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Use of information communication technologies by cricket farmers

Abel M. Peter[1]*, Solomon O. Ogara[2] and Grace Mugumbate[3]

[1]Department of Plant, Animal and Food Sciences Jaramogi Oginga Odinga University of Science and Technology, P. O. Box 210-40601-Bondo, Kenya.
[2]Department of Computer Science and Software Engineering, Jaramogi Oginga Odinga University of Science and Technology, P. O. Box 210-40601-Bondo, Kenya.
[3]Department of Chemical Sciences, Midlands State University, Private Bag, 9055, Gweru, Zimbabwe.

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Cricket farming is an upcoming enterprise to most households in rural communities. Apparently, there is no documented evidence on how farmers access agricultural information on cricket value chain. This study was carried out to assess the use of information communication technologies (ICTs) by farmers to access value chain information. ICTs application in cricket farming means ease to access cricket value chain information and improved interaction between cricket farmers and stakeholders. The study adopted an exploratory mixed method research design by use of a structured questionnaire and focus group discussions to collect data. The data was analyzed by using both descriptive and inferential statistics. Quantitative data was analyzed and interpreted using the R-statistical software. Qualitative data was analyzed thematically by drawing meanings from themes thereof. The results showed that the most sought information was cricket rearing practices and the least was market prices for cricket products. Radio was found to be the most significant ICT channel used (p>0.05). However, most farmers complained of poor infrastructure which made it difficult for them to utilize the ICTs effectively. The outcome of this study informs stakeholders on information needs of farmers and the challenges they face while seeking for information.

Key words: Cricket, farming, value chain, information, communication, technologies, integration.

INTRODUCTION

Agriculture forms the single largest employer in the world. About 80% of the world's households live in the rural areas and most of them depend on agriculture for food and income (Bruinsma, 2017). Investing in agriculture is one of the most effective ways to alleviate poverty, improve food security and reduce hunger and malnutrition (Dar and Laxmipathi, 2013). Generally, the biggest producers of this food are small scale farmers who account for 98% of world's agricultural holdings with 10 ha of land or less. Almost all of these small farms are in developing countries, where they support around 2 billion people. In sub-Saharan Africa and South Asia, an

*Corresponding author. E-mail: onyinkwa.abel@gmail.com; Tel: +254728466669.

estimated 80% of farmland is cultivated by small scale farmers (Nwanze, n.d). In Kenya for instance, 70% of food consumed in rural households is from own production while 30% is purchased. On the other hand, in urban areas 98% of food is purchased, and the rest obtained from own production (Mohajan, 2014). However, small scale farmers are often times uncertain of their output due to various challenges like inadequate agricultural information and inputs (Ncube, 2020). Investing in the smallholder farmers can promote growth and development in rural areas. Increasing their access to resources would lead to better food security and nutrition and help ensure sustainable stewardship of the planet's natural resources, raise productivity and contribute to national economic growth (Crush and Riley, 2018).

Information is one key input in agriculture as it equips farmers to tap from opportunities that would improve their productivity. The agricultural transformation agenda will not be achieved if farmers have no reliable and timely information that will help them make informed decisions on production (Kumar and Basu, 2022).

Farmers need access to timely and reliable information for their agricultural activities (Matto, 2018). This information helps them to make various farm decisions and avoid losses. Integration of ICTs in farming would play a role in improving communication along the agricultural value chain by reducing losses and in particular reducing delays in payment like in the use of mobile phone transactions during marketing of the produce (van Gogh et al., 2017).

Information and communication have played an important role in agriculture and farmers have always communicated and sought information from one another (World Bank, 2017). Consequently, farmers should be aware of the benefits of information communication technologies (ICTs) in giving information services that are significant for management of agricultural production. The economic potential of ICT in agriculture is not fully utilized (Milovanovic, 2014). As cited by Matto (2018) and Ajani (2014), ICTs have a potential to improve access to agricultural information, which has been one of the biggest challenges for small scale farmers. As defined by the World Bank (2017), ICT includes any device, tool or application that permits the exchange or collection of data through interaction or transmission. ICTs have the ability to transform the agricultural sector by ensuring fast and easy relay of information to the end users, the small scale farmers. The application of ICTs in agriculture in Africa, whose largest economic industry is agriculture for most of her countries, offers the best opportunity for economic growth and poverty alleviation on the continent (Zyl et al., 2014).

ICTs have been applied in various agricultural activities but small scale farmers are yet to benefit from them (Irungu et al., 2015). However, various factors influence the use of ICTs by small scale farmers, for example, socio-economic factors and level of literacy (Khan et al, 2022). This study focused on how small scale cricket farmers access information and to what extent they use ICTs in their agricultural activities.

Several studies conducted have only been focusing on cricket farming and its impact on household nutrition, the profitability of the enterprise and even food sources to be fed to crickets (Weigel et al., 2018; Fuah et al., 2015; Collavo et al., 2005). However, there is very little documented evidence available on how cricket farmers access agricultural value chain information. As noted by Gahukar (2016), knowledge and information on insect biology, appropriate rearing conditions and feeding are critical elements in achieving commercial mass production of edible. Inadequate information on best practices on breeding, management, pest and disease control, farm hygiene and nutrition, is a major concern to cricket farmers (Alabrese et al., 2017). This poses a need for information and knowledge dissemination to standardize the cricket farm management practices from nursery to harvest (Hanboonsong et al., 2013). Currently, lack of access to knowledge and agricultural information on cricket production and value chain is a major barrier to optimizing the benefits of cricket farming given. This study sought to analyze how cricket farmers access agricultural value chain information and design a framework for ICTs integration in cricket farming value chain as a means of accessing reliable and timely information.

Conceptual framework

After critical review of existing literature, a conceptual framework for the study was developed. The framework had inputs, feeding, rearing practices, pests and diseases, marketing, market prices and ICTs tools used as dependent variables. Cricket farmers' socio-economic characteristics, came as the intervening variables with farmers' agricultural and information needs forming the dependent variable as shown in Figure 1.

METHODOLOGY

Description of study area

The study was conducted in Homa Bay (0.6221° S, 34.3310° E) and Siaya (0.0617° S, 34.2422° E) counties of the Western part of Kenya. The area was chosen because most of the cricket farming activities takes place in said counties (Ayieko et al., 2016; Halloran, 2017; Magara et al., 2021). The counties form part of the Lake Victoria Basin counties which are found along the shores of Lake Victoria are as shown in Figure 2.

Research design

The study adopted an exploratory mixed method research design. This kind of research is normally conducted on a problem where

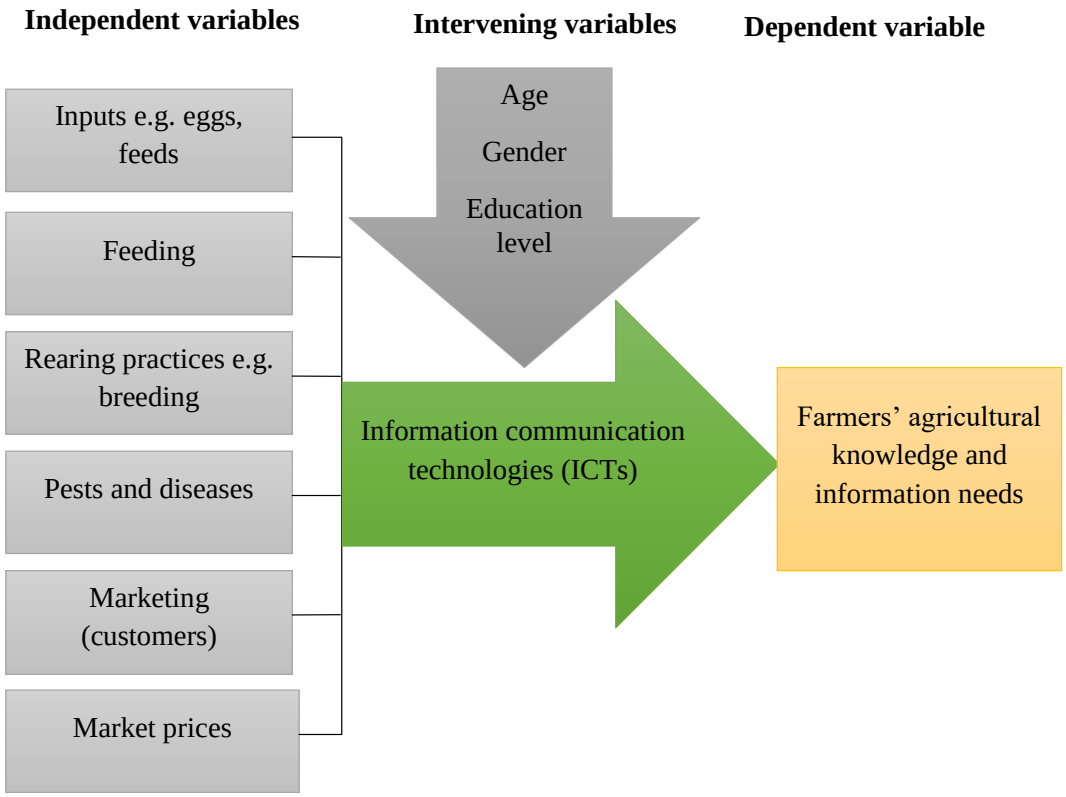

Figure 1. Conceptual framework for the study.

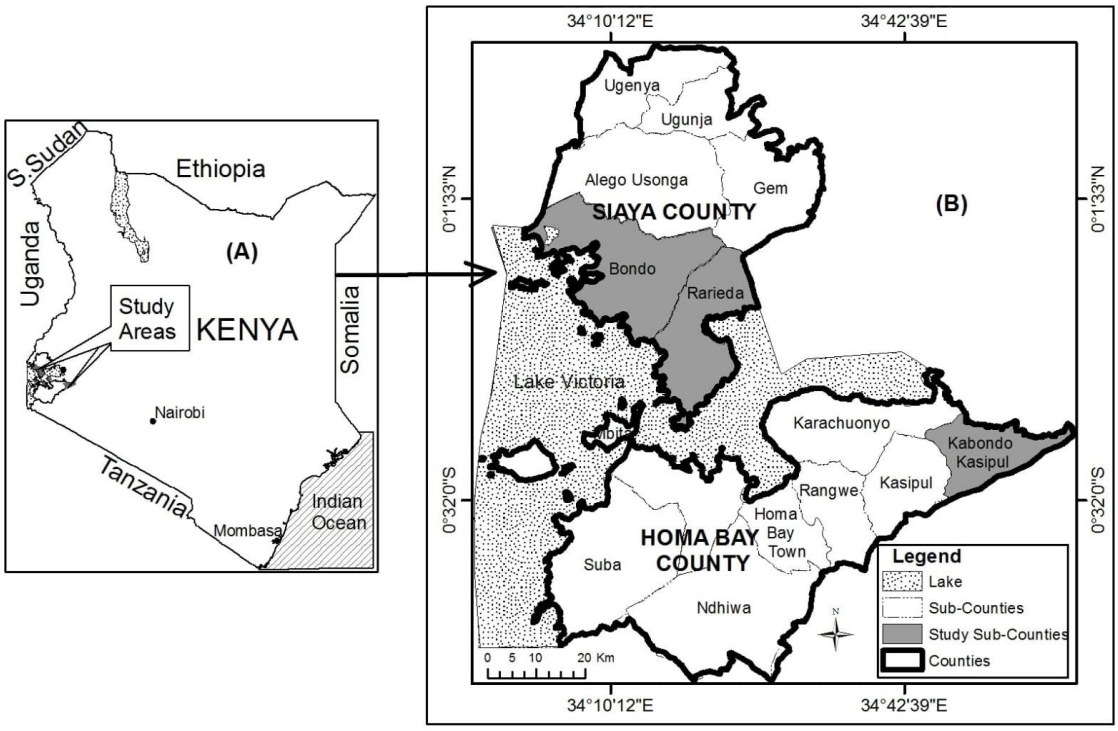

Figure 2. Map showing Siaya and Homabay counties.
Source: Ayieko et al., (2016)

there are few or no or earlier studies to rely on or predict the outcome. It establishes an understanding of how best to proceed in studying a problem or what methodologies would be applied to gather information about the issue. A research that adopts this kind of design always intends to develop tentative theories and hypotheses and also gives direction for future research and techniques to be involved in addressing problems (Johnson and Onwuegbuzie, 2004).

Sampling procedure

Sampling allows the researcher to study a relatively small number of units representing the whole population (Sarantakos, 1998). Cluster sampling method was chosen for this study. It was chosen on the basis that it is inexpensive and less time consuming. The method is also most appropriate to study a target population scattered over a wide geographical area (Alvi, 2016; Taherdoost, 2016).

In this study, sub-counties from the two counties were taken as clusters. Two sub counties from Siaya County and one sub-county from Homabay County were selected randomly. A county in Kenya is a territorial division that forms the chief unit for local administration while a sub county is a unit of administration through which a county provides its services and functions to the public.

This study targeted cricket farmers within the counties to evaluate the use of ICTs to obtain cricket farming value chain information.

To determine the sample size, the formula formulated by Cochran (1977) was used. He formulated two formulae whereby the second was a correctional formula to the first one in cases where the population is small. This is attributed to the fact that, a given sample size provides a proportionally more information for a small population as compared to a large population (Puszczak et al., 2013).

$$n = \frac{n_0}{1 + \frac{(n_0 - 1)}{N}}$$

where n_0 is the sample size, n is the adjusted sample size, and N is the population size.

In this study, 150 cricket farmers population were targeted in the two counties. Using the formula, a sample size of 108 respondents was obtained.

To arrive at this sample size, fifty eight cricket farmers were randomly drawn from each of the two sub counties in Siaya County and another thirty six farmers from one Sub County in Homa Bay County. This made up a total of 94 farmers who participated in the responding to the questionnaire. The remaining fourteen cricket farmers were drawn from the two counties and participated in the focus group discussions.

Data collection

In the study area, the cricket farmers were identified through Jaramogi Oginga Odinga University of Science and Technology and the Anglican Development Service (a partner in the flying Foods Project) who have been participating in training of cricket farmers in the region (Halloran et al, 2017).

Quantitative data was collected through survey of the sample cricket farmers using a structured questionnaire. The questions were administered by the researcher and five trained enumerators who were familiar to the study area and the subject matter.

The interview was done in English, Kiswahili and the local language (Dholuo). The questionnaire was interpreted to Dholuo language by an expert and then interpreted to English. The questionnaire was to collect farmer/household characteristics, information needs and access. The questionnaire also collected data on use of ICTs in accessing information on cricket farming and limitations to the use of ICTs.

They were guided on how to respond to the items in the questionnaire and were interpreted for in cases where they did not understand.

For qualitative data, focus group interviews were used to collect data on information needs, usage of ICTs and the constraints from key informants. The key informants were drawn from farmers who were practicing cricket farming and those who had stopped.

The focus groups contained trained moderator who understood Dholuo language and ensured that all the items in the schedule were responded to appropriately. One participant was asked to take notes on the proceedings of the discussions to ensure comfort in sharing experiences.

Data analysis and presentation

The data collected was recorded, coded and keyed into a computer. Qualitative data was analyzed through inductive thematic analysis. This involved picking the most relevant themes and coding them by giving them a reference number. The codes were then regrouped depending on the intensity and the frequency to which they were expressed to help conceptualize and develop meanings (Powell and Single, 1996).

For quantitative data, it was analyzed by use of descriptive and inferential statistics and R programming (Version 3.5.3) software for statistics. The information was displayed by use of statistical techniques such as graphs as well as describing and interpreting the data in line with the study objectives. A binary logistic regression analysis was done to analyze the relationship between the dependent and independent variables.

RESULTS AND DISCUSSION

Socio-demographic characteristics of farmers

Table 1 describes the socio-demographic characteristics of the respondents in the two counties under study.

It was noted that in both counties, males were more involved in cricket farming than females with 38.3% for Homabay County and 26.6% for Siaya County. The findings differed from those found by Oloo et al. (2021) who found that more women were involved in cricket farming than males. It was also noted that in Homabay County, most cricket farmers were below the age of 40 years and in Siaya County most farmers were between 31 and 50 years. Similar results were obtained by Oyaro et al. (2022) who observed that middle aged farmers in the age of 36 to 60 years were practicing cricket farming. Notably however, in Siaya County, there was no farmer who was above the age of 60 years. On education level, for Homabay County, most farmers had gone up to college level while in Siaya County, most farmers had attained secondary education.

Similar results were obtained by Obiero et al. (2019)

Table 1. Socio-demographic variables by geographical location.

Variable	Homa Bay		Siaya		Total	
	N	%	N	%	N	%
Gender						
Male	36	38.3	25	26.6	61	64.9
Female	22	23.4	11	11.7	33	35.1
Total	58	61.7	36	38.3	94	100
Age (years)						
< 30	17	18.1	1	1.1	18	19.2
31 - 40	13	13.8	15	16.0	28	29.8
41 - 50	6	6.4	15	16.0	21	22.4
51 - 60	9	9.6	5	5.3	14	14.9
> 60	13	13.8	0	0.0	13	13.8
Total	58	61.7	36	38.3	94	100
Education level						
No formal	8	8.5	2	2.1	10	10.6
Primary	13	13.8	20	21.3	33	35.1
Secondary	14	14.9	11	11.7	25	26.6
College	17	18.1	6	3.2	23	21.3
University	6	6.4	0	0.0	6	6.4
Total	58	61.7	36	38.3	94	100

Table 2. Agricultural activity by county.

Activity	Homa Bay		Siaya		Total		χ^2 (DF)	p-value
	N	%	N	%	N	%		
Rain-fed agriculture	55	58.5	34	36.2	89	94.7	2.2634(2)	0.3225
Horticulture	1	1.1	2	2.1	3	3.2		
Greenhouse farming	2	2.1	0	0.0	2	2.1		
Total	58	61.7	36	38.3	94	100		

who in a study observed that most small scale farmers had attained secondary education and some tertiary training.

Majority of the respondents from the two counties depended on rain-fed agriculture. A very small number does horticulture and green house farming. There was no association between the agricultural activity and the county, this is as shown by the p-value (>0.05). This would be attributed to the fact that the Lake Victoria Basin receives high rainfall and so rain fed agriculture is possible in the two counties (Table 2).

Access to cricket value chain information by cricket farmers

Table 3 shows the channels that the farmers used to access cricket value chain information. From the table, it was notable that majority of the respondents were concerned with cricket rearing practices with a 90%. Market prices were the least sought information with 18% of farmers. Diseases and pests came second with a 50% of farmers.

This agrees with a research conducted earlier by Hanboonsong et al. (2013) about cricket farming in Thailand where most farmers were concerned about information on pests and diseases and other rearing practices.

A binary logistic regression analysis was done to assess the influence of inputs, rearing practices, pest and diseases, feeding, market and market prices on agricultural and information needs. Rearing practices, feeding and the market for cricket had a significant effect on agricultural knowledge and information needs. On the other hand, inputs, pests and diseases and market prices did not have a significant effect (Table 4).

Table 3. Cricket farmers' information needs and information.

Information needed	Farmers' responses (%)
Inputs	51
Rearing practices	90
Diseases and pests	50
Feeding	55
Market (customers)	19
Market prices	18

Table 4. Regression estimates of the influence of ICT information on agricultural knowledge needs.

Coefficients	Estimate	Std. error	Z value	Pr(>|z|)
Intercept	-2.187	0.984	-2.223	0.02619*
Inputs	-0.284	1.249	-0.227	0.82013
Rearing practices	3.212	1.009	3.185	0.00145*
Pests and diseases	-0.729	1.292	-0.564	0.57299
Feeding	2.411	0.818	2.948	0.00320*
Market (customers)	2.481	1.213	2.045	0.04086*
Prices	0.006	1.007	0.006	0.99511

*Denotes significance at 5% level of significance.

It was therefore evident that information on cricket rearing practices was the most sought category by 90% of farmers with a strong statistical significance ($p<0.05$) while the least sought was market prices ($p>0.05$). These results are similar to those obtained by Hanboonsong et al. (2013) who noted that vital information on cricket rearing management like nutrition, disease and pest management among others were a challenge to most farmers.

Sources of information to cricket farmers

Figure 3 shows that farmer-to-farmer information exchange between the farmers was a key source of information in their day-to-day production followed by learning institution. Similar results were obtained by Halloran et al. (2017) and Šūmane et al. (2018) who reported that institutions like universities offered training and refresher courses to farmers on new methods of farming. This underscores the significance of these institution and research centers as a potential information disseminator to farmers.

ICT channels that farmers used to access information

Radio

From Table 5, it can be deduced that most farmers' owned and used radio to obtain cricket value chain information with 60.6% for Homabay County and 36.2% for Siaya County. Radio was found to be statistically significant in terms of airing value chain information ($p<0.05$). The number of respondents in the two counties that reported that radio aired value chain information about cricket farming was equal.

Television (TV)

From Table 6, it is notable that most farmers owned a television and used it to obtain cricket value chain information with a 67.9% for Homabay County and 18.9% for Siaya County. This indicated that TV had a potential of disseminating cricket value chain information to farmers.

Computer

From the results obtained, Homabay County cricket computers are not widely used in accessing information and that implies they are underutilized (Table 7).

Mobile phone

From Table 8, Homabay County had the highest number farmers were leading in the use of computer with 72.7%

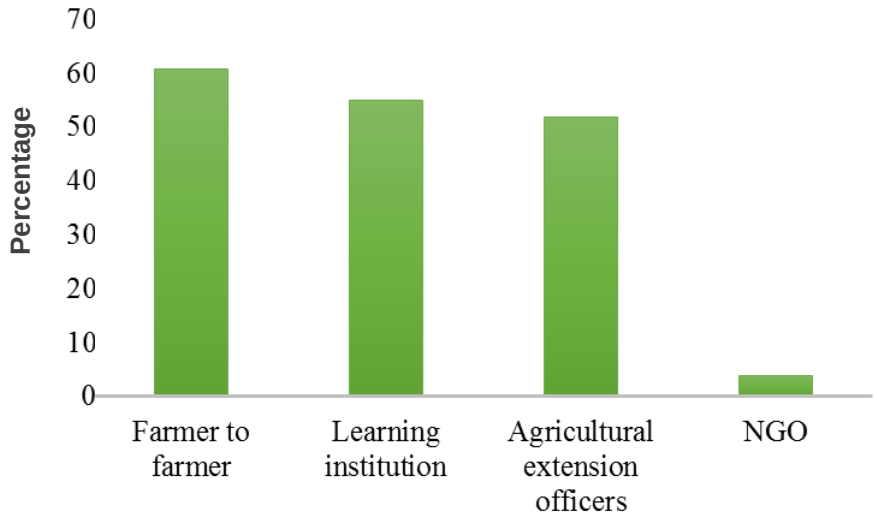

Figure 3. Bar graphs showing how farmers accessed cricket value chain information.

Table 5. Use of radio.

Have radio	Homa Bay		Siaya		Total		χ^2 (DF)	p-value
	N	%	N	%	N	%		
Yes	57	60.6	34	36.2	91	96.8	0.1796(1)	0.6717
No	1	1.1	2	2.1	3	3.2		
Total	58	71.2	36	57.5	94	100		
Air cricket farming programmes?								
Yes	57	60.6	34	36.2	91	96.6		
No	1	1.1	2	2.1	3	3.2	71.189(2)	3.479x^-16
Total	58	61.7	36	38.3	94	100		

Table 6. Use of television.

Have TV	Homa Bay		Siaya		Total		χ^2 (DF)	p-value
	N	%	N	%	N	%		
Yes	37	39.8	16	17.2	53	57	4.414(2)	0.1101
No	21	21.5	20	21.5	41	43		
Total	58	61.3	36	38.7	94	100		
Air cricket farming information								
Yes	57	67.9	26	18.9	83	86.9		
No	1	1.9	10	11.3	11	13.2	13.90(2)	0.00096
Total	58	69.8	36	30.2	94	100		

and Siaya County with 9.1%. This clearly indicates that of farmers using mobile phones to obtain cricket value chain information while Siaya County had the lowest number of farmers using mobile phones. The use of mobile phone to obtain value chain information is significant in using the phone by farmers. This clearly demonstrated the potential of mobile phones in farming.

All the four ICTs channels that were in question in this

Table 7. Use of computer.

Have computer	Homa Bay		Siaya		Total		χ^2 (DF)	p-value
	N	%	N	%	N	%		
Yes	26	28.0	7	7.5	33	35.5		
No	32	33.3	29	31.2	61	64.5	7.255(2)	0.02659
Total	58	61.3	36	38.7	94	100		
Use computer								
Yes	54	72.7	12	9.1	66	81.8		
No	4	6.1	24	12.1	28	18.2	12.69(2)	0.00175
Total	58	78.8	36	21.2	94	100		

Table 8. Use of mobile phones.

Have of phone	Homa Bay		Siaya		Total		χ^2 (DF)	p-value
	N	%	N	%	N	%		
Yes	54	57.4	35	37.2	89	94.6		
No	4	4.3	1	1.1	5	5.4	0.154(1)	0.6949
Total	58	61.7	36	38.3	94	100		
Use of phone								
Yes	45	51.1	6	5.7	51	56.8		
No	13	9.1	30	34.1	43	43.2	44.70(2)	1.963x10^-10
Total	58	60.2	36	39.8	94	100		

study were found to be statistically significant with a p-value (<0.05). However, radio was noted to be the most significant out of the four channels that were under study. These findings agree with what was documented by Magara et al. (2021) who found out that as much cricket farming was at its formative stages in Africa, information about cricket farming were disseminated to farmers by use of ICT channels like radios, TVs and print media and also through training of the farmers. Similar results were obtained by Nyareza and Dick (2012) who reported that 88% of the respondents preferred radio as their main mode of obtaining the information as the information given there was relevant, programs were run in the local language and farmers would contribute on the content being aired.

In terms of ownership between a radio and TV between the two counties, most farmers had a radio as compared to TV with 96.8% for radio and only 57% for TV. A study conducted by Opara (2008), who found that radio was ranked lower than TV in information access and he attributed this to the fact that radio is more affordable than TV. However, TV was the most preferred as it was audio visual and hence the most effective in information delivery.

On the other hand, computers seemed to have a fairly less influence in accessing information by cricket farmers. These results contravene with those that were obtained by Smith et al. (2004), Burke and Sewake (2008), and Erjavec et al. (2021) who found that most farmers made purchases on the internet and others used the internet in obtaining farming information.

For mobile phones, the results obtained in Homabay County are similar to those obtained by Adamides and Stylianou (2013) who reported that in a study, 98% of the respondents used mobile phones to obtain agricultural information. Further, Okello et al. (2010), Okello et al. (2012) and Nwafor et al. (2020) reported that younger people utilized ICTs more than older people in their agricultural transactions. With this in mind, more effort needs to be done in engaging the youth to participate in cricket farming by designing programmes that will utilize ICT platforms in bid to lure them to cricket farming.

Khan et al. (2020) found that newspapers and radio programs provided relevant and adequate information on weather forecasts and plant protection methods. They also noted that farmers accessed technology and crop varieties through the print media. These findings corroborated with Rahman et al. (2020) assertion that farmers sought information on crop varieties using print media. This was confirmed by focus group interviews which revealed that apart from the four ICT channels investigated in this study, the respondents obtained

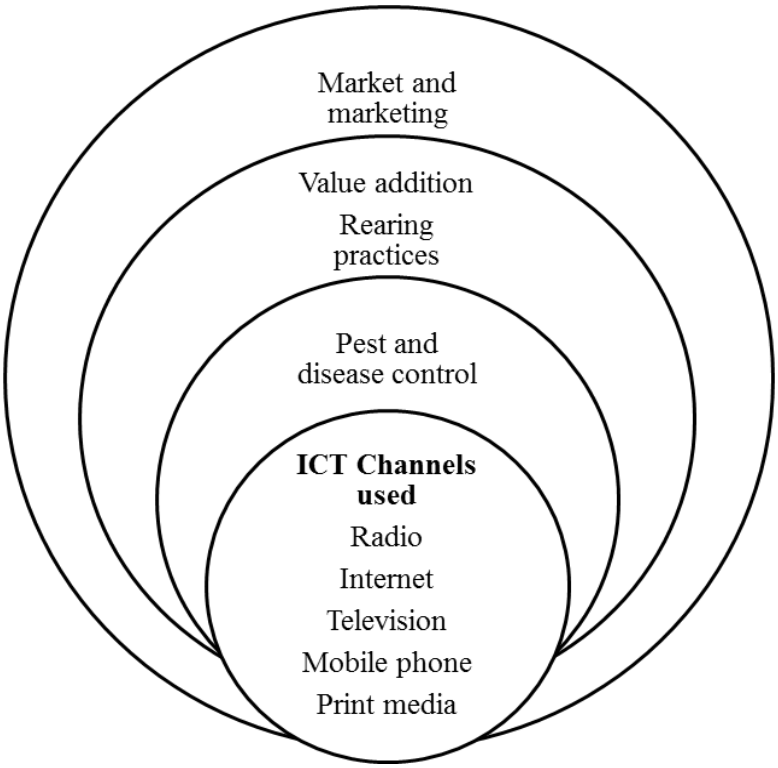

Figure 4. The feedback from focus group discussions.

information from print media like the newspapers.

Thematic analysis of focus group discussions

Figure 4 illustrates the responses from the group discussions. The farmers reported that the most significant information to them was market and marketing information and was followed closely by cricket rearing practices and value addition. Pest and disease control measures were the least sought information. Other information needs included trapping of crickets from the wild, collection of eggs. These findings contravened with those that were reported by Halloran et al. (2021) who postulated that farmers were not aware of the latest knowledge about disease control and breeding technologies.

All the ICT channels that were under study were found to have significant positive influence in disseminating value chain information to farmers. However, some farmers reported that they have been using print media to access information.

Assessment of the constraints to value chain information access by cricket farmers using ICTs

Misaki et al. (2018) tabulated a number of challenges that faced small scale farmers when using mobile phones and some of the challenges that came out strongly were low education and training, high servicing costs and poor infrastructure.

Again, from the focus group discussions so many issues came up with the use of ICTs including limited airtime in the aired programs, high cost of internet and network challenges in some areas. Similar results were obtained by Aker et al. (2016) who reported that because of the costs incurred when using ICTs, some farmers were unwilling to pay for information that was not directly impacting their production. Similar results were also obtained by Getahun (2020) who found that electricity coverage in rural areas remains a major challenge to farmers in those areas.

The interviews further revealed that there was a poor relationship between cricket farmers and the organization(s) that introduced them to cricket farming. This greatly affected them and made some of them to get discouraged about the enterprise. Some farmers complained about promises that were made by the organizations and were not fulfilled. This included provision of materials and equipment for cricket farming and marketing channels for cricket products.

Conclusion

All the ICTs in this study were found to be significant for information access by farmers. However, radio was found

to be the most significant channel out of all the four channels in information dissemination. This underscores the potential of ICTs, especially radio, in helping farmers make timely and informed decisions in the farm.

There is need therefore, for robust promotions and incentivizing farmers to ensure efficient utilization and integration of ICTs in their day-to-day farming activities. Given that print media was reported to have been used for information access, efforts must be made to enhance its usability and accessibility by farmers.

According to the study findings, respondents were interested to know the companies or organizations that deal with value addition of cricket products to supply the organizations with cricket products for value addition. This was not one of the objectives in this study but it came out evidently and therefore need to be addressed in future studies. Studies should also be conducted to analyze the scale of effectiveness in utilization of the information farmers obtain using ICTs.

CONFLICT OF INTERESTS

There was no conflict of interest in preparation, execution and reporting of this research.

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