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Potential Role of Information Communication Technologies in Sugarcane Production by Farmers of Bungoma County, Kenya

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Abstract:
Sugar cane production in Kenya has been on the decline mainly because of poor information flow from extensionists to the farmers. Yield decline fell from 71 tons per hectare to 60 tons per hectare among the out growers between 2004 and 2015. The overall objective of this study was to examine the potential role of Information Communication Technologies in sugar cane production by the out growers of Nzoia sugar Company, Bungoma County. Specifically, this study aimed at determinining the information needs of farmers which can be addressed by ICTs for sugarcane production. The approach was correlational research design targeting the population of 8711 farmers in Milo, Misikhu, Matisi, and West Sang'alo sub locations. Proportionate random sampling method was used to obtain a sample size of 211 farmers. Focus Group Discussions and key informants were purposely selected using the quota sampling to augment the survey results. Data collection was by use of the questionnaires, interview guides, focus group discussions, key informants, and observation checklist. Pilot testing was on 30 farmers of Lugari Sub County and an alpha score of 0.70 was obtained. Data analysis done using SPSS (Statistical Package for Social Sciences, version 21). This was for both inferential and descriptive statistics. Each hypothesis was tested and accepted at $\alpha = 0.05$ confidence interval. Findings were presented in form of tables and cross tabulations. The study showed that information availability had a significant positive effect on sugar cane production. i.e. (land preparation p=0.000, use of recommended planting materials p=0.015, type of topdressing fertilizer p=0.000 and knowledge of production costs p=0.000). The research concluded that farmer's access to agricultural information had positive effect on sugar cane production. The study recommended that the sugar company emphasizes provision of agricultural information to sugar cane farmers and incorporate use of mobile phones in passing technical information.

Keywords: *Potential role, ICTs in sugar cane production, farmers of Bungoma County, Kenya*

1. Introduction

The Kenya sugar sector has not been competitive and is under threat when the COMESA (Common Market for East and Southern Africa) measures are finally removed. One of the key interventions that need to be put in place is by ensuring that out grower farmers get access to important technical information to help increase production per unit area (KSB, 2012). In an attempt to maximize yield, Kenya Sugar Research Foundation (KESREF) has provided several productions based technologies (KESREF, 2010; KSB, 2012). Despite the presence of high yielding varieties of sugarcane and relevant technologies for production of sugarcane, the sugarcane yields among the farmers of Nzoia Sugar Company have been on the decline while the costs of producing sugar cane have been rising leaving the farmer with a net loss. As a result of this, there has been a constant increase in sugarcane acreage over the years without a corresponding increase in yields (KESREF, 2010; KSB, 2012). For instance, in Nzoia Sugar Company, the improved technologies have increased sugar cane yields from an average of 60 tons to 101 tons per hectare on the nucleus estates whereas the sugar cane yields on smallholder farmer continued to decline from 74 tons to 60 tons per hectare (KSB, 2012). The difference between the two sub-sectors is mainly attributed to the adoption of improved technologies, including improved sugar cane clones (KESREF, 2010; KSB, 2012). It is clear that the low and declining crop yield among small holder sugar cane farmers is linked to limited access of information related to such innovations.

According to Munyua *et al* (2008), farmers need to access information about the new technology before they adopt it yet the traditional method of providing this through extension has been overstretched and underfunded. The same study reported that Africa has one extension worker per 4000 farmers unlike developed countries which have one extension worker per 200 farmers. This was supported by Anderson *et al* (2007) who showed that the efforts to deliver agricultural information via traditional extension have been expensive and disappointing.

According to the Sugar Campaign for change (SUCAM, 2013) updates, the reason for the continued decline of sugar cane yield has been inaccessibility to important production information by farmers and other stakeholders. Similarly, Kiplang'at and Acholla (2005) showed that lack of important information on production leaves farmers disadvantaged. In addition, Munyua, (2007) showed that the rural farmers do not have access to the knowledge generated in universities and research institutions. It is therefore evident that farmers' access to relevant production information has not been adequately addressed and use of ICT will be critical in filling this information gap. In Kenya, we have not had useful data demonstrating the potential role of ICTs in sugar cane production among the small scale farmers of Nzoia Sugar Company which justified need for this study.

2. Materials and Methods

This study was conducted in Bungoma county of Kenya (Figure 1). The county lies between 1384-2100 meters above sea level. Its geographical coordinates are 0° 34' 0" North, 34° 34' 0" East (KNBS, 2010). It has a surface area of 3593 square kilometers with the projected population of 1,650,750 (806,157 males and 844,593 females) according to the 2009 population census report. It has the population density of 453 persons per square kilometer. The County has nine Sub-counties, 21 Divisions, 81 Locations, and 179 Sub-locations (KNBS, 2010). With infrastructure, the county is connected to major towns of Eldoret, Kitale, Kisumu, Busia, and Kakamega with tarmac roads. (KNBS, 2010). The county has the following natural resources and economic features; (Mount Elgon, with forests and wild life, historical sites like Chetambe hills, with rivers like Nzoia, Kuywa, Chwele, and Malakisi. It has the tourist attractions destinations like Mt Elgon National Park, Mt. Elgon Forest Reserve, Nabuyole and Malakisi Falls, Sanga'lo, Musikoma and Kabuchai Hills (KNBS, 2010). The Main Economic Activities include Webuye Pan Paper Mills (not working), Nzoia Sugar Factory, Tobacco factory at Malakisi and Mastermind, commercial businesses, sugarcane farming, livestock farming. Despite the relatively good endowment with natural resources, the county's population continues to grapple with poverty level of 52% (KNBS, 2010).

The county lies in Agro Ecological zones; lower midland I(LM1), lower midland II (LM2), upper midland I (UM1), UM2 and upper highland I (UH1), (GOK, 2013). It receives a bimodal rainfall pattern with long rains starting from March to August a short rain from September to November with a total annual rainfall ranging from 1500mm-2400mm (GOK, 2014). The area has deep soils ranging from sandy clays to friable loamy clays. Farmers in Bungoma practice mixed cropping. The main cash crops are sugarcane and coffee on small scale. The common food crops are; maize, common beans, bananas, sweet potatoes, cassava, and vegetables (GOK, 2014). Livestock in the area include cattle, sheep, goats, pigs, rabbits, and poultry.

2.1. Research Design

The research design was correlational research design which involved data collection using surveys, analysis and reporting to determine whether a relationship existed between information needs of sugar cane farmers and sugar cane production (Mugenda and Mugenda, 2003).

2.2. Sampling Strategy

A purposive sampling method was used to select the key informants from among the stakeholders list. The same was used to get the sub locations where sampling took place. The sub location was divided into the administrative villages and multistage random sampling was used to select the sample sites. This allowed the researcher to divide the selected study area into strata at various levels; four zones, one sublocation per zone and random sampling was done within the villages. The study targeted population of farmers selected from four sub locations with highest sugarcane concentration namely: The sample frame in this study consisted of all the farmers in the four sub locations chosen with the highest sugar cane concentration thus 8711 farmers. Sampling was done in 4 sub location i.e. 51 (Misikhu), 50 (west Sanga'lo), 55 (Matisi) and 55 (Milo). A multistage random sample size of 211 farmers was arrived at using the formula by Naing *et al* (2006).The study population comprised of household heads, farmer lobby group like NOCO (Nzoia Out Growers Company), sugar cane lead farmers, Ward extension officers, and Company field officers, zonal managers of the Nzoia Sugar Company and county Heads of Departments in Agriculture sector in Bungoma County

In the study area, data was collected through face-to-face interviewing of the sample household heads using a structured questionnaire. The questions were administered by the researcher and one enumerator from each sub location. The enumerator had to be familiar with the study area and subject matter. The interviews were done in English, Kiswahili, and the local language Kibukusu.

According to Kanthuri and pals (1993), the general rule is to use the largest sample possible. Similarly, (Israel, 1992), shows that a good sample size of 200-500 is needed for correlational design. This study adopted the proportionate multistage sampling of the zones. This study involved collection of both secondary and primary data. The primary data were obtained from the field.

2.3. Household Questionnaires

In this study, closed ended questionnaires were used to collect data. (Mugenda and Mugenda 2003).

2.4. Key Informants

Six (6) Key informants who were working with Nzoia Sugar Company were purposively sampled for interview. The researcher used structured, Semi- Structured or unstructured or open ended interviews. Structured were used to gather views, attitudes, feelings, understanding and opinions, semi – structured were used to ask questions covering wide range of topics and issues while unstructured were used in collection of social data.

2.5. Focus Group Discussion

Focused group discussion was used for obtaining data on information needs of farmers, group feelings towards the extension service provision by the sugar company, yield trends among the farmers over the years and possible impact of proper information flow to farmers. Four (4) group discussions (FGD) were conducted from; Matisi, Misikhu, Milo and West Sanga'lo sub locations. The research used unstructured interviews to collect information from the group. Group members were purposively selected and mobilized through the Zonal sugar cane offices to a meeting with a quorum of at least 8-10 members.

2.6. Secondary Data

Secondary data was collected from reports and other archival sources. These included reports from'; the ministry of Agriculture, Bungoma county offices, Agriculture offices in wards, government offices of planning, survey, and also meteorology department.

3. Data Analysis

The raw data collected were edited and coded into useful format for analysis. The data collected were coded and the primary data entered into the computer for analysis. The data were analyzed using both descriptive and inferential statistics. The statistical package for social sciences (SPSS version 21) was used to process and analyze the data. These were used to establish the relationship among the study variables and then tested the formulated hypotheses.

Specific Objective	Measurable variable/indicator	Method of analysis
To establish the information needs of farmers which can be addressed by ICTs for sugarcane production.	❖ Recommended way of land preparation ❖ Use of certified cane varieties ❖ Use of recommended fertilizers ❖ Knowledge of production costs	Chi-square (χ^2) test for independence was used. This was the descriptive statistics

Table 1

4. Results

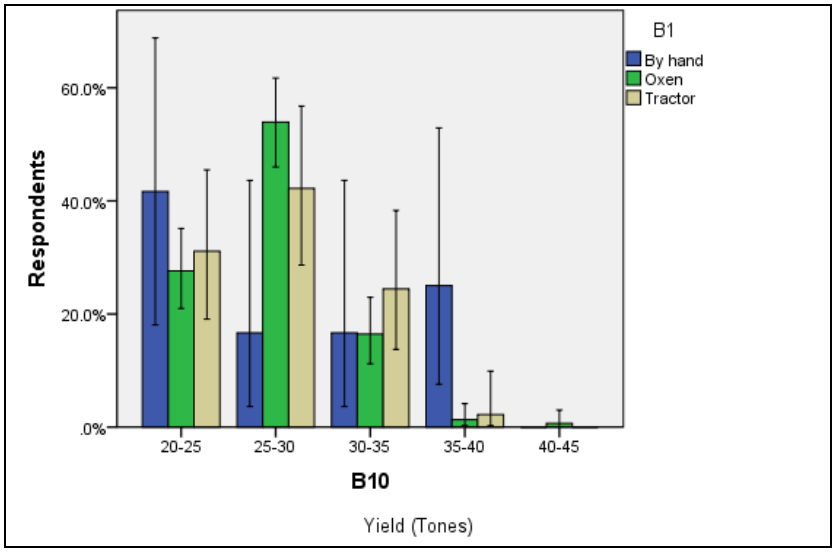

Figure 2: Association between sugar cane yield and equipments used for land preparation among sugar cane farmers of Bungoma County, Kenya

The study results with Pearson Chi-Square value($\chi^2_{12,\ 0.01}$ =30.504)showed that there was highly significant (P<0.01) association between the equipments used for land preparation and sugar cane yield. In this case higher yields are associated with use of tractor compared to lower yields associated with the use of oxen and hand digging. The key informants complained that the tractor hire is expensive and unaffordable for small scale sugar cane farmer in Bungoma County. Similarly, in Zimbabwe; Chidoko *et al* (2011) reported that sugar cane yields were declining due to reduced use of tractors during ploughing.

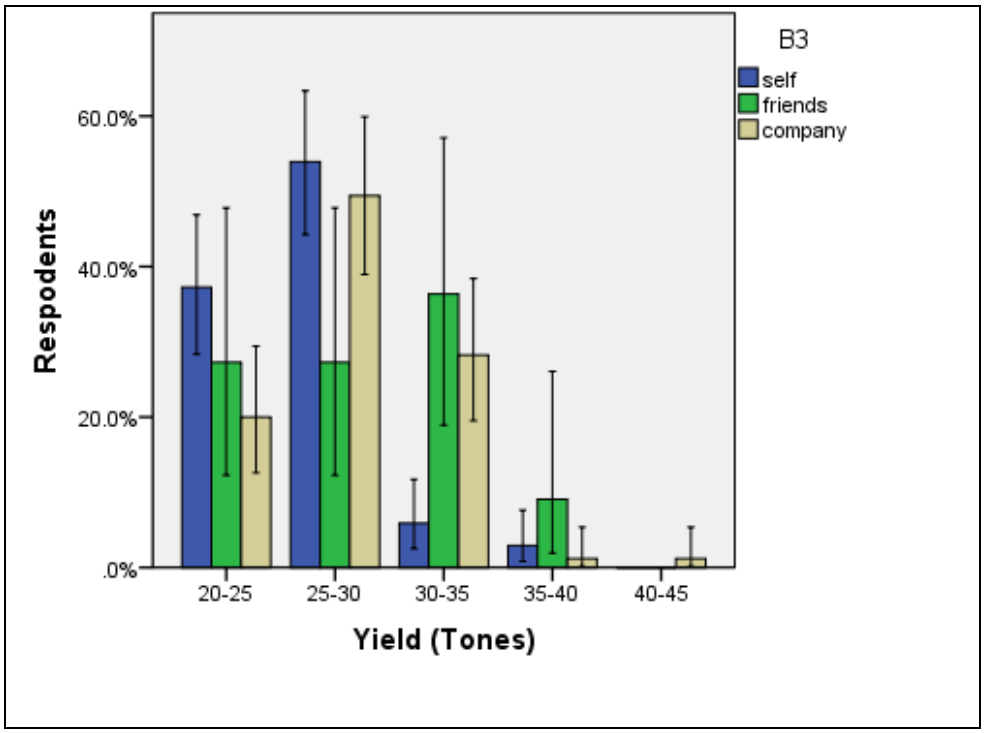

Figure 3: Association between sugar cane yield and source of planting material among sugar cane farmers of Bungoma County, Kenya. Source: Field data 2014

The study results with Pearson Chi-Square value ($\chi^2_{8\ ,0.01}$=15.751)indicating that there exists a highly significant (P<0.01) association between sugar cane yields by farmers and the source of the planting materials. Similarly, Odenya *et al* (2008) reported that farmers lacked knowledge and awareness of the existence of clean and disease free panting materials and their sources. The study showed that sugar cane yields from the recommended sugar cane varieties that are supplied by the company were significantly higher than yields obtained from planting materials sourced from farmers' fields and friend's fields.

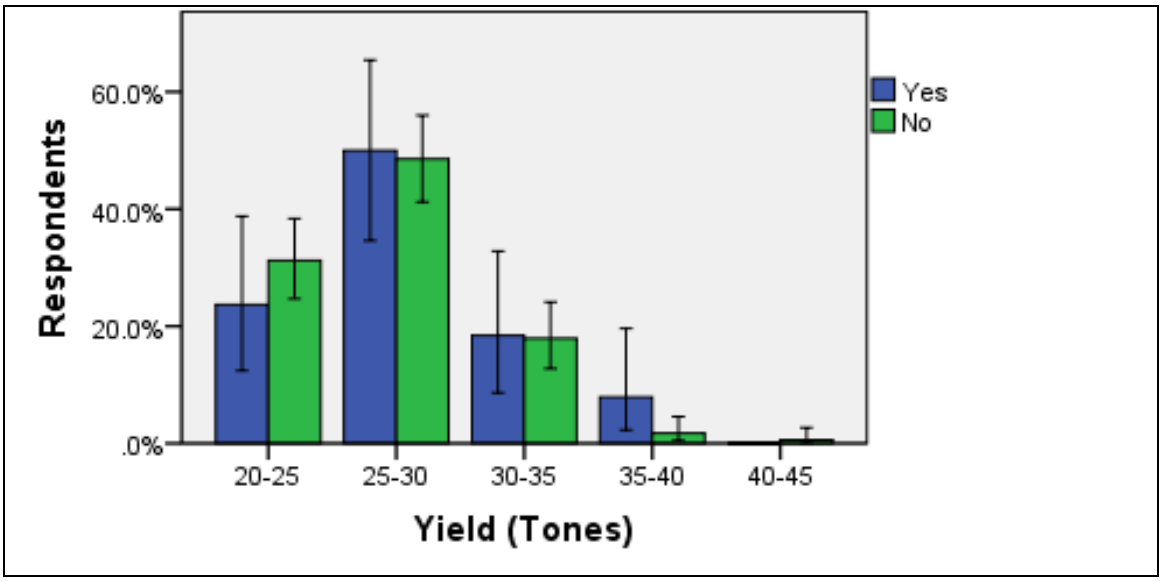

Figure 4: Association between sugar cane yield and farmers knowledge of the production costs among sugar cane farmers of Bungoma County, Kenya. Source: Field data 2014

The study results with Pearson Chi-Square value ($\chi^2_{4,\ 0.01}$ =25.078)indicating that there exists a highly significant (P<0.01) association between sugar cane yields by farmers and their knowledge of the sugarcane production costs. The Focus Group Discussion revealed that farmers fear keeping records of farm operations claiming that it discourages them when they account for every detail. The key informants confirmed that perhaps two out of ten people keep records. The zonal managers confirmed that the few farmers who keep records are business minded and are keen on profit making hence able to invest properly. Higher yields are associated with farmers who know how much it costs to produce sugarcane. This was also reported by most key informants that most farmers who were hiring

land means fully involved into commercial sugar cane production and as such kept records and had higher returns compared to those who were doing it without clear knowledge of the costs of production.

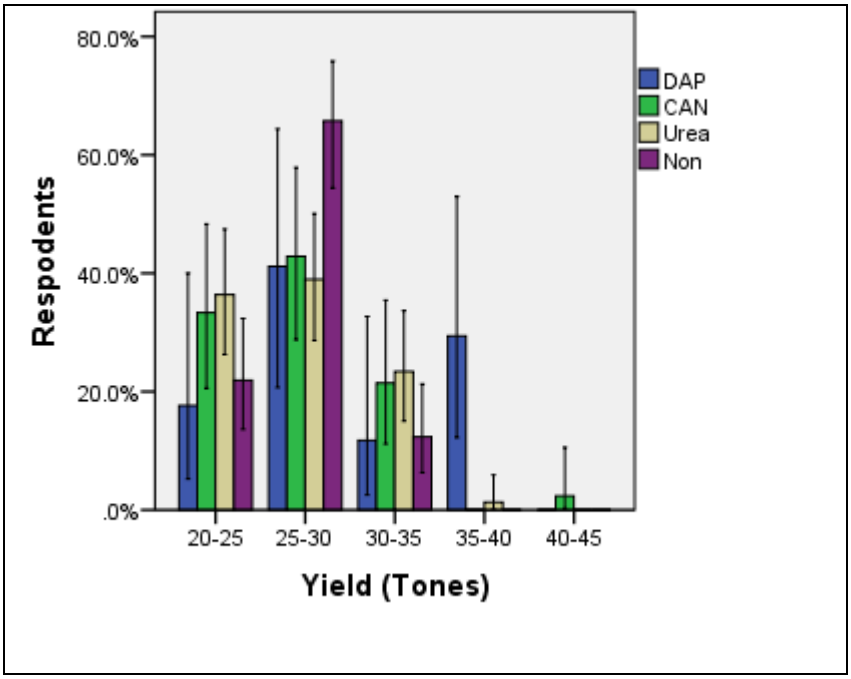

Figure 5: Association between sugar cane yield and fertilizer type used for topdressing among sugarcane farmers of Bungoma County, Kenya. Source: Field data 2014

The study results with Pearson Chi-Square value ($\chi^2_{12,0.01}$=32.739) indicating that there exists a highly significant (P<0.01) association between sugar cane yields by farmers and the top dressing fertilizer. As confirmed by the key informants, most farmers were applying all types of fertilizers whenever they access them and as such could not really tell where the difference cane from. Higher yields are associated with top dressing especially with CAN and mixture. Similarly, the report by Chandiposha *et al* (2014), found out that, there was significant difference between the fertilizer types. The same report also revealed that the blended fertilizers had the highest significance on the number of stalks over the straight fertilizer. Chandiposha *et al* (2014) explained that this might be due to nitrogen requirement of sugarcane which is greatest during the tillering (formative) phase which is present in sugar blended fertilizers and not available in straight fertilizer. Nitrogen is required for adequate tiller production and canopy development. In addition, Nyemba (2009) recommended that adequate Nitrogen supply should be made available to the crop in the soil from the start of the tillering phase. In addition, White (1991), revealed that adequate and timely supply of Nitrogen promotes tillering, canopy development, stalk formation, and stalk growth which ultimately leads to higher yields.

4.1. Summary of Findings

The study found out that information needs of sugar cane farmers had a statistical significant relationship with yields. (Land preparation p=0.000, Source of planting material p=0.015, top dressing fertilizer p=0.000, knowledge of production costs p=0.000). Farmers need to access this information in order to boost production.

4.2. Conclusions

The following conclusions were drawn based on the above findings. That addressing the information needs of sugar cane farmers by provision of sugarcane production information at the right time will enhance sugar cane yields among the sugar cane farmers in Nzoia Sugar Company. The information to include; land preparation, fertilizer use, recommended sugar cane varieties, and cost benefit analysis of sugar cane.

4.3. Recommendations

The company should put in place an elaborate farmer training programme to address the information needs of sugar cane farmers. The company to put in place an e-extension programme where farmers can use their mobiles phones and call for free information on sugar cane production.

4.4. Acknowledgements

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