# Application of ICTs in Transforming Agricultural Extension

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**Abstract**

*Purpose* - The purpose of this study was to investigate how extension service providers employed ICTs in transforming agricultural extension information service delivery in Tana River County, Kenya. The study examined how the application of ICTs can help to transform public extension service delivery thereby improving the farmers' access to agricultural information.

*Methodology* – Data was collected from 456 farmers in Tana River County in Kenya. The farmers were identified using simple random sampling. Data was collected using structured questionnaires and interview guides. Data analysis was performed using simple descriptive statistics.

*Findings* - The findings revealed that there was limited application of ICTs in the dissemination of agricultural extension information in Tana River County, Kenya. However, where application was prominent, an increase in productivity was noted.

*Implications* – The findings of this study may be used by the County Government of Tana River and the national Government of Kenya to improve agricultural productivity in the country through improved extension services.

*Originality* – The study was an original research conducted in a remote food-insecure county in Kenya. It links agricultural productivity to effective access to extension information services supported by ICTs.

**Keywords**
Information and communication technology, agricultural extension services, agricultural productivity, extension systems, Tana River County, Kenya

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## 1 Introduction and background of the study

Digital transformation of the public service has become an essential part of the strategic agendas, both in the public and the private sectors. This paper explores how Information and Communication Technologies (ICTs) can be used to transform the way public agricultural extension services are provided to smallholder farmers in Tana River County, Kenya. The paper recognises the important role extension and advisory services play in promoting agricultural productivity, increasing food security, and improving rural livelihoods. It investigates how ICTs have been applied in improving skills of the public extension service providers as a means of improving smallholder farmers' access to agricultural information.

The first and second Sustainable Development Goals (SDGs) aim to end poverty and hunger globally. The objective of these goals is to increase, at least twofold, agricultural productivity for smallholder farmers. This is expected to double incomes particularly for the vulnerable groups such as women, pastoralists and those engaged in fishing. This will be achieved through safe and fair access to production resources such as land, inputs, knowledge, financial services, markets and prospects for value addition and non-farm occupation by the year 2030 (UN General Assembly, 2015). However, it is a fact that efforts to end starvation by the year 2030 will not be successful if the world food production is not addressed. Advances in food security and sustainable agriculture should therefore focus on improving smallholder farmers' access to agricultural information as a means of enhancing their capacity to produce more food.

A report on food systems for inclusive rural transformation by Food and Agricultural Organisation (FAO, 2017) stated that achieving sustainable agriculture in low income countries has been a challenge in comparison to developed economies where agricultural productivity has increased significantly over the past 20 to 30 years. ICTs are therefore being considered as holding potential in empowering farmers with relevant and timely knowledge on agricultural production (World Bank, 2011).

## 2 Literature Review

Food security assessments by the International Fund for Agriculture and Development (IFAD, 2012) and FAO (2017) demonstrated that between two thirds and three quarters of

the food-insecure people live in rural areas had no access to technology and information geared towards enhancing agricultural productivity. The same reports argued that in order to be able to offer sustainable livelihoods for everyone, sub-Saharan African countries need to increase food production five-times by the year 2050 so as to meet the food requirements of the predicted population growth. Attaining this target requires working on each aspect of the agricultural production chain. It entails restoring exhausted soil, adhering to safe use of pesticides, using better and certified propagation materials and breeding stock, as well as observing crop and livestock nutrition through use of fertilisers and feeds. To achieve this, there is need to significantly improve the quality of extension services that support agriculture through intensifying the use of ICTs in extension work. This will enhance the capacity of extension workers to provide timely information, increase choice, reduce transaction costs, and contribute to improving the efficiency of decision making to raise rural incomes and improve the quality of life of the rural populations (Rao, 2007).

There are several challenges that hinder the application of ICTs in agriculture in Kenya. These include inadequate policy environment, illiteracy, infrastructure and capacity problems. According to Wambura, Acker and Mwasyete (2012), agricultural extension service is spread all over the world. However, its ability to help smallholder farmers to increase their farming output, and thus advance their living standard, has been inadequate. Davis *et al*. (2010) as well as Baig and Aldosari (2013) noted that while extension service was said to be supporting over one billion smallholder farmers all over the world, there was need to improve the delivery of the services through the use of ICTs. This would in turn improve the outreach to farmers and impart relevant skills in agricultural sciences and technology that will eventually change their farming systems and lead to increased quality yields thereby stimulating desirable changes in the agricultural sector.

In analysing constraints to access to and utilisation of agricultural extension information, Tanko, Adeniji and Nwachukwu (2012) were of the opinion that among the factors that lead to poor adoption by farmers are the perceptions farmers have regarding the training methods employed by extension service providers. This implied that there was need to retrain the service providers especially on delivery methods where digital technology is essential in ensuring seamless access to information by farmers.

Conferring credence to assertions by Bachhav (2012), it is accepted that the use of ICTs in providing agricultural extension services will enhance farming productivity by increasing access to information on best practices in farming, weather trends, and markets. This will help the farmers to know where to buy inputs or sell their products. Zarmai *et al*. (2014) affirmed this fact by declaring that in the agricultural sector, appropriate and well-timed information helps farmers to make the right decisions to sustain growth. Access to well-structured and appropriate information as well as its proper application of the same by farmers can lead to enhanced agricultural production.

## 3 Conceptual Framework

In order to get a clearer insight into the issues involved in the application of ICTs in agricultural extension, it was essential to delve into the relationships demonstrated in the process. Figure 1 shows how ICTs-led extension can help transform agricultural productivity.

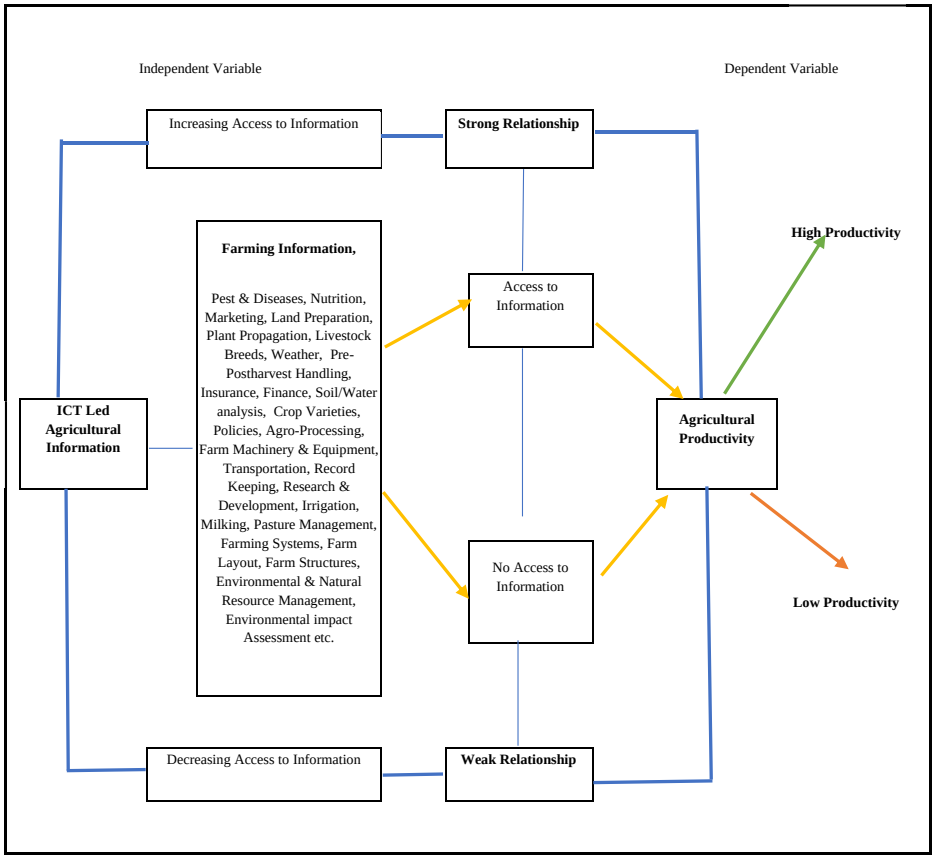



**Figure 1: Conceptual Framework**

Source: Authors (2019)

The concept behind this study was that the establishment of an effective ICT agricultural extension would facilitate seamless access to information resources for public access. However, various factors such as infrastructure, finance, policies and ICT literacy levels hindered effective implementation of ICTs-based extension services.

## 4 Methodology

The respondents in the study were 203 farmers from Galole constituency receiving ICT-based extension services and 253 farmers from Bura and Garsen constituencies who did not access ICT-based extension services. Simple random sampling method was used to select a smaller sample from a large population of farmers in the county. Data for two production cycles (seasons) was collected, that is, production for the year 2017 was considered as baseline and follow-up production for the year 2018 as the actual production. Structured questionnaire and interview guide were the instruments used for data collection. A total of 203 questionnaires were administered in Galole while 253 were administered in Bura and Garsen constituencies. The authors also interviewed extension officers and agriculture input dealers. Data analysis was performed by using simple descriptive statistics aided by SPSS and Excel to generate indicators such as frequency counts, percentages, means, counterfactual and standard deviations.

## 5 Findings

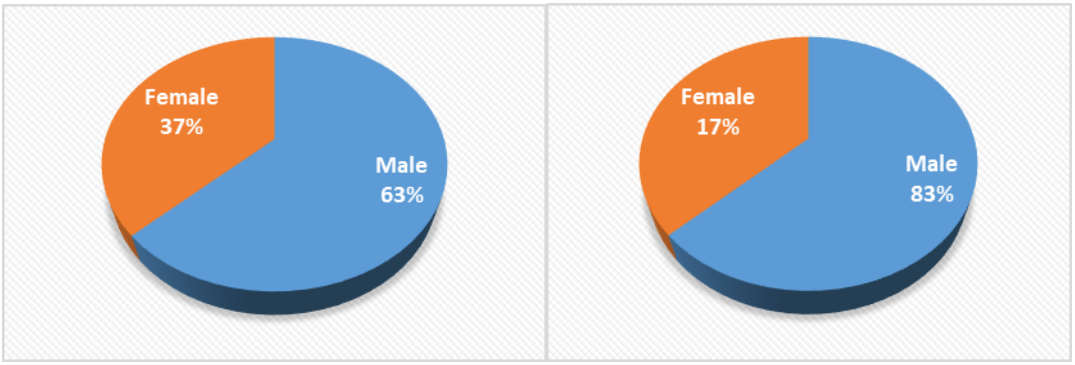
This section discusses the two extension service areas, the respondents, gender, access to ICT and the differences in production of the two extension service areas.

**Table 1 Extension service area and population**

| **Area surveyed** | **Respondents** | **%- age** |
|---|---|---|
| Farmers accessing ICT-based services | 203 | 44.5 |
| Farmers accessing non-ICT-based services | 253 | 55.5 |
| **Total** | **456** | **100** |

Table 1 shows that about 44.5% of the farmers had access to ICT-based extension information while 55.5% did not have access to ICT-based extension services.

The study also analysed the gender of the respondents in order to appreciate how it affected ICT application in extension and the data gathered was as indicated below:




ICT-based Extension Zone Non-ICT Extension Access

**Figure 2: Gender of the respondents**

Figure 2 presents the gender of the farmers in the two extension service zones. The figure indicates that in the ICT-based extension zone, the majority (63%) of the farmers were male while 37% were female. In the non-ICT extension zone, 83% of the farmers were male while 17% were female.

The study also analysed the impact ICT use in providing extension services on agricultural productivity by evaluating how farmers utilised their mobile phones in accessing agricultural information. The findings are presented in Figure 3.

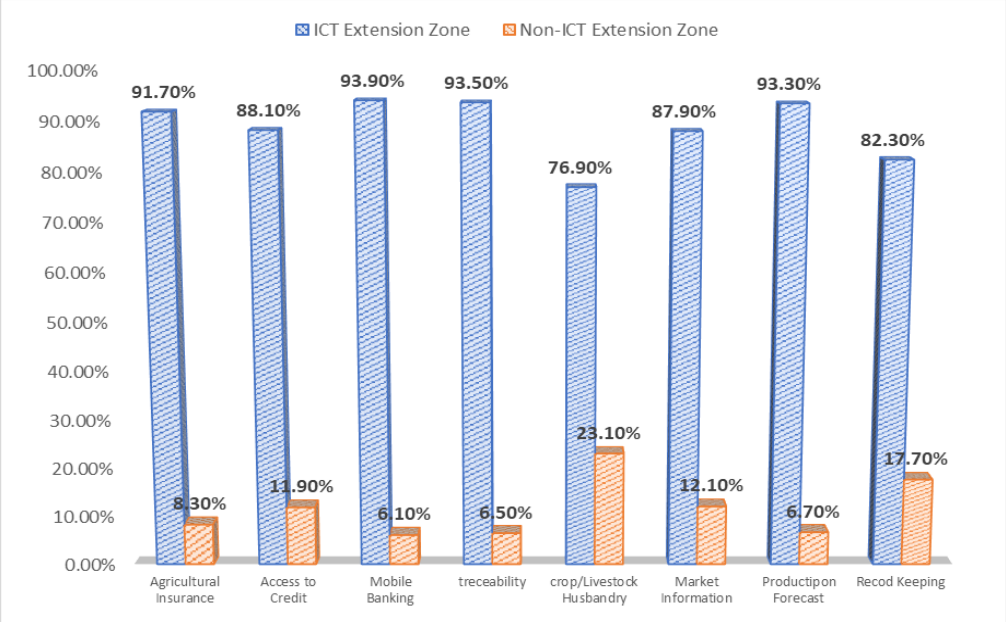



**Figure 3: Application of ICTs in agricultural extension**

From Figure 3, it was realised that more farmers in the ICT extension zone had adopted the use of mobile phones to access extension information as compared to the farmers in the non-ICT extension zone. From the data gathered, it was realised that out of the 456 respondents over 70% of those in the ICT zone were using mobile phones to access information on agriculture. In the contrary, only 20% of the farmers in the non-ICT zone used mobile phones to access agricultural information.

It was also noted that 23% of the farmers in the non-ICT zone accessed information on crop and livestock husbandry. This was the highest recorded number of farmers in this zone which was attributed to the livestock farmers who used mobile phones to communicate with veterinary officers whenever they needed help. There was also an element of record keeping using the mobile phone as it was realised that all feedback messages from the extension service providers were saved for reference in the future.

Most farmers in the ICT-zone depended on their mobile phones to access extension services that supported their agricultural livelihood activities. These included record keeping, mobile banking, agricultural insurance, crop and livestock husbandry, market information, traceability, and production forecast.

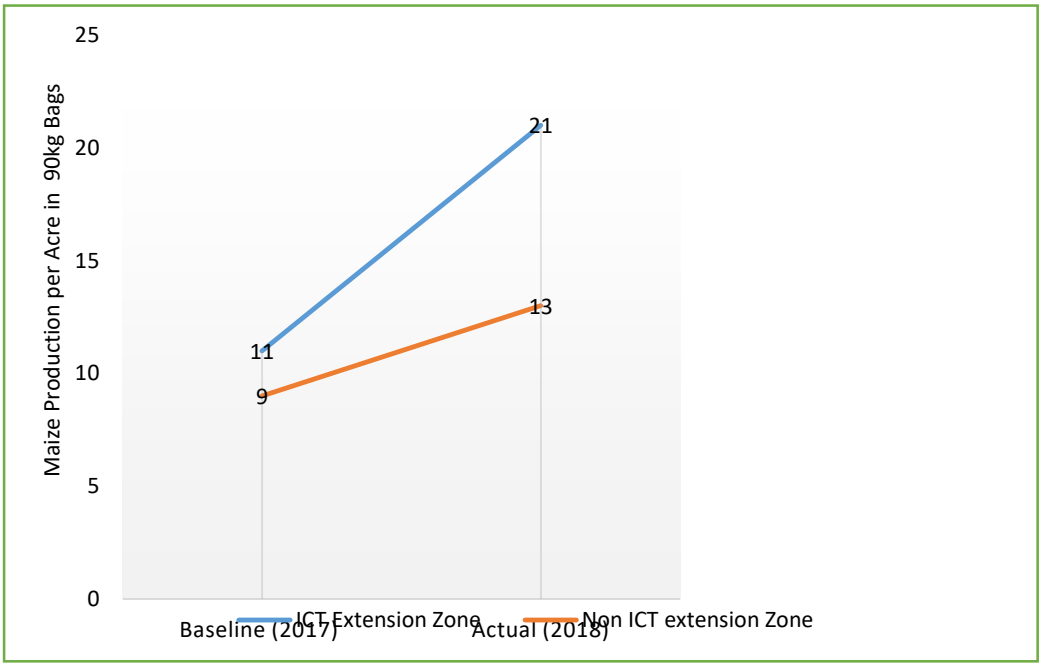



**Figure 4: Production performance of maize farmers by baseline and follow-up**

The study also analysed the impact of agricultural productivity in relation to the use of ICT in extension service delivery by evaluating the maize value chain as shown in Figure 4. From the figure, it was found that the follow-up production of both the ICT-based extension zone farmers and non-ICT extension farmers has gradually increased from 11 to 21 bags per acres and 9 bags to 13 bags for the non-ICT extension farmers. Thus, the increased rate for ICT-based extension zone farmers was higher compared to that of non-ICT extension zone farmers. This implies that the farmers in the ICT-based extension zone could be able to provide better treatment for crops by getting the right and timely information. Therefore, they were able to make prompt decisions about variety selection, fertilisers, pest and diseases control, harvesting and post harvesting handling, marketing as well as other important technologies regarding crop husbandry. This, therefore, led to their production increasing proportionately.

## 6 Conclusion

ICT tools such as cell phones, the Internet, radio, and television when properly applied in agricultural extension can greatly enhance the farmers' access to information relevant for their agricultural production and agribusinesses. The tools can be used to disseminate specific information about agricultural technologies. However, these tools only supplement the extension process and are most effective if combined with established good extension systems. Similarly, the extension service has to be client-focused and needs-driven. The study acknowledged that in order to achieve demand-driven extension system in Tana River County, it was essential to integrate flexibility, participation and sustainability. This inferred the need to investigate the gaps in extension service policy formulation and implementation by defining stakeholders and considering the capacities of both the extension agents and the smallholder farmers. The study also concluded that while Tana River County was found to have an elaborate extension system, agricultural productivity had continued to decline among smallholder farmers due to the inability of extension service providers to transmit research results to farmers. The use of ICTs in delivering extension services can change this trend and transform agricultural productivity in the County.

## 7 Recommendations

The problems of establishing or maintaining an effective ICT agricultural extension service were traced back to the lack of a realistic policy or an unstable policy framework for charting

the mission of the extension system. It is, therefore, recommended that the County Government of Tana River should put in place a comprehensive ICT policy that would enable the extension system to contribute to increasing agricultural productivity.

The study also recommends that further research be conducted to ascertain whether the Maputo Declaration on Agriculture and Food Security was being adhered to. The declaration contained several important decisions regarding agriculture but prominent among them was the commitment to the allocation of at least 10 percent of national budgetary resources to agriculture and rural development. This would ensure adequate resources in setting up an effective ICT extension system.

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