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The Extent of ICT Adoption by ACP Farmers: mAgriculture Adoption in Kenya

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The Technical Centre for Agricultural and Rural Cooperation (CTA) is a joint international institution of the African, Caribbean and Pacific (ACP) Group of States and the European Union (EU). Its mission is to advance food and nutritional security, increase prosperity and encourage sound natural resource management in ACP countries. It provides access to information and knowledge, facilitates policy dialogue and strengthens the capacity of agricultural and rural development institutions and communities.

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Contents

Executive summary

Kenya boasts over 70% mobile phone penetration but the technology has not been adequately applied in critical economic sectors such as agriculture in Kenya. The introduction of this readily available technology in key economic sectors could lead to tremendous positive changes in the industry, leading to efficient business processes, information sharing, less expensive transaction platforms and higher profits for all of the stakeholders. However, to date there has been little implementation of mobile technology in agriculture, despite the immense potential of this affordable and readily available technology to transform this sector in Kenya. There is need to identify the factors that will help in the penetration of such technologies to the target stakeholders.

We need to study the existing scenario on the general use of ICTs and mobile technology in the agricultural sector and develop a framework to guide the adoption of mobile technology in agriculture, to guarantee the success of such mobile agriculture technologies in this important sector of the Kenyan economy. Here we present the opportunities and the challenges facing mobile technology in agriculture in Kenya, identify the success factors for implementing mobile technology by the stakeholders and suggest the areas of focus that could be transformed by mobile technology.

Introduction

The mobile phone is seen as the basic computing device for the developing world. Most African farmers heavily rely on agriculture. In sub-Saharan Africa, the agricultural sector accounts on average for close to 20% of total gross domestic product (GDP) and about 60% of the region's labour force (Beintema and Stads, 2004). Many countries in the region depend on agriculture to a much greater extent than the regional averages. For instance, in Kenya, agriculture contributes to 24% of total GDP and about 80% of the country's labour force (KNBS, 2012). This working paper focuses on the current implementation of mobile technology solutions in the Kenyan agricultural sector, their level of penetration and the benefits accrued by their users as well as the challenges faced. It also highlights further opportunities that have not yet been explored, where mobile technology can be used to revolutionise agriculture in Kenya and in other developing countries.

Mobile technology applications in the agriculture sector in Kenya

Over the past 10 years, mobile technology has been adopted in various sectors of the economy in Kenya and agriculture has not been left behind. The innovative mobile solutions in agriculture touch nearly all of the sub-sectors of agriculture ranging from dairy farming, general livestock farming, crop farming e.g. potatoes, tea, maize, etc.; while some of the solutions in this sectors have experienced continuous growth over the years, others have not survived due to various technical, human and organisational factors.

Table 1 shows the various mobile solutions in the agricultural sector in Kenya, the approximate number of users they have, their geographical coverage, the year of launch, the agriculture sub-sector they target and the general goal of the solution.

Objectives

The objectives of this research were to identify:

- the status implementations of mobile technology in agriculture in Kenya
- the challenges facing the implementation of those technologies
- other areas of application in agriculture that can be impacted by the implementation of mobile technologies.

Methodology

The development of mobile solutions in the agricultural sector has not been widely applied and is still taking shape. There is a strong case to use a case study approach as it supports the objective to study implementations of mobile systems in agriculture and gather information from specific existing cases. Yin (2003) states that in a case study research, there is no universally acceptable number of cases and a case study could be based on a single case or on many cases. Moreover, the validity of case studies can be enhanced by the strategic selection of cases rather than on their number (De Vaus, 2001). Case studies are often viewed as particularly appropriate where research and theory are at their early, formative states and lack a strong theoretical basis (Benbasat *et al.* 1987). Yin (1989) goes on to indicate that case study research gives the opportunity to study a phenomenon within its real life context.

Table 1. mAgriculture solutions in Kenya.

Project	Geographical coverage of implementation	Type	Agriculture sub-sector	General goal
MFarm	Central Kenya, western Kenya, eastern Kenya, spreading to other regions	SMS	Crops	Commodity prices
ICow	Nairobi, central Kenya, spreading to other regions	SMS	Livestock	Provide a cow gestation calendar and breeding information for dairy farmers
Kilimo Salama		SMS and application	Livestock and crops	Crop weather data and insurance
Govt. Kit for mAgriculture	Nationwide, pilot launched in some zones	SMS Tablet application	Crops	Information provision
M-Kilimo	Nationwide	Voice	Crops	Information provision
M-Shamba	Nationwide	SMS	Crops	Information provision
Maize Variety SMS Service	Nationwide	SMS	Crops (maize)	Maize varieties in a Division
What to plant, rate and price	Nationwide	SMS	Crops (all kinds)	Lets the farmer know what to plant, the rate of seeds and the price of the seeds
M-Kulima's M-Bima	Eastern province	SMS and mobile application	Livestock	Purchase of livestock insurance and information updates for pastoralists

While gathering data in a case study approach, Yin (1984) suggests the usage of at least six sources of data such as documentation, archival records, interviews, direct observations, participant-observation and physical artefacts. To accomplish the data collection required in this research, four methods were used: documentary exploration, direct observation,

participant observation and field interviews. These methods were chosen because of their high chance of providing accurate information, which was helpful in understanding the scenario on the ground.

The questionnaire and field interviews were aimed at collecting information on mobile phone services within Kenya, mobile devices among the target stakeholders, and the usage and experience with general mobile applications and with m-agriculture applications. It is also necessary to gather data that will inform the research on the various aspects of the used theoretical foundation. Information on the mobile devices among the stakeholders will be necessary in establishing what kind of user interfaces are to be developed for various categories of users. Other device capabilities will give data that could be used to decide what kind of middle-tier applications could be developed for different m-agriculture applications. The kind of information format that could be handled by the mobile devices among the stakeholders within agriculture was also established. Data on communication aspects was gathered, including the reliability of Global System for Mobile Communications (GSM) networks such as 2G or 3G, which determines the speed of network access between a mobile application and its corresponding business application. The questionnaire consisted of a combination of open-ended questions and close-ended questions.

Purposive sampling was used to select participants for the study. Information was collected from the following stakeholders of the dairy industry: farmers, veterinary officers, agricultural officers, agro-vet dealers and milk processors. Information was also collected from relevant government bodies such as the Kenya Dairy Board, Communications Commission of Kenya (CCK) and Ministry of Agriculture.

An appropriate coding scheme was used for the questionnaire and survey in order to facilitate a smooth process during the analysis. The answers to open-ended questions were categorised into groups and coded. The data quantitative data was entered into the Statistical Package for Social Sciences (SPSS) computer software for analysis. Once the results were keyed in, data cleaning was carried out to identify any inconsistencies.

Descriptive analysis was done, where the distribution of responses to each variable was described. This was followed by additional analysis as required e.g. cross-tabulation analysis with the aim of identifying associations among various variables.

Results

A varying range of technologies has been used to develop mAgriculture applications in Kenya. These range from SMS, Unstructured Supplementary Service Data (USSD), mobile web and installable applications e.g. Android and Java apps. According to Gichamba and Lukandu (2012), approximately 54% of farmers have mobile phones with internet capability and the capability of hosting installed mobile applications. The high percentage of data-enabled phones indicates that developers of mobile agriculture systems can develop business applications and software services that communicate with the mobile applications.

This high percentage means that there can be reliance on remote information storage, e.g. in a relational database. Information can then be sent or retrieved from the remote storage via the mobile-based system. However, 46% of the respondents would require mobile agriculture applications that use another means of communication other than data (e.g. SMS and USSD). However, interviewed farmers were from regions that would be described as

more suburban than rural areas. A study on a purely rural area would probably have shown different results.

The studied implementations of mAgriculture exhibited largely low-end mobile phones as the target device. M-Farm, iCow, M-Shamba, M-Kulima, Kilimo Salama, Maize Variety SMS Service by KEPHIS and Kenya Seed company's SMS service on What to Plant, Rate and Price are all SMS-based applications. However, all of these systems have complementary technologies to allow the accommodation of different stakeholders as well as input, management of data, monitoring and reporting.

The penetration of mAgriculture solutions is not yet fully nationwide, with farmers in agriculture intensive areas and suburban regions having a bigger advantage than those in regions with minimal or less profitable agricultural activities.

The mAgriculture solutions have faced various challenges, from cost, technical difficulties in deployment and hosting to usability difficulties. A challenge affecting the SMS-based solutions is the cost, whereby the service is available for a charge of between KSH 5 (USD 0.06) and KSH 10 (USD 0.12). This cost seems to be expensive to farmers, given that most of them are not large-scale farmers and they do not get very good prices for their farm produce. The owners of the solutions reported to have challenges with network availability, downtime and the creation of a profitable yet helpful billing model to all the stakeholders who are involved, without intimidating the farmer. For the SMS solutions, the language barrier is another challenge to farmers, where some of them cannot use the service because they cannot read the language used to disseminate the information. Others would confuse the SMS syntax while requesting for the service as most SMS solutions follow a certain pattern of querying that farmers have to adhere to; the words must be correctly spelled in order to receive the exact service. To curb this, system developers such as M-Farm are working with agents on the ground who are thoroughly trained in the SMS-based service, so that they can assist farmers who might be having difficulties. The agents are from the community and so it is easier for them to interact with the target users of the application.

Privacy was also a challenge to some farmers, where they would either not be willing to divulge all their information or would give false information, especially with regard to personal data details such as their age. The developers of M-Shamba reported difficulty with obtaining personal data, because of cultural issues where people do not feel comfortable to freely talk about personal issues. Another challenged faced by the existing implementation is adoption by the user. Most farmers want to see the system working before they will adopt it. For instance, as a way of marketing M-Kilimo the company behind the system, KenCall used radio advertisements and marketing materials showing testimonies from other farmers who have benefited from that service.

The M-Kulima platform has a livestock insurance purchase element that allows livestock farmers to purchase insurance. Agents on the ground have an installable mobile application that allows livestock farmers to purchase insurance for their animals. The biggest challenge experienced was network unavailability when data was to be submitted to the server in Nairobi. The system is currently being changed to allow sending of transaction data via SMS instead of via phone internet. Besides the identified areas, there are potentially other sections of agriculture that can benefit from mAgriculture applications, especially value chain operations including marketing and selling and buying farm produce.

Conclusion

All the studied mAgriculture applications have a revenue model, where the farmers pay a fee to use the service. The service fee ranged from USD 0.6 to USD 0.12. The farmers database could be used to reach out to farmers by advertisers of new farm products as inputs, announce other new farming-related products and agriculture-related events. Farm equipment and agro-vet companies can make use of a farmer database to spread information on best practices. The government can also use the database to contact farmers on useful, possibly subsidised, services. With the increasing penetration of mobile technology, the development of cost-effective and beneficial mAgriculture applications is paramount to the success of the usage of mobile technology in agriculture.

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