INTERNET AND THE PROMOTION OF AQUACULTURE IN KENYA

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Abstract

The objective of this paper was to analyze the contribution of internet in the improvement of Aquaculture in Kenya and to establish the effectiveness of Phone internet in reaching the fish farmers. The paper further aimed at analyzing the role of Internet in the promotion of Aquaculture with particular reference to Kenya's Ministry of Agriculture, Livestock and Fisheries fish Farming project. The target population was the Aquaculture farmers and officers from the Ministry of Agriculture, Livestock and Fisheries. The study used inferences from the population characteristics exhibited in the samples. One of the findings was that the computer, Internet and mobile phones ranked the highest in the most preferred ICT tools used in the promotion of aquaculture. According to the findings, 99 percent of the government officials had access to the Internet though the quality of internet service varied depending on the region. Some factors are also necessary to be considered in order to improve aquaculture information dissemination. Age, income and educational background of fish farmers should be considered while disseminating aquaculture information to them.

Keywords: Internet, Kenya, Aquaculture, fish farming

Introduction

Information Communication Technology (ICT) is revolutionizing the world and this has a huge socio-economic implication for mankind. At the end of the 20th Century, people in rural and remote areas of developing countries are facing many unprecedented challenges brought on by the changing global economy, dynamic political contexts, environmental

degradation and demographic pressures. The number of food insecurity around the world continues to increase. To deal with these challenges, and to make critical decisions, people at all levels of society, and especially the food insecure and the organizations that serve and represent them, must be able to access critical information and communicate. Improved communication and information access are directly related to social and economic development (World Bank, 1995).

The Internet has woven its way into nearly every aspect of our lives: people use it for communication, entertainment, education, and commerce opportunities (Horrigan and Rainie, 2006). Rural households, which have historically lagged behind in terms of Internet access, have seen dramatic increases in recent years. The farming industry, in particular, has found several applications for this distance-negating technology, including checking weather forecasts, buying inputs and selling products online, or even setting up and running individual farm websites. The percentage of farms online has increased from thirteen percent in 1997 to over 60 percent in 2005. In fact, nearly $30 billion of business was conducted online in the agricultural, forestry, and fishing sectors in 2005 (Dorfman and Watson, 2005).

Numerous studies have looked at how farmers have incorporated the Internet into their lives and farm businesses. Mishra and Williams (2006) suggest that the propensity for a farm household to adopt the Internet is positively related to a number of variables, including age and educational level of the operator, the presence of a spouse, farm size and regional location. They are further able to examine whether the household uses the Internet specifically for farm business purchases, for household purchases, or both. They find that the results (positive impacts of age, education, farm size, and regional location) are very similar among all groups (Mishra and Williams, 2006).

The Internet's popularity, its efficiency in communication and the reducing price of hardware have resulted in the implementation of Internet connectivity in several projects such as the iKisan.com project (Tiwari, 2008), the Tarahaat project (Tiwari, 2008) and the e-Choupal project (Rao, 2007) in India. These projects have applied a variety of connectivity-based technologies to the needs of each project. Telephone dial-up connections may be a simple answer for limited budget projects with low amounts of data transferred within telephone line-covered areas. Examples are the i-Village and the Gydanroot projects (Tiwari, 2008).

Other studies have reported how the Internet has assisted farmers. For example, the i-Community by Hewlett-Packard project chose VSAT to solve the last mile‟ connection problem (Tiwari, 2008). This solution accords with the e-Choupal and the i-Village project (Tiwari, 2008). Additionally, the

VSAT was also an alternative mode of connection used by the Zee Interactive Learning System for its communication satellites (Sood, 2001). Wireless networks are another alternative for limited and unstable telephone lines in rural areas. For instance, a wireless system has been used occasionally to transfer off-line contents in a project in Pondicherry (Sood, 2001). Furthermore, Wireless-in-Local-Loop (WLL), which is able to transfer both data and voice simultaneously across long distances, was an option implemented by the Indian Institute of Technology Madras (IIT-Madras) (Sood, 2001). These channels have been applied to disseminate aquaculture information in local languages which were more attractive to Internet users (Sheriff, 2009). Furthermore, alternatives of preferred languages have been made available for users (Rao, 2004). Web14 portals, agricultural databases and Internet kiosks presented in local languages have been developed and then introduced to needy farmers in order to encourage them to develop more knowledge (Rao, 2004; Tiwari, 2008).

Media and Aquaculture

The power of the mass media in disseminating Aquaculture information to the farmers is essential. However, it is not yet established how the Department of Fisheries in Kenya utilizes the mass media sources, especially the Internet, to disseminate the valuable information on agriculture to the farmers and their officers. It appears that the full potential of the aquaculture sector to contribute to human development and social empowerment is yet to be realized, and the sector may require new approaches to realize its goals.

Although the Department of Fisheries has its own website for the public, there is delay in the information reaching the farmer. The challenge with the farmer is how to access this information. There is also the challenge of the printed publications that do not reach the farmers at the grassroots level. These are among the problems faced by the Department of Fisheries in Kenya.

For the Department of Fisheries to disseminate all of their Aquaculture information and provide up to date information to the farmers and their officers, one of the best answers is the Internet. This paper focused on the Internet as a promotional tool, and sought to bring to light the different channels and opportunities that the Internet offers in the promotion and improvement of Aquaculture in Kenya.

Use of Internet in Aquaculture in developed countries

Although a number of studies in developing countries showed that TV was a main source of aquaculture information among poor and illiterate farmers, TV did not show this kind of significant role in some developed

countries such as New Zealand and the USA (Field et.al, 2007; Locke, 2005). The use of the Internet for agricultural purposes, such as record keeping, online selling or purchasing and searching for information, was about 31.8% of the farmers in Locke's (2005) study. This finding was in accordance with Pickernell, et.al (2004) study that 71% of respondents used information technology for business purposes. In details, 33% of the respondents had their own web sites and customers were able to perform their purchases online on 18% of the respondents' web sites (Pickernell et. al,2004). The ICT networks also facilitated the knowledge transfer, in forms of either technical information or advice, between farmers and experts in a training programme held in the Northwest of England (Lowe, 2011).

In contrast, American farmers were more likely to use traditional media, such as print media and interpersonal sources, compared to electronic information sources (Diekmann & Batte, 2009). In detail, it was also found that print media were more preferable to Ohio farmers than interpersonal sources and broadcast media (Diekmann & Batte, 2009). Additionally, it was supported in an American study that even a number of aquaculture information available in various forms, other farmers were considered as one of the most important information sources (Velandia et al, 2011).

Despite reports that the number of computer and Internet users in developed countries was much greater than those in developing countries (Warren, 2004), some barriers to technology adoption among farmers in developed countries still occur. Reason behind those obstacles is the lack of appropriate hardware: for example, a number of farmers in the USA and the United Kingdom did not have a computer; or had a low-performance computer (Warren, 2004). In addition, only a half of the English farmers who owned a computer used their computer for business purposes (Department for Environment, Food and Rural Affairs [DEFRA], 2002 cited in Warren, 2004). In England, farmers surfed the Internet for both business and non-business purposes including checking the weather reports, checking input and productivity prices, searching for farming information, sending emails to friends and family and general browsing (Warren, 2004).

Moreover, lack of awareness of Internet capabilities is another issue in aquaculture development in developed countries (Warren, 2004). Even in developing countries such as New Zealand, a difficulty on ICT infrastructure could be found in rural areas, which partly caused a delay in adapting Internet for aquaculture purposes (Shiblaq & Fielden, 2008). It was also reported that the level of education as well as household income related to the tendency of adopting new technology (Archer, 2004 cited in Shiblaq & Fielden, 2008; Warren, 2004).

Nevertheless, it is found that family members play a significant role in Internet adoption by passing relevant information to other members who

were not confident about Internet tool usage (Warren, 2004). Additionally, family members tended to realize Internet potentials and had positive attitudes toward using Internet for their business, especially if a child or a spouse had skills in using a computer and the Internet (Warren, 2004).

Furthermore, it was found that the importance of information sources in farmers' point of view may be affected by their age, land tenure and income (Velandia et al, 2011). Additionally, extension officers were more influential to decision making than other farmers in high income or old farmers‟ point of view (Velandia et al, 2011). Computer wireless connections and the third generation (3G) mobile telephone networks were expected to be crucial means in improving agricultural sectors in developed countries by combining a mobile phone with a handheld computer to transfer a variety of information types at a higher rate (Warren, 2004). Additionally, e-Commerce was anticipated to be a key distribution channel for aquaculture businesses (Pickernell et. al, 2004).

Drivers of ICT use in agriculture

To encourage a group of people to try something new requires effective drivers and benefits to convince them. In a study by Sindir (2005), Turkish farmers were a good example of a group resisting the adoption of new technologies until the consequent advantages were realized. Relative advantages from the changing behaviors were considered as the most important factor among trained farmers in Elsey and Sirichoti‟s (2003) study. These advantages maybe better yields and incomes from adopting new technologies or practices including breeding new fish species (Kalusopa, 2005; Sheriff, 2009).

Reliability of information sources is also an important issue for adopting new knowledge.

Poor credibility or unfamiliar information channels are likely to cause illiterate farmers to be reluctant to take any risks or to experiment with new methods and practices. Moreover, it is confirmed in Elsey and Sirichoti's (2003) study that the source of information was ranked second for adopting new knowledge into practices. Furthermore, appropriate aquaculture information may directly reduce costs of aquaculture imputs, improve quality of the fish produced and increase chances to get higher selling prices (Kalusopa, 2005).

Use of Internet in aquaculture in developing countries

The economies of most developing countries are based on an agricultural or food industry. For example, growing rice for consumption is the main agricultural activity among impoverished families in Thailand (OAE, 2009). However, small farm activities cannot cover all expenditure;

an OAE's (2009) study found that about 80% of Thai farmers were still in debt. Poor farmers thus need income from other sources, such as out-of-farm jobs.

As Internet has spread throughout the world, Internet tools and techniques have been employed in aquaculture sector with the hope that they will eventually improve agricultural productivity, quality and values. Karnka's (2006) study, which provided computer sets connected to the Internet for a specific farmer group, revealed that most participants had positive attitudes toward the use of Internet for supporting their learning activities. These respondents also regarded the Internet as not only a useful information source but also as a more credible information provider (OAE, 2009). Furthermore, the success of innovations in learning also depends on the communication channels used (Elsey & Sirichoti, 2003).

In his study, Karnka (2006) found that after becoming familiar with using the Internet, the respondents positively changed their mind toward the complications of using Internet. However, at first, attitudes toward the use Internet among farmers were expressed as novel, extravagant and too modern for them (Karnka, 2006). These attitudes can be seen as a challenge to overcome in order to encourage needy farmers to adopt innovations. Moreover, foreign languages, and too generalized information in conjunction with low-speed and unstable Internet connection were seen as barriers to access to required information by impoverished farmers in a developing country (Karnka, 2006).

Internet and Aquaculture in Africa

The benefits that could be derived from the Internet by African countries in general have been mentioned in many publications. Sadowsky has, for example, outlined the potential profits for governments, education, health, statistics, agriculture and natural resources, development and planning, telecommunications, and foreign affairs. The Internet with its different services has recorded a great expansion through the whole of the industrialized world. The developing world, on the other hand, has benefited only marginally from this explosion. This is due to the weak level of technology in the developing countries, but also to the mixed feeling shown by the authorities, who say that data processing networks rely on heavy technology and are generators of high expenses in telecommunications.

However, these investments have not always translated into a corresponding improvement in the Internet access services experienced by users, through lowered prices or increased quality of service. In many countries the development of Internet access services is still held back by constraints on key inputs, notably in relation to the terrestrial connectivity between the submarine cables, the IXPs, the 'last-mile' access infrastructure

– whether fixed or wireless – and the Internet service providers (ISPs) that deliver access to the end-users in Africa. As discussed in this report, policy remedies are required that remove roadblocks to new market entry and expansion, promote of investment by providing clear rules, and provide strong political leadership to achieve ICT goals.

Africa has a low level of Internet access. This is partly due to poor telecommunication infrastructure with low bandwidths in most of the countries. In addition only a few countries operates Internet exchange point and hence this impacts negatively on high international traffic (Ngini et al., 2002). The ITU report (2001) report indicates that the continent has a teledensity of 2.48, which is far below that of developed countries. The cost of accessing Internet remains high in Africa.

Telephones and mobile phones used as a connection to Internet

The telephone system is not only a fundamental communication infrastructure but also a basic facility that supports the use of other technologies. For example, in some African areas, the telephone was the only ICT tool used by most farmers (Bertolini, 2004 cited in
Munyua, Adera & Jensen, 2008). Its advantages included adaptability and the capability of transferring both voice and data at gradually decreasing cost (Mangstl, 2008). Additionally, mobile communication technologies have become gradually more important in many parts of the world, especially in improving the delivery of information about agriculture (Munyua, Adera & Jensen, 2008). These communication devices present several advantages such as portability, wide range of coverage and instantaneous two-way communications.

Real-time aquaculture information and fish prices were also provided through mobile phones in Senegal (Munyua, Adera & Jensen, 2008). The advice about best places to sell their catch was also utilized by Kerala fishermen in India (Abraham, 2007 cited in Mittal & Tripathi, 2009; Jensen, 2007 cited in Mittal & Tripathi, 2009).

Furthermore, the availability of state-of-art technologies, which are now integrated into mobile phones, has further improved communication. Built-in global positioning systems (GPS), high-resolution digital cameras and short-length video recorders are exemplary embedded technologies. These advances facilitate the use of mobile phones for sending and receiving voice, text, image and video information (Munyua, Adera & Jensen, 2008). In addition, most respondents in a study done by Hassan et al. (2008) claimed that telephone and mobile phones have become ubiquitous. Other studies have found that mobile telephony is regarded as the most successful ICT tool used in attempts to develop the global agricultural sector (Mangstl, 2008).

Mobile telephones have been used by farmers for a variety of purposes. For example, Jensen and Thysen (2003) reported that short message service (SMS) was used to acquire required information, such as weather information and suitable time to spray pesticides.

Besides information delivery, the mobile phones can be applied to specific other purposes such as transferring money from one bank account to another for labour payments and input purchases in Kenya (Hafkin & Odame, 2002 cited in Munyua, Adera & Jensen, 2008).

Moreover, market information in voice mail formats, and also the access of information in the Internet through mobile phones is delivered to Kenyan farmers (Munyua, Adera & Jensen, 2008). Other research studies have reported that farmers and agricultural experts are sending information as images via mobile phones with a built-in digital camera and Internet access (Parikh, 2009). This approach saved time and money in addition to providing more support by a limited number of aquaculture experts to a greater number of farmers over a larger area.

Theoretical grounding

This paper used two theories, Reception Theory and Two-step flow theory. Reception theory is a version of reader response literary theory that emphasizes the reader's reception of a literary text. It is more generally called audience reception in the analysis of communications models. In literary studies, reception theory originated from the work of Hans-Robert Jauss in the late 1960s.

Reception theory is an approach to textual analysis, which puts more emphasis on the audience; the meaning is made at the moment of consumption. At that moment, the individual audience member considers the representations presented to them in the context of their own values, opinions and experiences. Therefore, people with similar socio-cultural backgrounds are likely to make similar readings of the same texts. The theory also follows, that if the audiences' values, opinions and experiences are similar to the producers, then they are likely to read the meaning of the text in the way it was intended, or at least which is very close to it.

Reception theory can be applied to other media formats such as films, TV, Internet, among others, since different audience's like different characters portrayed in those media texts but the interpretations are the same. The technical and symbolic codes which construct the representations we perceive are the same as the denotation is often the same.

The two-step flow of communication hypothesis was introduced by Paul Lazarsfeld, Bernard Berelson, and Hazel Gaudet in 1944. This theory asserts that information from the media moves in two distinct stages. First, individuals (opinion leaders) who pay close attention to the mass media and

its messages receive the information. Opinion leaders pass on their own interpretations in addition to the actual media content. The term 'personal influence' was coined to refer to the process intervening between the media's direct message and the audience's ultimate reaction to that message. Opinion leaders are quite influential in getting people to change their attitudes and behaviors and are quite similar to those they influence. The two-step flow theory has improved our understanding of how the mass media influence decision-making. This theory refines the ability to predict the influence of media messages on audience behavior, and it helps to explain why certain media campaigns may have failed to alter audience attitudes and behavior.

An integrated approach to the expansion of Internet services will promote the necessary (but often neglected) horizontal communication between agencies linked to rural and agricultural development. Therefore when Internet is used as a tool to promote and relay information about Aquaculture to the farmer it does not only create a relationship between the farmer and the text but the farmer is able to interpret and give meaning to the text and this will go a long way in promotion and development of Aquaculture.

Methodology

This research used a descriptive study design in order to analyze the role of Internet in the promotion of Aquaculture in Kenya. A descriptive design is used to obtain information concerning the current status of the phenomena to describe "what exists" with respect to variables or conditions in a situation. The methods involved range from the survey which describes the status quo, the correlation study which investigates the relationship between variables, to developmental studies which seek to determine changes over time (James, 1997).

Descriptive studies are helpful in revealing patterns and connections that might otherwise go unnoticed. Descriptive research is also used to obtain information concerning the current status of the phenomena to describe what exists with respect to variables or conditions in a situation.

Simple random sampling was used to select 15 respondents form the Ministry of Agriculture, Livestock and Fisheries to form part of the study. From the data acquired from the Ministry of Agriculture, Livestock and Fisheries, thirty large scale farmers, middle and low level farmers were selected using simple random sampling from the counties constituting the respondents for the study. In order to ensure an unbiased sample, every member of the population had equal opportunity to be selected in the sample (Pattern, 2004).

The survey method was used to collect data in this study. Questionnaires were used as data collection tools because they are much more efficient in that they permit collection of data from a much larger sample. Schloss and Smith (1996). Plus, all the respondents who participated in the study are literate and therefore capable of answering the items adequately. Questionnaires also allowed respondents to give frank answer to sensitive questions especially if they are not required to disclose their identity. The research administered the data collection instruments. All respondents were assured of confidentiality and security. Data obtained from the questionnaires were supplemented by data obtained from in-depth interviews.

The questionnaires were administered through face-to-face method to the respondents and the questionnaires consisted of two sections. The first part included the demographic and operational characteristics designed to determine fundamental issues including the demographic characteristics of the respondents. The second part was devoted to the identification of the role of Internet in the promotion of Aquaculture where the variables of the study were into focus.

These questionnaires consisted of both open (unstructured) and closed (structured) ended questions. The structured questions were used to facilitate an easier analysis as they were in immediate usable form; while the unstructured questions were used so as to encourage the respondent to give an in-depth and felt response without feeling held back in revealing of any information.

Findings and Discussion

From the study, 13 out of 15 government officials filled in and returned the questionnaire contributing to 86.7%, while 12 out of 15 fish farmers filled in and returned the questionnaires contributing to 80%. This was a satisfactory response rate from the sampled population. The results are represented in Table 4.1 below.

Response from government officials	Frequency	Percentage	Response from fish farmers	Frequency	Percentage
Responded	13	86.7	Responded	12	80
Not responded	2	13.3	Not responded	3	20
Total	15	**100**	**Total**	**15**	**100**

Table 4.1: Response Rate

ICT tools used by Kenya's Ministry for the promotion of aquaculture

Computer, Internet and mobile phones ranked the highest in the most preferred ICT tools used in the promotion of aquaculture. According to the survey 99 percent of the government officials had access to the Internet though the quality of internet service varied depending on the region. Other forms ICT tools such as TV, radio, CD/DVD players were also used in the promotion of aquaculture in Kenya. In some instances community loud speakers were also used in the promotion of aquaculture.

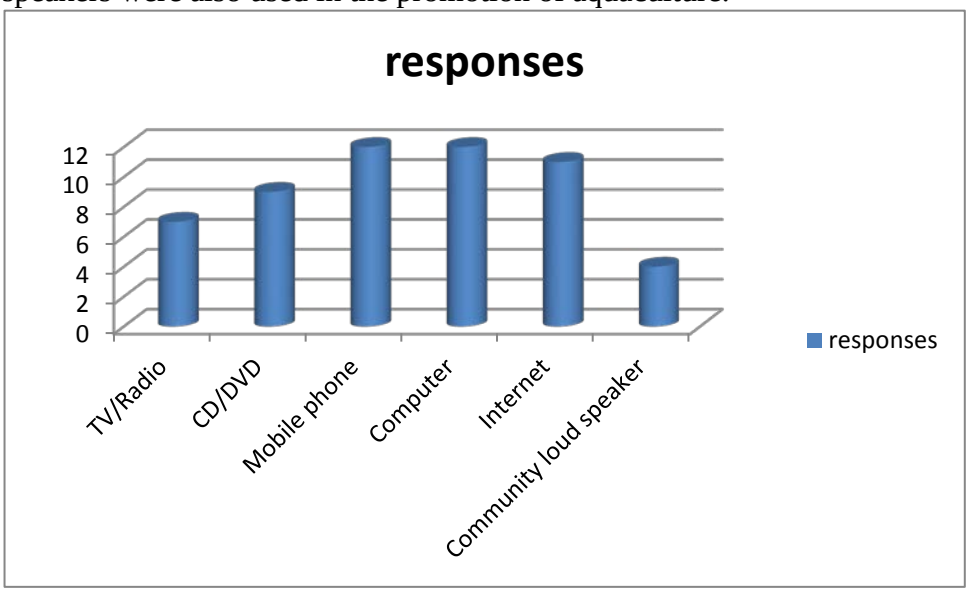

Figure 1: ICT tools used by the department for the promotion of aquaculture

With the help of the ICT tools the government officials drawn from the Ministry of Agriculture, Livestock and Fisheries and in particular the department of Fisheries provide technical information on site selection, pond design, construction, feeding and the best management of aquaculture at all the levels of value chain, advice on proper and appropriate harvesting is also provided.

Types of tools used by government officials to access the Internet

In terms of the kind of tools currently used by the participants to access internet, The survey showed that computers (40.6%) was the most popular internet tool used, followed by mobile phones (32%) as aquaculture information source. This conforms with Irivwieri (2007) who argued that computers and Internet enabled phones are a major source of getting aquaculture information among literate government officials and literate farmers. Its popularity may be due to the high incidence of literacy among

government officials in the department of fisheries. 21.4% of the participants also reported that they used cafes to access Internet services while 6.4% of the government officials also use the I-pad to access information about aquaculture.

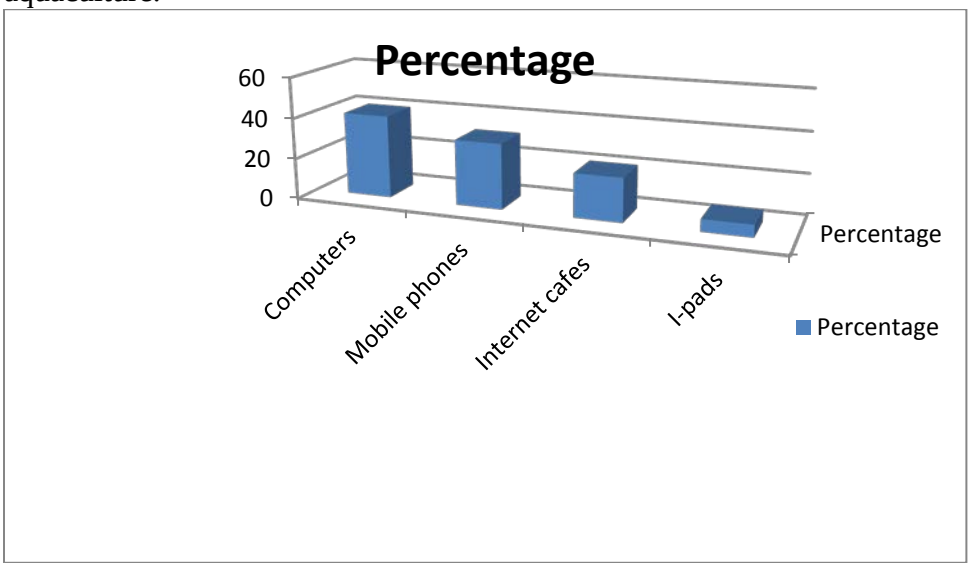

Figure 2: The kind of tools used to access Internet by government officials

Amount of time respondents spend accessing information about aquaculture

When participants were asked how much time they spend accessing information about aquaculture, nearly a half of the participants (45.3%) preferred a one-hour information session for daily transmission, whereas another 32.1% preferred the length of 45-minute long information sessions. When asked about a potential weekly transmission, the majority of the participants (43.6%) also had a preference for 15-minute information sessions while another 29.3% favored 30- minute long information sessions. In addition, 36.3% of the participants preferred a 30- minute long information session for a monthly transmission. However, a smaller percentage of the participants (31.9%) also preferred to keep the information session at a length of 15 minutes. Overall, it can be seen that the longer the length of information, the less often it was preferred by the participants as shown in Figure 3 below.

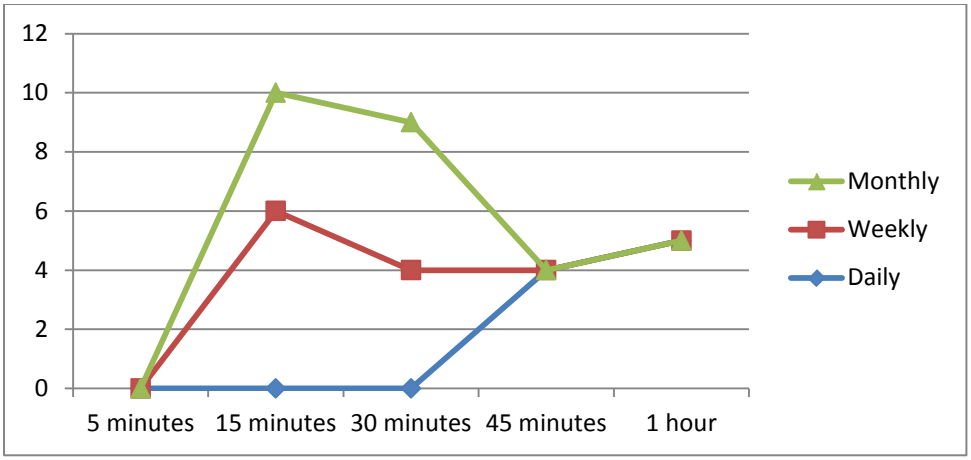

Figure 3: Time officials spend accessing information about aquaculture

The survey showed that all the government officials and the extension officers had access to Internet. The officials also noted that extension workers encountered transport problems in trying to reach the farmers, and they also lacked a standardized manual for their extension services.

Positive outcomes realized after offering services to fish farmers

With the aquaculture information that the government officials get through the internet, they offer services to farmers who reported the following positive outcomes. 60% of the officers interviewed reported that farmers had increased productivity, while 40% reported higher selling price for the farmers produce due to improved yield.

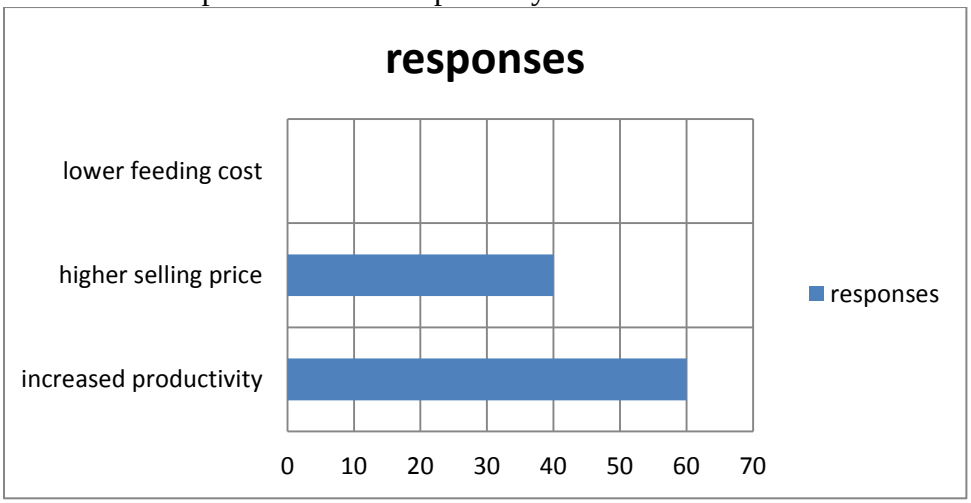

Figure 4. Positive outcomes realized after offering services to fish farmers

To further improve how aquaculture information is disseminated to government officials, suggestions such as automatic updates to be provided that is in collaboration with mobile services providers. Information provided should also be in a simplified form for easier understanding. There is also need for increased publicity through advertisements, promotions, publication of aquaculture magazines and aquaculture pamphlets. More information/resource centers in villages should also be established.

It was noted that a number of rural residents had to share even basic communication tools. They had a chance to use high technology tools, such as computers and mobile phones only when they were offered free by research projects. It may be assumed that affordability is another reason affecting the use of Internet among rural community members. Therefore, the relationship between income and the use of Internet for obtaining new aquaculture knowledge should be determined.

Internet tools used by fish farmers and the preference by fish farmers

In terms of Internet tools currently used by the participants, Table 3 below shows the percentage of Internet tools used among the fish farmers. The survey showed that computers at 73.6% were the most popular Internet access tools used as an aquaculture information source. This conforms to Irivwieri's (2007) conclusion that computers and mobile phones were the main Internet access tool for fish farmers to get aquaculture information. Computers and Internet enabled mobile phones helps farmers better understand aquaculture information and material.

By contrast, this result was different to Tarnoczi and Berkes‟ (2010) findings which showed that computers and mobile phones as a source of internet access only played an additional role to other sources of information.

Internet access tool	Percentage use
Computers	73.6
Internet enabled phones	15
Do not use internet	11.4

Table 2: Internet Access tools currently in use

Contrary to many international studies many fish farmers rarely received aquaculture information from the internet, due to lack of electricity and infrastructure (Ekoja, 2004).

However, the different percentages between computer possession and the use of internet enabled mobile phones as an information source may support IICD‟s (2006) findings that a majority of the participants regarded computers and mobile phones as a source of entertainment rather than information.

These results were in an agreement with Cecchini (2002, cited in Malhan & Rao, 2007b) that for developing countries the Internet was less useful for improving fish farming decisions. In contrast, developed countries such as the United Kingdom and USA, show higher percentages of Internet access in farms at 60% and 55%, respectively (the Department for Environment, Food and Rural Affairs, 2002 cited in Warren, 2004; the United States of America Department for Agriculture (USDA), 2001 cited in Warren, 2004). When they were asked about their willingness to learn or to use internet in order to improve aquaculture productivities, positive results were posted.

Types of Aquaculture information required and the delivery preference

All participants really needed relevant aquaculture information in order to improve their fish productivity, although their requirements were slightly different. Table 3 presents aquaculture information needs.

Information Requirements	Percentage
Appropriate fingerlings	62
Feeding	19.8
Marketing	14
Harvesting	4.2

Table 3: Aquaculture Information Requirements among Participants

From Table 3, it can be seen that nearly two third of the participants (62%) needed information related to appropriate fingerlings while the other participants required information of fish feed and their prices (19.8%), information on marketing their produce (14%) and harvesting of fish (4.2%).

This survey had similar findings to several other studies (Ekoja, 2004; Elizabeth & Zira, 2009; Ogunlade, Oladele & Falaki, 2006) where information on appropriate fingerlings and feeding information occupied the main priority of fish farmers, furthermore, it is in conformity with Aboyade (cited in Ekoja, 2004) that procurement of appropriate fingerlings was the highest ranked request from farmers.

Participants were asked for feedback about how often they would like to receive aquaculture information. Nearly a half of the participants (45.3%) preferred a weekly transmission, whereas another 32.1% preferred a monthly transmission. However another (22.6%) of participants would have preferred a daily transmission of information from the department of fisheries.

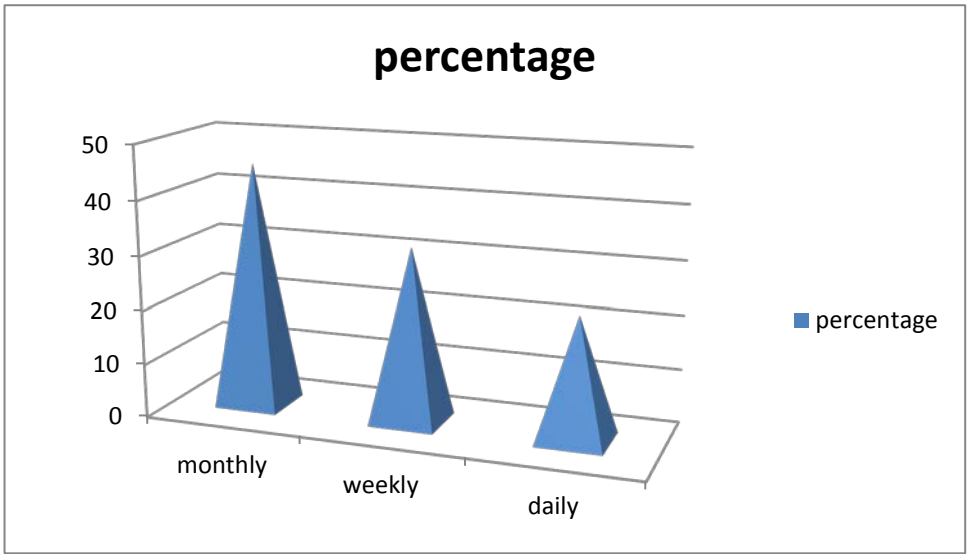

Figure 5. Percentage of participant preferences towards frequency of information dissemination

Summary

Studies and projects around the world related to aquaculture information dissemination have encountered different obstacles depending on several issues (Kari, 2007; Margono & Sugimoto, 2011; Ratnam, Krishna Reddy & Reddy, 2005). These problems include poverty, illiteracy, insufficient support, lack of timely information, user-friendly interface, two-way communication, insufficient network infrastructure and a lack of awareness of Internet benefits and cultures (Kari, 2007; Margono & Sugimoto, 2011; Ratnam, Krishna Reddy & Reddy, 2005).

Most farmers in developing countries are not able to earn adequate incomes to cover all expenses for living and carrying out agricultural processes. Therefore, all revenue is saved for necessary expenditure such as food and aquaculture supplies. In many studies, even fundamental communication tools such as radios, televisions and telephones were viewed as extravagant assets and had to be shared among community members (Irivwieri, 2007; Opara, 2008). Moreover, in some areas, other more expensive ICT tools like computers and mobile phones could not be taken into account unless provided by the project supporters (Sheriff, 2009; Sindir, 2005). This issue exacerbates the lack of useful information dissemination through ICT tools.

Illiterate unskilled workers are also a vital problem for information delivery via ICT tools

in many developing countries (Curtain, 2003). It is also claimed that poor people in developing countries did not necessarily have fluency in their own language (Mangstl,2008). In some areas, all members of the community disclosed that they have not used computers before (Sheriff, 2009). Additionally, use of many state-of-art devices may require some level of capability or experience (Sindir, 2005). This may hinder knowledge transfer processes, particularly scientific concepts. In the worst case, farmers may be forced to move into other types of agriculture in which they have not been involved previously (Irivwieri, 2007).

This problem is aggravated when it comes to valuable information resources at the global level in which English is typically used (Rao, 2004; Mangstl, 2008). Unavailability of aquaculture information in local languages may hinder the improvement of aquaculture information dissemination (Curtain, 2003). Even in some countries where different local languages have been used, communicating and transferring information is not always easily done. In Nigeria, different twenty five local languages had been used in different thirty seven states (Oladele, 2006). This causes inconvenience when it is necessary to produce materials in many different languages in order to provide the same contents.

Fundamental infrastructures and ICT devices may be insufficient or poorly functioning in rural areas in many developing countries, for several reasons such as inadequate support from government and private sectors, unstable or restricted power supply, unavailability of landline phones, delayed restoration of communication networks after failure and insufficient network connectivity (Sood, 2001; Tiwari, 2008). In an on-going project, unreliable connectivity and hardware malfunctions also amplified the levels of displeasure among users (IICD, 2006). These issues limit the optimal use of Internet for disseminating information to needy people. Additionally, inconsistent national policies were also claimed to be an obstacle for progress of aquaculture development (Kizilaslan, 2007; Sindir, 2005).

Besides infrastructure, information and other supports from government or government officers, have not fulfilled the requirements of needy farmers. Insufficient information support and weak links between information users such as farmers, researchers and extension workers were reported to be major factors for low agriculture yields (Ministry of Agriculture, Republic of Kenya, 1997 cited in Kiplang & Ocholla, 2005).

The relationships between extension workers and farmers in some areas needed to be strengthened because some farmers had the perception that the extension workers do notprovide the necessary information; or use technical and scientific terms which could not be easily understood (Kalusopa, 2005; Irivwieri, 2007).

Ill-timed recommendations from experts or aquaculture support systems are one of the difficulties reported in several studies. Useful information which arrives belatedly may be considered as useless. This situation may cause unfavorable yields from aquaculture activities or result in sub-optimal incomes (Krishna Reddy & Ankaiah, 2005). Moreover, complaints in regard to behind-schedule market prices were raised among project participants (Rao, 2007). Farmers unaware of the advantages and benefits from utilizing Internet presented another difficulty to be overcome (Rao, 2004). This issue may cause a large amount of investment and effort to become worthless.

Information delivery to Fish farmers

It is interesting to note that within Fish farming families, each member had differently impacting roles in conveying aquaculture information. The participants themselves (62.9%) provided aquaculture information to other family members, followed by their spouse (24.3%) and their children (6.4%). The government officials from the ministry of Agriculture, Livestock and Fisheries and in particular the department of Fisheries (56.5%) were mentioned as a major source of aquaculture information to the farmers other sources were web sites which also played a significant role in providing information.

The survey results and interviews with farmers and government officials, some factors needed to be considered in order to improve the aquaculture information dissemination.

The needs survey revealed that age, income and educational background of participants related to the ICT tools used to receive aquaculture information. Significantly, income level of participants related to technology familiarity and attitudes toward the technology services such as convenience, cost, knowledge enhancement, technology practices and information timeliness. In addition, participants educational level was also linked to the knowledge enhancement perceived by the participants.

Furthermore, age of respondents also reflect the use of the Internet to receive aquaculture information. This finding corresponded to the fact that the Internet in Kenya became commercialized in less than two decades. Therefore, it may be concluded that the technology emergence also affected the tendency of technology usage for fish farming purposes.

From the interview results it may be assumed that relationship between farmers and government officials responsible in a particular area affected how the information was delivered to farmers. A loose

relationship may urge farmers to make use of other available approaches including Internet tools and services.

Conclusion

The analysis of the survey revealed that the majority of fish farmers were satisfied with the Aquaculture information that they received through the internet and would like to continue to receive agriculture information on other topics.

Additionally, the interviews with fish farmers showed that the use of ICT tool for dissemination of aquaculture is another option for solving the gap between farmers and government officials. Consequently, a number of fish farmers can receive aquaculture information without waiting for the Fisheries officials' visits.

Comments from Fisheries Officers supported the advantages of using the Internet to provide the farmers instant announcements to a multitude of farmers in broad areas. This will help farmers stay up-to-date with aquaculture news, the farmers can recheck the information details at anytime they would like to because the provided information can be accessed at any time from the specific website. Compared to TV or radio, if the farmers did not watch or listen to the programs at that time, they would miss the information. In case they had a chance to do that, they might miss some information such as date, time and conditions. Even publications or brochures free provided to farmers included specific information details and could be rechecked several times, the farmers might simply lose these materials.

References:

Coche, G.A., B. Haight, and M. Vincke. 1994. Aquaculture development and research in sub-Saharan Africa: Synthesis of national reviews and indicative action plan for research. CIFA Technical Paper No. 23. Rome: FAO.
Brummett, R.E. &Pouomogne, V. (2004) Aquaculture Extension in Sub-Saharan Africa.
In: Coche, A.G. (Ed.), Aquaculture Extension in Sub-Saharan Africa. FAO Fish Circ., 1002. Rome: FAO, p. 55.
Mbugua, H.M. 2002. The role of fisheries department in aquaculture development in Kenya . *Samaki News: A Magazine of the Department of Fisheries of Kenya* 1(1): 24–30.
Bauman A, Smith BJ, Maibach EW, Reger-Nash B (2006). Evaluation of mass media campaign for physical activity. J. Eval. Program Plann., 29(3): 312-322.
Goe WR, Kenny M (2005). The information age: Implication for U.S agriculture, J. Rev. Policy Res., 6(2): 260-272.

Musa AH, Md Salleh H, Narimah I, Abdul Muati Zamri A, Ishak AH, Jusang B (2000). Accessibility to IT among the community. Paper presented at Community and ICT Seminar, 10-11 May 2000. Pusat Pendidikan Luar UPM, Serdang.

Nielsen L, Heffernan C (2006). New tools to connect people and places: The impact of ICTs on learning among resources poor farmers in Bolivia, J. Int., 18(6): 889-900.

Abbas, M. Sheikh, A.D., Muhammad, S. and Ashfaq, M. (2003). Role of electronic media in the adoption of agricultural technologies by farmers in the central Punjab- Pakistan. *Int. J. Agri. Biol*., 5: 22–5.

Buren, E.D. (2000). *Cultural Aspects of Communication for Development.* Trans: Falsafi, S. Tehran. Iran: IRIB Press.

FAO. (2001). Knowledge and information for food security in Africa from traditional media to the Internet. Communication for Development Group, Sustainable Development Department.Rome: FAO.

Tiwari, S.P. (2008). Information and communication technology initiatives for knowledgesharing in agriculture. *Indian Journal of Agricultural Sciences, 78*(9), 737 – 747.

Shiblaq, F. & Fielden, K. (2008). ICT provision in a rural community: a New Zealand case study. *Proceedings of the IADIS International Conference ICT, Society and Human Beings.* The Netherlands: Amsterdam.

Asche, F. et al. (2008) Future trends in aquaculture: Productivity growth and increased production, Springer Link.

Munyua, H., Adera, E., & Jensen, M. (2008). Emerging ICTs and their potential in revitalizing small scale agriculture in Africa. *Proceedings of the World Conference onAgricultural Information and IT* (pp. 707 - 718). Japan: Atsugi.

Bjørndal, T. et al. (2002) The development of salmon and trout aquaculture. *CIHEAM*

Bureau of Fisheries and Aquatic Resources (BFAR) (2008). Roadmap commodity:Tilapia.Fisheries, Policy and Economics Division, Bureau of Fisheries and Aquatic Resources.

Fitzsimmons, K. (2010) Potential to increase global tilapia production: Potential to increase global tilapia production: Global Outlook for Aquaculture Leadership, Kuala Lumpa 2010

Locke, S. (2005). Farmer adoption of ICT in New Zealand. *The Business Review, Cambridge, 3*(2), 191 – 197.

Kiplang‟at, J. & Ocholla, D.N. (2005). Diffusion of information and communication technologies in communication of agricultural information among agricultural researchers and extension workers in Kenya. *South African Journal of Libraries and Information Science, 71*(3), 234 – 246.

Norman-López, A., & Bjørndal T. (2009) Is tilapia the same product worldwide or are markets segmented? *Aquaculture Economics & Management, 13*(2), 138-154. doi:10.1080/13657300902885360

Hassan, M.S., Hassan, M.A., Samah, B.A., Ismail, N., & Shaffril, H.A.M. (2008). Use of information and communication technology (ICT) among agri-based entrepreneurs in Malaysia. *Proceedings of the World Conference on Agricultural Information and IT* (pp. 753 - 762). Japan: Atsugi.

Dorfman, J. and R. Watson. 2005. "Farming, the Internet, and E-Market Structures." *Ecommerce in Agribusiness.* T. Schmitz, C. Moss, A. Schmitz, A. Kagan, and B. Babcock, eds. Longboat Key, FL: Florida Science Source.

Nachmias and Nachmias (2007); *Research Methods in the Social Sciences: Worth Publishers, New York* Mugenda, O. M and Mugenda, A. G (2003). *Research Methods: Quantitative and Qualitative Approaches.* Nairobi, Acts Press.

Wiersma , W& Jurs S (2005) : *Research Methods in Education*, Ally and Bacon ;Boston Ngechu. M. (2004). *Understanding the research process and methods*. An introduction to research methods. Acts Press, Nairobi.