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Integrating Information and Communication Technology Use and Environmental Conservation in Livelihoods of Small Scale Dairy Farmers of Nandi and Uasin Gishu Counties

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Abstract

Dairy farming if not well managed can lead to soil erosion, rise in livestock- human diseases, overgrazing, encroachment into other land uses and negative impact on people's livelihoods. This adverse effect of dairy farming livelihoods on the environment if not checked, may lead to environmental degradation which, will eventually lead to unsustainable livelihoods and food insecurity. Information and communication Technology (ICT) can be used to reduce such negative environmental impact. The small land holdings and fragmentation characterizing most farms in rural areas poses a challenge to dairy farming. It means the dairy farmers will have inadequate access to resources necessary to adequately practice dairy farming. In addition, small holdings may also pose environmental challenges to dairy farming. It will give a small room for sustainable farming system and a challenge in waste management. The objectives of this study were to assess the nature of environmental conservation information received by small scale dairy farmers via ICT gadgets and to examine the effect of environmental conservation information received on livelihoods of small scale dairy farmers. Findings showed that farmers sort information on proper dairy farming methods and environmental conservation. There is therefore need for small scale dairy farmers to be equipped with adequate knowledge on environmental conservation so as to maintain sustainable dairy farming livelihoods.

Key Words: Environmental Conservation, Sustainable Livelihoods, Dairy Farming, ICT

INTRODUCTION

Many governments have put a lot of efforts into ICT integration in everyday life. The United Kingdom (UK) has streamlined ICT learning modules into their national primary education curricula. The Government of Uganda has a fully-developed Ministry of ICT, established in January 2006, to nationalize the importance of ICTs. The Government of Kenya has an ICT policy, established by its National ICT Board, for guiding the future direction of the country in terms of ICT. In addition, the Kenyan government under Jubilee administration established the Ministry of Information, Communication and Technology in March 2013 to nationalize the importance of ICTs in the country. There is an entire area of development work called ICT4 Dev, which currently yields almost 100,000 hits in a typical Google search (World Bank, 1999). These examples illustrate the importance of ICT and the constantly evolving nature of the relationship between technology, communication and the people who use it.

The term ICT is an accepted acronym for information and communication technology. ICT can be defined as new and modern technologies for example, computers and internet. It also includes traditional communication media such as radio and

television (Langmia, 2005, Batchelor and Scott, 2005). Therefore, ICT is a term used to imply a gadget that can be used to pass information across. It can be new technology or the traditional technologies. These gadgets are of great importance due to the speed and accuracy of the information passed across.

The World Development Report 1998/99 highlighted the power of access of knowledge for development. It stated that *"recognition of the importance of knowledge has gained momentum and there is a new impetus to integrate into countries development strategies"* (World Bank, 1999). On the other hand, Kofi Anan said if information and knowledge are central to democracy they are the conditions for development. Thus ICT is seen as a catalyst for development and hence an important ingredient in the process of development. This gives emphasis on the significance of knowledge in development and by extension the significance of Information Technology and Communication (ICT) in improving people's livelihoods.

Extension educations in dairy farming development have not been successful due to weak linkages in dairy farming research-education-extension nexus. ICT offers an excellent opportunity in bridging information gap, sharing information and creation of knowledge. This will go a long way in linking research, extension and education that has for a long time remained delinked (Everson, 2001). Lack of access to relevant knowledge in dairy farming has led to poor strategies to support livelihood strategies of individual dairy farmers and communities (Beintema and Pardey, 2003). For example, Uganda is ranked the second most producing country of bananas but at the same time rated low in the sales of the same bananas globally. This is attributed to lack of information on availability of markets for the bananas. ICT offers an excellent opportunity for improved coordination across agricultural nexus, bridging information gap, sharing information and creation of knowledge (Tenywa *et al*. 2008). ICT can increase the economic and social well-being of poor people, and empower individuals and communities (Adhikari, 2002 and Kenny, 2001). ICTs bring about social and economic development through creation of an enabling environment.

Almost every activity in today's world is dependent on the application of ICTs for one use or the other. With over a billion small scale farmers worldwide, there is need to innovate ways to support these farmers in terms of information, technology, advice and empowerment through ICT based agricultural extension and advisory services (Davis and Asenso – Okyere, 2010). This is only possible if people can get access to ICT facilities. Integration of ICT into people's sources of livelihoods can yield good fruits in as far as their livelihoods and well-being is concerned. The agriculture sector is one of the most important sectors in the world and Kenya in particular as it avails a source of livelihood to a greater percentage of the poor people in the world. In Kenya, approximately 70 per cent of people rely directly and indirectly on agricultural sector for their sources of livelihoods. The percentage of the poor in this bracket is however, greater. Yet the sector is still faced with a number of challenges that hinders small scale farmers from eking their livelihoods. One of these challenges is inadequate information on various proper farming practices. This study focused on dairy farming, a subsector in agriculture, which is quite significant source of people's livelihoods. It contributes to 14% of agricultural GDP and 3.5% of total GDP in Kenya's economy. Agricultural extension services that were mainly train and visit by extension agricultural officers did not yield much as a result of inadequate manpower due to retrenchment of these officers leaving a ratio of 1: 1200 (one extension officer to one thousand two hundred farmers) in Kenya (MOA, 2008). This ratio is quite high in comparison to 1: 400 suggested by Food Agricultural Organization (FAO).

Extension as a function can be applied to various sectors of society. It implies transfer of knowledge and information. Dairy farming extension involves transfer of knowledge and

good practices to farmers. Traditional extension practices involved extension officers visiting farmers in their own farms or at farmers training centers (Stringfellow *et al.* 1997). In most developing countries there are very few extension workers (Due *et al.* 1997). This was worsened by the introduction of structural adjustment programmes by the World Bank and International Monitory Fund (IMF) to the developing countries in early 1980s. This led to reduction of subsidies in the agricultural sector that resulted in retrenchment of extension officers and privatization of key services like Artificial Insemination (AI) and veterinary services. The ratio of Extension officers to farmers in Africa is very low. This presents a small number of extension officers in the country which is a great challenge to the provision of extension services to farmers (Rutarora and Matee, 2001; Isinika, 2005). It is now very expensive for small scale farmers in third world countries and Kenya in specific, to access extension services. This is because the farmer has to bear the full cost of the service. Thus there is need to boost the work of the few extension workers available in these developing countries (Lwoga *et al*., 2011). ICT provides a safe window for this (Gakuru *et al*., 2009). ICT will enable extension workers, research institutions and academic institutions to cover a wider area in terms of dissemination of agricultural education to small holder farmers in the country. The information can improve a great deal farming practices among the small holder dairy farmers and by extension lead to better livelihoods and good life for the small holder farmers.

Many stories have demonstrated the ability for ICT-based applications to improve people's lives and increase their incomes with simple services (Jensen, 2007) for example the use of SMS. The underprivileged population and rural societies' sources of livelihoods are generally agricultural based. This emphasizes the fact that integration of ICT in agricultural extension services can do a great deal in improving people's livelihoods, food security, and environmental conservation and thus reduce poverty levels in the less developed countries especially in Africa.

Human activities are diverse and a key component in food security and environmental conservation. The relationship between human activities, livelihood sources and environmental conservation is an area of particular interest given the arguments surrounding climate change, and the increasing productivity of human populations and stresses on the physical environment that such developments initiate. Humans make use of the land they inhabit to a degree unmatched by any other species. Dairy farming is one of the activities that guarantee livelihood source but if not well managed can lead to environmental degradation. There is need to increase the level of good dairy farming practices and environmental conservation measures in dairy sector. However, the challenge has been a small number of extension personnel. Currently the ratio of agricultural extension officers to farmers is low. This presents a small number of extension officers in the country which is a great challenge to the provision of extension services to small scale dairy farmers. As a result, the provisions of extension services have not been sustainable as envisioned by Kenya's agricultural extension policy. The use of ICT can be a panacea to this problem.

Study Area

The study was carried out in two counties in Rift Valley, Kenya. These counties are Uasin Gishu and Nandi. Nandi County is predominantly dairy farming. High breeds and crosses are available. Kilibwoni and Kabiyet sub-counties have high numbers of high breed cows. Dairy farmers practice semi zero grazing and on a few farms zero grazing (Mudavadi *et al*., 2001). The county produces 215.5 tons of milk per year. Nandi County is located in the Rift Valley, it borders the following counties; Uasin Gishu to the North and East, Kericho to the South East, Kisumu to the South, Vihiga to the South West, and Kakamega to the West. It has an area of 2,884.2.2 km^2. It has a cool-wet climate

supplemented by rich volcanic soils. The county has a population of 752,965 (KNBS, 2009). Its headquarters is Kapsabet town.

Uasin Gishu County is the leading milk producer and with the highest population of dairy cows in Kenya (GoK, 2010). The county produces 269.5 tons of milk per year (FAO, 2011). Uasin Gishu County is situated in the mid west of Kenya's Rift Valley, some 330 km North West of Nairobi. Uasin Gishu is a cosmopolitan county, covering an area of 3345.2 square kilometers. It is located on a plateau and has a cool and temperate climate. It is a home of 894,179 people (KNBS, 2009). Uasin Gishu County borders Kericho County to the south, Nandi to the South West, Bungoma to the West, and Trans Nzoia to the North. Other counties sharing borders with Uasin Gishu are Elgeyo-Marakwet to the east and Baringo to the South East. Its headquarters is Eldoret town.

RESEARCH METHODOLOGY

The study employed a survey research design. The target population for the study was 2847 farmers from five Farmers Business Organizations (FBOs) in Nandi and Uasin Gishu Counties in Kenya, 25 FBO officials and 5 officials from Technoserve Company. The sample size was 338 farmers, 15 FBOs officials and 3 Technoserve officials. The farmers sample size was arrived at by using Krejcie and Morgan (1970) table of determining sample size. The study employed purposive sampling for study area, TechnoServe and FBO officials. For farmers at FBOs, systematic random sampling was used. In total 18 respondents were interviewed. Questionnaire and interview schedules were used in data collection.

RESULTS AND DISCUSSIONS

ICT Integration and Environmental Conservation in Dairy Farming

The environment is an important resource in every community. The sustainability of every activity undertaken by members of a community requires that environmental protection is upheld. Dairy farming is practiced in a particular environment and for it to be sustainable, the environment should be protected. According to a guide to good dairy farming practices by Food and Agriculture Organization (FAO) of the United Nations and International Dairy Federation milk production should be managed in balance with the local environment surrounding the farm (FAO and IDF, 2011).

In this study, it was found that the most important benefit of ICT integration in dairy farming extension is that farmers have been able to learn about sustainable use of resources and make their businesses sustainable. Dairy farmers were given extension information on environmental management for sustainable milk production through the TechnoServe Mobile Unit. Farmers were informed through SMS in advance on that day the videos would be played on Mobile Technology Unit.

The study also showed that it was a concern to TechnoServe and FBO staff that the production of milk was sustainable and was undertaken in harmony with the environment. To meet these concerns it was important that dairy farmers produce milk in a way that meets the wider community's expectations, by using natural resources efficiently and minimizing any adverse impact on the environment. Every dairy farmer played a role in protecting their industry and the future of their enterprise by adopting management practices that enhanced the environmental sustainability of their dairy farming system. These findings concur with the FAO's Animal Production and Health Guidelines: Guide to Good Dairy Farming Practices (FAO and IDF, 2011).

Some of the good dairy practices covered in the videos that enhanced environmental protection were: implementing an environmentally sustainable farming system through use of farm inputs such as water and nutrients efficiently and sustainably (see plate 2), minimizing the production of environmental pollutants from dairy farming, managing dairy cows to minimize adverse environmental impacts, selecting and using energy resources appropriately, maintaining and/or encouraging biodiversity on the farm;

having an appropriate waste management system through implementing practices to reduce, reuse or recycle farm waste as appropriate, managing the storage and disposal of wastes to minimize environmental impacts (see plate 1); and ensuring that dairy farming practices do not have an adverse impact on the local environment by containing dairy runoff on-farm, and using agricultural and veterinary chemicals and fertilizers appropriately to avoid contamination of the local environment (see Figure 1). These environmental concerns concur with the dairy farming guidelines identified by FAO and IDF (2011).

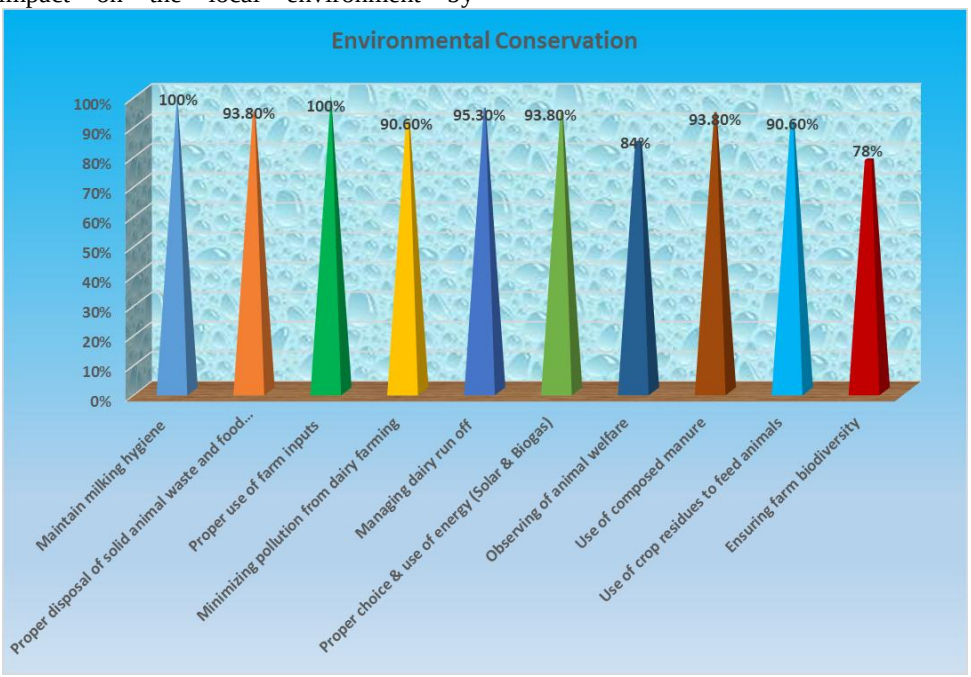

Figure 1. Environmental Conservation Practices Adopted by Farmers in 2018

Plate 1. Zero Grazing Unit Showing Liquid Waste Drainage System in Kesses Uasin Gishu County

Plate 2. Zero Grazing Unit Showing Water and Food Troughs in Uasin Gishu County

ICT Use and its Effectiveness on Dairy Farmers Livelihoods

ICT integration in agricultural extension services has immensely contributed to improved livelihoods and environmental conservation. Expanded telecommunications networks have increased the speed, reliability, and accuracy of information exchange through text, voice, and other applications between farmers and other stakeholders (Richardson, 1996). The presence of these networks in rural areas in developing countries has led to creation of opportunities for small scale farmers to connect with extension workers, agribusiness, researchers, and each other. This has improved the farmers farming activities. This concurs with Said *et al*. (2010) study on "Contribution of Mobile Phones to Rural Livelihoods and Poverty Reduction in Morogoro Region, Tanzania". The study comprised of a study sample of 310 households. The study employed Focused Group Discussions (FGD) and Key Informant Interviews (KII) as data collection instruments. The study showed that, mobile phones contributed to the reduction of poverty and improve rural livelihoods by expanding and strengthening social networks, increasing people's ability to deal with emergencies, cut down travel cost and improve efficiency of activities. In addition, the study found out that mobile phones reduced cost of doing business, increase productivity by aiding in securing better markets and prices and helps in communicating promptly business related information.

In addition, the coming up of cloud computing services (internet services) have improved agricultural development. The advantage of cloud computing is that it offers pooled and elastic resources on demand over the internet (Richardson, 1996). Cloud computing has been described as "a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources like networks, servers, storage, applications, and services that can be rapidly provisioned and released with minimal management effort or service provider interaction" (Terero *et al.* 2006). Social networks like the use of emails, face books, whatsapp and twitter have really revolutionized the system of information sharing. Over the past few years, these services have created opportunities for data sharing initiatives that were once prohibitively expensive for most institutions to explore, let alone small scale dairy farmers. Among the small scale dairy farmers in Nandi and Uasin Gishu Counties information sharing has been facilitated by wide use of mobile phones.

The study revealed that the extension information received via ICT gadgets has enabled small scale dairy farmers in the two

counties control animal pests and diseases, receive dairy farming trainings, reach dairy farming service providers, clarify dairy farming methods learnt earlier, learn various storage methods for their dairy products, learn various soil erosion control mechanisms and contact transport services providers like motor cycle (*Boda boda*) services for their dairy enterprises. In addition, though not greatly, dairy farmers are also able to get prices of dairy products at different markets, access credit services and weather information, and also contact farm labour when needed.

As a result of the above information, dairy farmers in the two counties have been able to improve milk productivity (World Bank, 2009; Lokanathan *et al*., 2011; Rizvi, 2011). Milk production is a source of livelihood for the dairy farmers in the two counties. Thus, improved milk production leads improved cash flow to the family (family income). Once the family is stable in terms of income flow, it will lead to improved food security, better health for family members and improved standards of living for family members and the entire community (Fengying *et al.*, 2011). This will lead to accumulation of assets like land, decent housing, motor cycles, vehicles, and shares, and eventually enable the farmer earn respect in the society.

Improved livelihood sources have enabled farmers in the two counties overcome weather related shocks. For example, shocks as a result of prolonged drought or heavy rains that destroy property. As a result of accumulation of assets and stable cash flow, the farmer is able to make savings that will be used during bad economic times that may result due to weather shock or increase in inflation rates. In addition, ICT integration in agricultural extension has enabled farmers share knowledge amongst them (Moyi, 2003; Duncombe and Heeks, 2005). This is quite significant because farmers are both extension clients and extension providers. The moment they are able to share knowledge, they will be able to build strong social networks and have a great access to education and training, reduce vulnerability and be good decision makers. They will be able to have greater voice and power in their communities (see figure 2).

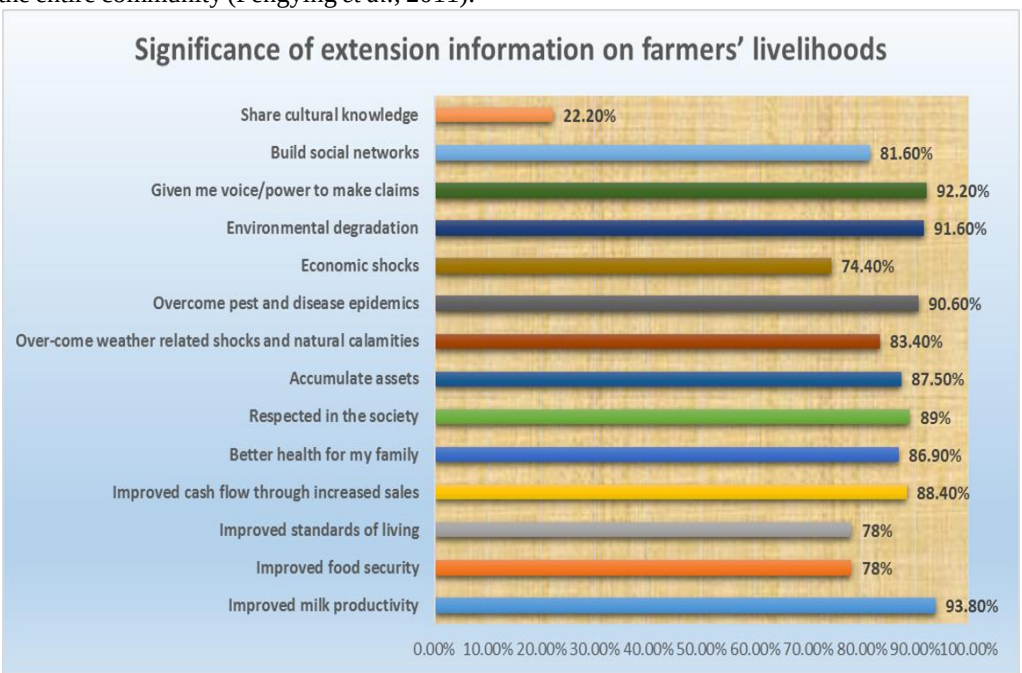

Figure 2: Significance of Extension Information on Farmers' Livelihoods 2018

CONCLUSION AND RECOMMENDATION

Results showed that the most important benefit of ICT integration in agricultural extension was that small scale dairy farmers have learned about sustainable use of resources and make their businesses sustainable. Dairy farmers were given extension information on environmental management for sustainable milk production through the TechnoServe Mobile Unit. Some of the good dairy practices covered which enhanced environmental protection were: implementing an environmentally sustainable farming system; having an appropriate waste management system; and ensuring that dairy farming practices do not have an adverse impact on the local environment.

Small scale dairy farmers were given extension information on environmental management for sustainable milk production through the TechnoServe Mobile Unit. Information provided includes but is not limited to proper use of farm inputs, reduction of emission of pollutants from dairy farming, encouraging proper selection and use of energy sources (mainly the use of solar energy and biogas), encouraging biodiversity, having proper waste management systems in dairy farming and proper use of farm chemicals to avoid contamination of the environment. These are measures which will enable small scale dairy farmers achieve sustainable dairy farming. There is need to monitor the implementation of these environmental conservation measures. As a result, it is important for the County Governments of Nandi and Uasin Gishu to allocate more resources to agriculture to ensure intensification of agricultural extension services in the study areas and the Counties at large. This is possible if extensions officers are facilitated to visit farmers and monitor the extend at which environmental conservation measures have been implemented. There is therefore need to monitor the implementation of these environmental conservation measures to promote sustainable dairy farming to enhance improved livelihoods and socio-economic development as envisioned in Kenya's Vision 2030.

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