news article by Muwanei [2], some of the ghost farmers are officers from the Ministry of Agriculture. According to Mulenga [4] the ghost farmers use FISP as a social cash transfer benefit. The individuals receive the inputs and immediately sell them [4] [6].

III. Related Work

1) Better Rice Initiative Asia (BRIA) Database System: The BRIA database system [13] was developed with the objective of eliminating the use of paper and managing complex work related to the handling of farmer data in Indonesia. Basic data was collected from farmers in each district. An administrator then entered the data into the system, after verification by BRIA coordinators. During data collection the BRIA coordinators were equipped with an android tablet, with the BRIA mobile surveyor application installed, and a handheld GPS device. Locating a farmer's land parcel is a key pre-requisite to gaining financial services from the initiative.

The system being developed is very similar to the BRIA database system. The objective of managing farmer data in a web application is shared between the two systems. The only difference is that at present, the proposed system is not managing spatial data, although this is proposed in a future module.

2) Database of Livestock Farmers - Punjab: The Punjab Information Technology Board (PITB) [14] developed a database of Livestock farmers on behalf of the Livestock and Dairy Development Department of Punjab, India. The objective of this system is to provide the Department of Livestock and Dairy Development a unified platform through which to access farmer and farm profiles. This platform helps the department identify the distribution of farmers in the province and view land and crop information.

The system being developed only differs in terms of the type of farmer being targeted. At present, the focus is on registration and verification of farmers leading to the receipt of inputs. The Punjab system on the other hand seems to be a decision support system for internal department operations.

3) Agriculture Information Service Built on Geospatial Data Infrastructure and Crop Modeling: The paper by Honda et al. [15] describes an agricultural information platform called FieldTouch. A team of 100 farmers in Hokkaido, Japan, participated in the development of the platform. The platform assists farmers in planning their agricultural activities by suggesting where fertilizer should be applied.

4) Access to crop prices and information: Simelane [16] describes a mobile application created to provide farmers in marginalized rural areas with a platform on which to sell their produce as well as get access to vital information. Following a study in Northern KwaZulul-Natal, South Africa, the researcher found that the majority of farmers in this area owned feature phones. Feature phones are mobile devices that lack the more complex features of smart phones. These devices are typically only capable of voice calling, sending and receiving of SMS messages and in some cases internet access. That information was useful in deciding what technologies were used during development of the application.

Figure 1 is a depiction of the Market screen in the mobile application. The farmer is can search for a particular commodity and view its current price. Having access to commodity prices would ensure that farmers get the right price for their goods. This is important if marginalized farmers are to be lifted out of poverty.

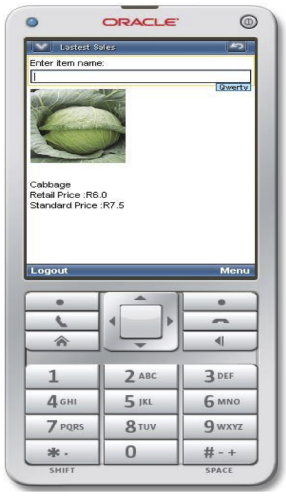

Fig. 1. Application for market access [17]

5) Real-time Monitoring of Grain Warehouses: In his paper [18], Chibuye presents a model to be used to collect real-time data using the Android Things platform and cloud technologies. The model proposed had to be low cost, have minimal power requirements and be extensible. To meet these limitations, the Raspberry Pi was proposed as the hardware framework on which to base the model on. The Raspberry Pi is a card-sized computer developed for educational purposes. It has proven to be a capable hardware platform for hardware prototype creation by providing the necessary processing power while being low cost and consuming minimal power. Various peripherals such as temperature, humidity and motion sensors make up the remainder of the model. The model described by Chibuye would allow the conditions within a grain warehouse to be monitored remotely through an internet enabled device.

6) A Wireless Sensor Network Based Grain Inventory Management System for Zambia's Food Reserve Agency: To assist in solving the problem of food security in Zambia, this work [19] proposed a wireless sensor network model for use the grain storage warehouses of the Food Reserve Agency of Zambia. The author went to great lengths to carry out a thorough investigation of technologies related to wireless sensor networks. Apart from that, the baseline study conducted gives an interesting view of the facilities available at most of the storage depots. A new set of business processes were also proposed by Muyunda, ensuring that the stock purchase and stock selling process are captured in the wireless sensor model.

7) Using the Cloud Architecture to Automate the Farmer Input Support Programme (FISP) Inventory System: As a precursor to this work, Chomba [20] looked into how information is currently being held. Chomba found that at the time, 61.76% of records were being stored on spreadsheets or manual systems. This finding was a huge motivation to this

work.

IV. Methodology

Qualitative data was gathered through numerous interviews with the relevant staff from the Ministry of Agriculture as well as a thorough document sampling process. The sampling process involved skimming through the numerous documents and manuals provided that cover the activities being modelled. The outcomes of the data gathering process were:

1) System requirements
2) Design of the model

During the analysis and development process, the Object-Oriented Systems Development Methodology (OOSDM) [21] is used. This involves the use of various diagrams to represent the system at varying levels of detail.

A. Current Business Process

According to the FISP Implementation manual [22], the application process begins at the farmer group level. The lowest agricultural grouping in each area, which is a camp, forms a Camp Agricultural Committee (CAC). The CAC is tasked with picking the location and date on which details of the application process will be communicated to the applicants. Each farmer organization (cooperative) will receive applications from farmers who intend to receive input support.

Upon receipt of the applicants from each farmer organization within a camp, the respective CAC carries out an appraisal process as is depicted in Figure 2. This involves scrutinizing each application, making sure the criteria laid out by the Ministry of Agriculture is met.

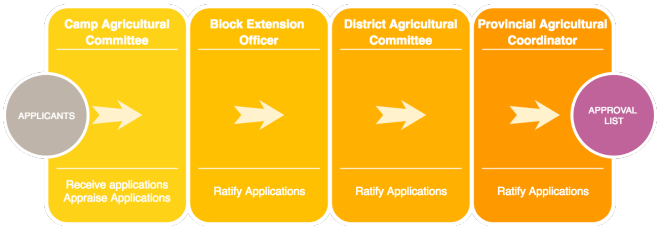

Fig. 2. Appraisal Process

The screening process occurs again with the Block Extension officer. He/she will examine the applications before passing them on to the District Agricultural Committee. A similar process occurs here. The process then ends with the Provincial Agricultural Coordinator. At this point, an approval list will be sent down to the CAC to be shared with the farmer organizations.

B. Proposed Business Process

The proposed process seeks to augment the current process of data capture. It would involve using a web application for both the registration and approval processes. Like the current process, applicants would have to go through the process sequentially.

C. System Architecture

The proposed architecture depicted in Figure 3 includes a dedicated database and web server hosted on networked infrastructure. Due to the lack of infrastructure at satellite depots, the Camp Extension Officers would have to access it using one of many mobile connectivity options (3G/4G or WiFi) on a tablet or smartphone. Officials at Block, District and Province level would also be able to access the system. It would provide each of them with statistics pertaining to their particular area. Apart from that, they would be able to view the profile of each applicant as well as approve them. The connectivity options are similar to that of the Camp Extension Officers. Although they have the added option of accessing the system using desktop computers where the required infrastructure is available.

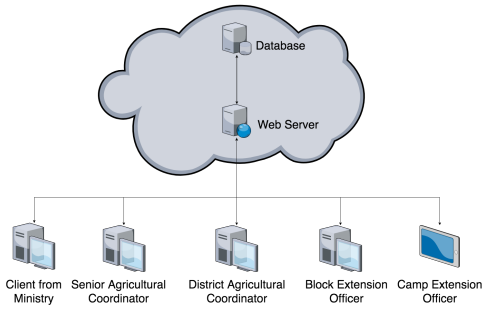

Fig. 3. Proposed System Architecture

D. System Modelling & Design

Use case models depict how a particular user interacts with a system. Figures 4, 5, 6 and 7 show the specific functionality that is available for the specified user types.

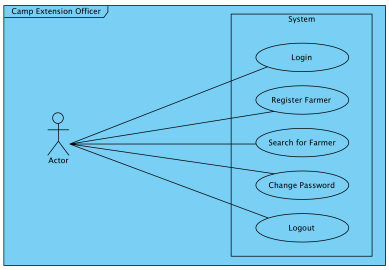

Fig. 4. Camp Extension Officer Use Case Model

V. Results & Discussion

At the time of writing, a basic system prototype has been created. This includes both the registration and approval processes. Figures 8 and 9 depict the Registration form and Farmer Registry.

Upon completion of a separate module, displaying of spatial data, the possibility of a pilot study will be explored. The input collected at this stage will be vital in the eventual transformation of the prototype to a market ready product.

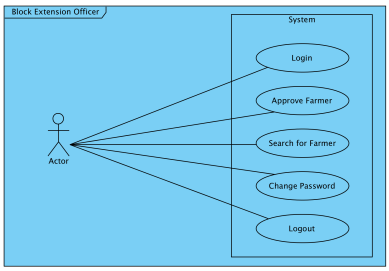

Fig. 5. Block Extension Officer Use Case Model

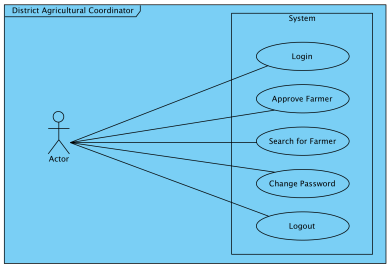

Fig. 6. District Agricultural Coordinator Use Case Model

VI. Conclusion & Future Work

In conclusion, a prototype has been developed to assist in the FISP Farmer Registration process.

This system forms part of larger Agricultural Management System. The next modules to be worked on are:

1) Inclusion of spatial data for farmer land parcels and warehouses.
2) Grain inventory management module for the Food Reserve Agency (FRA).
3) Grain bag identification using mobile technologies.

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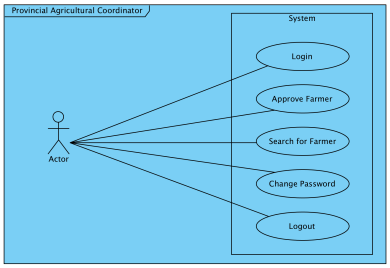

Fig. 7. Provincial Agricultural Coordinator Use Case Model

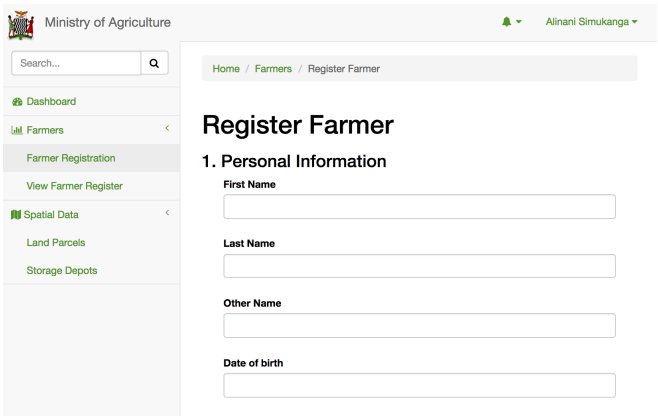

Fig. 8. Screenshot of Farmer Registration Interface

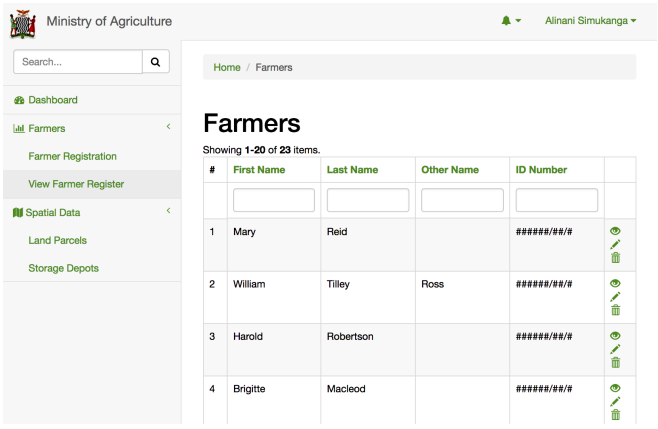

Fig. 9. Screenshot of Small-Scale Farmer Register

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