

**RESEARCH ARTICLE**

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**Availability, Use and Challenges of Information and Communication  
Technology Gadgets in Sustainable Small Scale Dairy Farmers Livelihoods in  
Nandi County, Kenya**

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**Abstract**

*Information and Communication Technology (ICT) gadgets are vital for the enhancement of sustainable small scale dairy farmers' livelihoods in less developed countries. Therefore, its availability and use is quite critical in enabling farmers acquire relevant dairy farming information through ICT integration in dairy farming extension services. Dairy farming communities appreciate ICT gadgets as easy, fast and convenient way to communicate and get prompt answers of respective dairy farming problems. In Kenya dairy farming contributes to 14% of agricultural GDP and 3.5% of total GDP of the economy. It also contributes to food stability, provision of employment opportunities and livelihoods. In order to fight food insecurity and enhance livelihoods, sustainable agriculture is paramount. The use of ICT gadgets to acquire dairy farming information is significant given that the ratio of extension officers to farmers is 1:1200 as opposed to Food and Agricultural Organization (FAO) recommendation of 1: 400. Thus, this paper looks at availability and use of ICT gadgets in enhancing sustainable small scale dairy farmers' livelihoods in Nandi County, Kenya.*

**Key Words:** ICT, Food Security, Dairy Farming, Sustainable Livelihoods

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**INTRODUCTION**

Information and communications technology (ICT) is often used as an extended synonym for information technology (IT), but is a more specific term that stresses the role of unified communications (William, 1991) and the integration of telecommunications (telephone lines and wireless signals), computers as well as necessary enterprise software, middleware, storage, and audio-visual systems, which enable users to access, store, transmit, and manipulate information (William, 1991). ICT is an umbrella term that includes any communication device or application, encompassing: radio, television, cellular phones, computer and network hardware and software, satellite systems and so on, as well as the various services and applications associated with them, such as video conferencing and distance learning. ICTs are

often spoken of in a particular context, such as ICTs in education, health, commerce, libraries or agriculture.

According to the European Commission, the significance of ICTs lies in its ability to create greater access to information and communication in underserved communities. Many countries around the world have established organizations for the promotion of ICTs, because it is feared that unless less technologically advanced areas have a chance to catch up, the increasing technological advances in developed nations will only serve to exacerbate the already-existing economic gap between technological "have" and "have not" areas. Internationally, the United Nations actively promotes ICTs for Development (ICT4D) as a means of bridging the digital divide (European Commission, 2013).

In the past few decades, ICTs have provided society with a vast array of new communication capabilities. For example, people can communicate in real-time with others in different countries using technologies such as instant messaging, voice over IP (VoIP), and video-conferencing. Social networking websites like Facebook, Twitter, WhatsApp, Telegram *e.t.c.* allow users from all over the world to remain in contact and communicate on a regular basis.

Modern ICTs have created a "global village," in which people can communicate with others across the world as if they were living next door. For this reason, ICT is often studied in the context of how modern ICTs affect society.

According to Ajayi, (2000) the changes taking place in ICTs have been the central and driving force for the globalization process. Both developed and less-developed countries can-not afford to miss out on the opportunities these technologies are creating. Faye, (2000) has observed that, ICTs are offering less developed countries a window of opportunities to leapfrog the industrialization stage and transform their economics into high value-added information economies that can compete with the advanced economics on the global market. In practice, globalization benefits those with technology, resources, contacts, information and access to markets. This can only be enabled with availability of ICT framework.

Dairy farming is a long term production of milk which is processed either on the farm or at a dairy plant for eventual sale of the product. Dairy farming, a sub-sector of agricultural sector, contributes to 14% of agricultural GDP and 3.5% of total GDP in Kenya's economy. The dairy industry is the single largest agricultural sub-sector in Kenya. 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. The

county produces 215.5 tons of milk per year (Mudavadi *et al.*, 2001).

This study focused on the small scale dairy farming in Nandi County in Kenya. The subsector is significant because it contributes to the national economy, nutritional well being, household income, employment opportunities and food security. However, the sector is faced with a number of challenges. Some of these challenges include: climate change, inadequate extension services, use of obsolete technology by farmers, pest and diseases, poor infrastructure and above all inadequate access to dairy farming information among small scale farmers. It is observed that agricultural products yield and value have either remained constant or have declined in Kenya.

The problem has become worse due to the fact that the country do not have adequate agricultural extension officers as they were retrenched as a result of structural adjustment programmes (SAPs) prescribed by World Bank and International Monetary Funds (IMF) in 1980s to less developed countries. Currently the ratio of agricultural extension officers to farmers is 1: 1200 in comparison to 1: 400 suggested by FAO. This present 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. With devolved system of government, agriculture is devolved to counties and the counties are ill prepared for the provision of extension services. This has led to food insecurity and unreliable sources of livelihoods to many Kenyans. Any effort geared towards improving livelihoods in Kenya needs to begin from agricultural sector. There is need to address the problem of inaccessibility to new technology and dairy farming information by small scale dairy farmers in order to improve food security and livelihood sources among the Kenyan small scale dairy farmers. ICT provides a safe avenue for this.

According to Annan (1999), "the Internet holds the greatest promise humanity has known for long- distance learning and universal access to quality education. It offers the best chance yet for developing countries to take their rightful place in the global economy. And so our mission must be to ensure access as widely as possible. If we do not, the gulf between the haves and the have-nots will be the gulf between the technology-rich and the technology-poor". The examples given above give emphasis to the benefits of integrating ICTs in our day o day activities in the community. Among these activities is small scale dairy farming. Therefore, this study assessed ICT gadgets availability for use by the small scale dairy farmers and challenges experienced in ICT use in Nandi County.

### RESEARCH METHODOLOGY

The study employed a survey research design. The target population for the study was 2007 farmers from three Farmers Business Organizations (FBOs), 15 FBO officials and 5 officials from Technoserve Company in Nandi County in Kenya. The sample size was 322 farmers (Total returned questionnaires were 304, giving a return rate of 94.4%), 9 FBOs officials and 3 Technoserve officials. In total 12 (60% of the total FBO and TechnoServe officials) respondents were interviewed. 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. Questionnaire and interview schedules were used in data collection.

### RESULTS AND DISCUSSIONS

#### Availability and Use of ICT Gadgets

Radios have been very popular before the advent of mobile phones and were seen as media of mass communication (Chapman, 2003 and FAO, 2011a). Radios were also available and faster means of relaying information (Okeke *et al.*, 2015). For a very

long time radios have played a great role in the field of extension. First, research findings can be distributed through radios to all stakeholders in dairy farming extension. Second, radios can make the link between researchers and extension workers by offering information on where research can be obtained and used and how to pass it on to users. Third, rural radios can be used to collect feedback from Communities through programmes that farmers give their responses to research, farmers share experiences on use of research, radios airs out farmers' views/recommendations on how to improve the research and communities provide alternatives depending on their experiences. Finally, radios can also be used to announce processes of research and extension work by giving venues for meetings with extension workers, advice on where to get inputs/services and advice on where to get technical support.

However, with the coming of mobile phones radio popularity is changing. Mobile phones are now popular. Mobile phones do not only enable the users to use SMS and voice messages, but the user can also access radio and other social media platforms such as WhatsApp, twitter, Facebook, Instagram, Telegram and even internet services. Mobile phones are replacing radios in all forms of use- entertainment and information. The only disadvantage is that some of these features are limited to a smart phone which is expensive for small scale dairy farmers and that mobile phones require a source of energy to recharge the battery.

The study showed that the most preferred gadget in Nandi County for the purposes of ICT integration in dairy farming extension services is the mobile phone (see Figure 1). All the respondents from the FBOs in the two counties owned a mobile phone. The second gadget in that order owned by the farmers is a radio followed by a television set. Very few farmers owned computers (desk top or a lap top) and video machines.

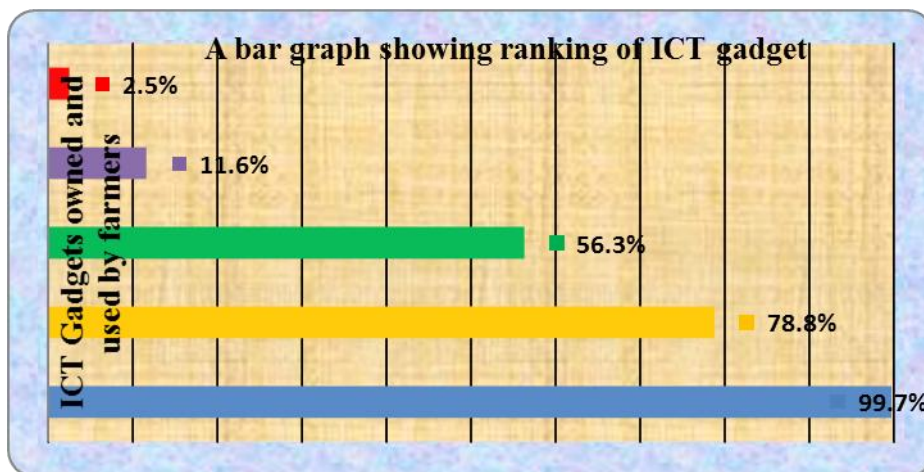


Figure 1. Ranking of ICT Gadgets Used by Farmers

Interviews conducted on TechnoServe and FBO staff sampled also confirmed that the most preferred gadget by the farmers was a mobile phone and every farmer had one {14 (93.3%)}. However, the interviewed respondents showed further that very few farmers owned smart phones {12 (80%)}. Smart phones have the advantage of enabling the user to venture into other social media applications such as twitter, Facebook, Instagram, Telegram, IMO, OLX and the most popular- WhatsApp. Smart phones also

enable the user to access internet services which are very vital in agricultural extension services.

Majority of those who owned mobile phones and those who owned radios and television sets said they used the gadgets on daily basis. A very small percentage of farmers used them on weekly basis. This is an indication that these gadgets (especially mobile phones) were reliable for the use in provision of extension services to the farmers (see table 1).

Table 1. Frequency of Use of the ICT Gadget

Frequency of Use	Type of Gadget	Frequency	(%)
Daily	Mobile phone, television and radio	285	93.75
Weekly	Computer & Video	19	6.25
<b>Total</b>		<b>304</b>	<b>100.0</b>

Those who did not own a particular gadget would go to Techno Serve Mobile Technology Unit, Farmers Business Organizations and Farmers Training Centres to seek the service in that order of preference. Mobile Technology Unit and Farmers Business Centres were popular because they offer their extension services free to the farmers. Techno Serve Mobile Technology Unit-short for “technology in the service of mankind” – is geared to help poor people by

connecting them to information and market opportunities (Techno Serve, 2015).The Mobile Training Unit (MTU) Programme is funded by the John Deere Foundation and implemented by Techno Serve. It seeks to improve the livelihoods of small scale farmers in rural Kenya. The programme is geared towards training smallholder farmers in agronomic best practices and support farmer groups with extension support in crop and dairy farming and provide intensive farming as a business training and Farmers Business

Organizations (FBO) in all stages of dairy farming (see plate 1). The MTU provides training concepts and mechanization alternatives to farmers at the start of each key stage of the farming cycle. It allows the programme to reach lesser served rural communities, minimize travel cost and inconvenience to farmers, enable farmers to see the best application of best practices and compare the result of demonstration plots in their own communities and help to maximize

the programme reach and impact (TechnoServe, 2015). However, TechnoServe mainly used video presentations on agreed dates communicated over the mobile phones to offer extension services to dairy farmers. Farmers who missed on these presentations may borrow the video cassettes to view them in their own private time. This is only possible for farmers who own computers and video machines.



Plate 1. TechnoServe Mobile Unit Showing Videos to Dairy Farmers at Lessos in Nandi County in 2018

This system inconvenienced farmers who missed out on video presentation due to other important commitments. Smart phones can be a remedy to this problem. Through smart phones, dairy farmers can access social media platforms such as WhatsApp, Facebook, Instagram, Telegram and twitter. Through these platforms they access timely video presentations of extension services presented earlier. If all farmers could access smart phones, FBO extension officers could put farmers in smaller groups in one of the platforms for instance WhatsApp. Through this platform, extension officer could send videos of farmer demonstration to the group. Thus FBO management and dairy farmers need to agree on a way of accessing smart

phones cheaply. The FBO can buy them in bulk then supply to farmers so that they can pay for the smart phones in installments.

Farmers Training Centres (FTC) were not popular because they are few, in fact only one per County, and thus situated far from the very farmers that are supposed to be served by the same facility. For example in Nandi County there is only one- Kaimosi Farmers Training Centre. The great distance from the facility is the source of demotivation of farmers to use the facility. In order to solve the problem of distance and inadequate FTCs, FTCs need to upload their extension materials on their website for ease of access by small scale dairy farmers. Farmers can then

download the extension materials on their smart phones for use.

A very small number of farmers go to ICT pay centres to seek ICT services. This is because of the high cost associated with these ICT pay centres. There is need for the county government of Nandi to collaborate with the national government so as to start ICT centres at the ward level that farmers can access with ease and at affordable cost. These centres can be established at education institutions like village polytechnics or secondary schools. Farmers can be trained on how to access extension materials from the ICT centres established. In addition, the FBOs can also establish their own ICT centres to help their members to access extension services from varied service providers.

Smart phones provided a variety of features like internet services, Facebook, WhatsApp, Instagram, telegram, twitter, OLX and other social networks that can be used to relay extension services to the farmers. As a result, farmers were left with the option of voice calls and SMS features which were limiting in terms of visual information that smart phones would provide. Extension Personnel appreciated the fact that such social media as WhatsApp forums could be used to send pictures and videos on good dairy farming practices to farmers in a particular farmers' WhatsApp groups with a lot of ease. They also appreciated the fact that WhatsApp platforms could be used to share videos on dairy farmers' field days demonstrations. According to them this would assist dairy farmers that may have missed such demonstrations due to unavoidable circumstances. This could not only be cheaper than voice calls and SMS forums but also effective in the sense that both visual and audio information could be relayed to farmers.

### **Challenges on ICT Use and Policy Recommendations**

Faye, (2000) has observed that, ICTs are offering less developed countries a window of opportunities to leapfrog the industrialization stage and transform their economics in to

high value-added information economies that can compete with the advanced economics on the global market. Modern information and communication technologies have created a "global village," in which people can communicate with others across the world as if they were living next door. These immense contributions of ICTs especially in less developed countries are hindered with a number of challenges experienced by community members.

Poor ICT infrastructural development on which ICTs depend on such as erratic and fluctuating power supplies (Chadwick, 2003; Mukesh, Deepati and Kanini, 2010) and Okeke *et al.* (2015) has been identified as one of the challenges inhibiting the use of ICTs in many communities. The poor infrastructural development leads to poor network coverage and the associated high cost of acquisition and use of ICTS (Munyua, 2000 and Chadwick, 2003). Poor network coverage and high cost of acquisition and use of ICT, leads to frustrations and lack of interest for the people to acquire and use ICT gadgets.

For mobile phones two major challenges were identified- inadequate network coverage and the high cost in acquisition and use of mobile phones (Munyua, 2000). The high cost associated with mobile phones was a reason why many dairy farmers had not acquired smart phones. Smart phones would enable them have access to the social media that would have enhanced their interaction with more extension services. The national government through rural electrification programme should provide steady supply of electricity for prompt ICT information on weather, pest and disease management. This can help farmers avert calamity experienced in agriculture in recent times due to varieties of weather and attack of pest and diseases (Mukesh, Deepati and Kanini, 2010). The provision of infrastructural facilities will enable service providers like Safaricom limited, Airtel limited and Telkom limited to provide boosters of their networks in remote areas to enable small scale dairy farmers in the rural areas access ICT services.

The other challenges affecting mobile phones were illiteracy and lack of collaboration among stakeholders in extension field. FBOs and NGOs like TechnoServe can organize training programmers for the small scale dairy farmers on the use of ICT gadgets. If this is done, every FBO will enable her members to be ICT literate. Besides, The FBOs and

NGOs can also organize farmers into small groups through WhatsApp, Telegram, Instagram, and twitter or Facebook platforms. Through these platforms, farmers can collaborate with other farmers and extension service providers to create and share extension materials (see Figure 2).

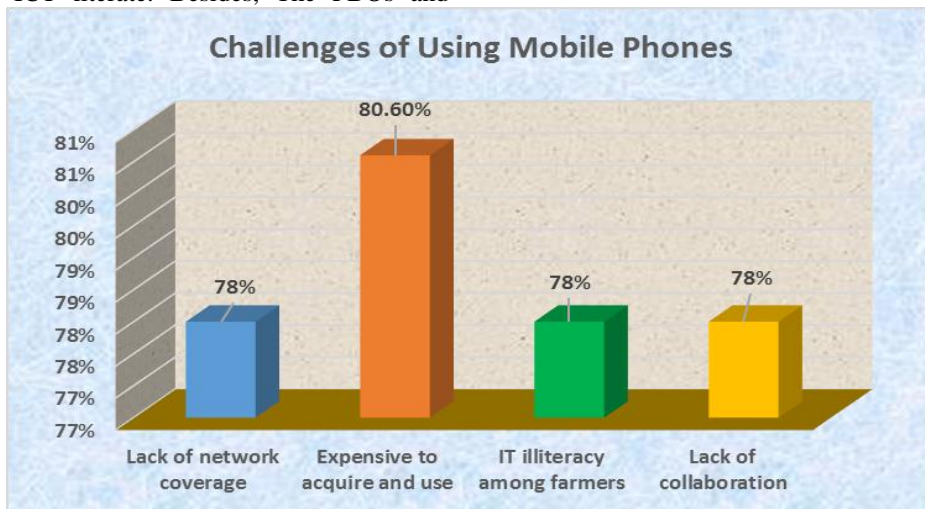


Figure 2. Challenges Experienced in Using Mobile Phones 2018

Radios for a very long time have been the most preferred means of extension service. It is an important media of mass communication (Chapman, 2003; FAO, 2011b). It is seen that radio is a media of mass communication, it is portable, affordable, it has large coverage in terms of network and make use of varied languages, for example in Kenya we have so many vernacular FM stations (Buren, 2000; Ronoh, 2013). In Kenya 95 per cent of Kenyans listen regularly to radio (Media Council of Kenya, 2013). However, in this study radios have been overtaken by mobile phones. Challenges experienced by farmers were the inability to retrieve information,

high cost in its acquisition, lack of collaboration among the stakeholders in extension field and improper timing during programme presentation. Extension programmes were presented when farmers are still in the field or doing other activities (Figure 3). The challenge on high cost of acquisition as already mentioned can be solved by FBOs and NGOs like TechnoServe assisting farmers acquire smart phones and other ICT gadgets at low cost. They can organize to buy them in bulk, there after sell to farmers on installments manageable by small scale dairy farmers.

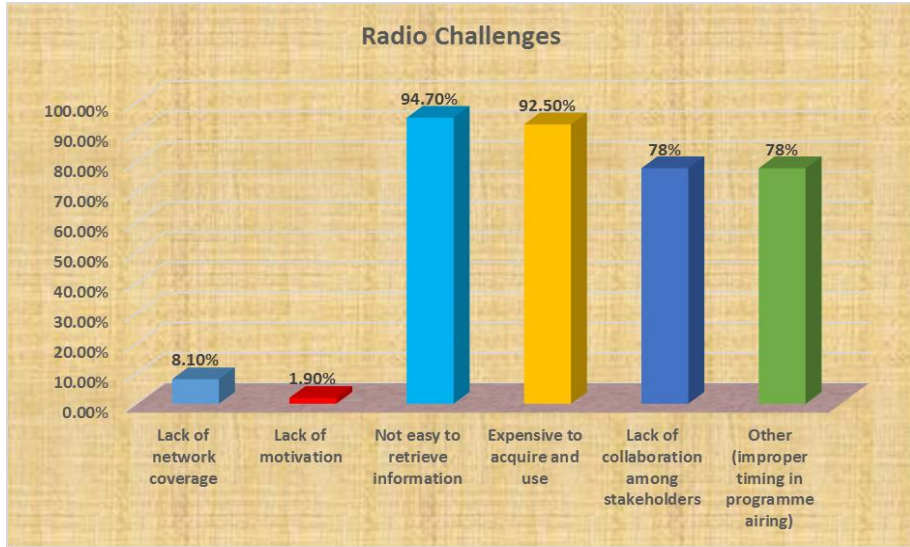


Figure 3. Challenges Experienced in Use of Radio in 2018

For the few who had computers, the challenges experienced with the use of computers were: the high cost in acquiring and using a computer, illiteracy that makes them unable to retrieve information from the computer and the lack of collaboration among stakeholders (see Figure 4). These problems can be solved by FBOs and NGOs like Techno-Serve assisting farmers acquire computers and other ICT gadgets at low

cost. They can organize to buy them in bulk, there after sell to farmers on installments manageable by small scale dairy farmers. The FBOs should also organize training sessions for farmers to be trained on the use of computers. The other challenges experienced by farmers by the use of computers include: inadequate internet coverage (Chadwick, 2003) and the general lack of motivation among farmers to acquire and use computers.

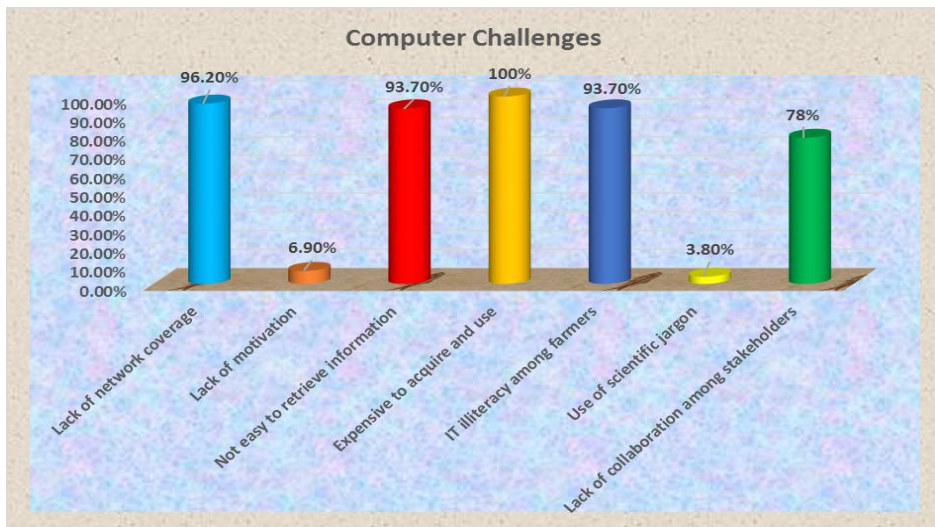


Figure 4. Challenges Experienced by farmers in Using Computers



The use of video machines posed the following challenges to dairy farmers: high cost in acquisition and use of the video machines, illiteracy among the dairy farmers, and lack of collaboration among the stakeholders in the provision of extension services and the general lack of motivation to acquire and use video machines among the small scale farmers. The lack of motivation is attributed to the high cost of acquiring the video machine (see Figure 5). These problems can be solved

by FBOs assisting farmers acquire video machines and other ICT gadgets at low cost. They can organize to buy them in bulk, there after sell to farmers on installments manageable by small scale dairy farmers. The FBOs should also organize training sessions for farmers to be trained on the use of video machines. This will also motivate the small scale farmers to use the gadgets and create networks that will improve their livelihoods.

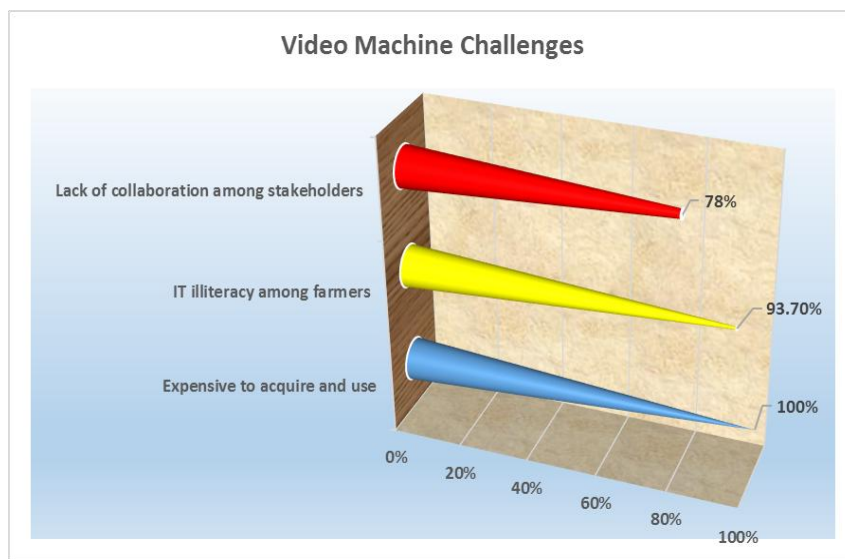


Figure 5: Challenges Experienced in Using Video Machines

## CONCLUSIONS

The findings showed that small scale dairy farmers in Nandi County have adopted mobile phones, radios, televisions, computers and video machines as means of ICT integration in dairy farming extension services. The most preferred means by both farmers and extension agents is the mobile phone as opposed to traditional radio. However, the use of mobile phone was limited to SMS and voice call only. This is because of inability of the farmers to acquire smart phones that would enable them to access the social media services (Twitter, face book, OLX, IMO, telegram, Instagram and WhatsApp) that

would enable them enjoy audio and visual components, clarity of information and elaborate content of the information. The study also showed that majority of the small scale dairy farmers used the preferred gadgets on daily basis but a few used them on weekly basis. Those not in possessions of a particular gadget would seek the services at TechnoServe Mobile Unit, FBOs, Farmers Training Centres ICT pay centres and only one would borrow a friend. It can be concluded that for effective use of ICT gadgets to support the livelihood of small scale farmers, there is a need not only for physical access as well as ICT literacy, but

also for business skills and skills on how to integrate the ICT in the dairy farming business. Emphasis should also be placed on providing technology which is appropriate and accessible to the small scale dairy farmers.

## RECOMMENDATIONS

The study recommended that farmers through FBOs to buy ICT gadgets in bulk to reduce cost. In addition, communication companies need to boost networks so as to improve accessibility and use of ICT gadgets. Finally, there is need to train small scale farmers on ICT use so as to improve ICT integration for sustainable dairy farming livelihoods.

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