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Roles of Information and Communications Technologies in Improving Fish Farming and Production in Rivers State, Nigeria.

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Abstract

The study examined the roles of ICTs for improved fish farming and production in Rivers State, Nigeria. The specific objectives were to - describe the socioeconomic characteristics of the responding fish farmers in the area; identify ICT devices used by respondents in the area; examine fish farming/production information needs of respondents; ascertain ICT roles in promoting fish farming and production in the study area; and identify problems of ICTs use by fish farmers in the study area. Multi stage sampling technique was adopted in sample selection. Data were collected with use of questionnaire and interview schedule. The sample size was 150 fish farmers randomly selected from a list of 1500 registered ICT user fish farmers obtained from fish farmers cooperative office in Andoni, headquarters of Zone II. Data were analyzed using descriptive tools such as percentages, presented in tabular forms. Majority, (43.3%) were 41-50 years with a mean age of 42.5 years, 91.3% were males, 76% were married, 63.3% had a family size of 1-4 people. Majority (56%) had secondary education, 50.6% had between 21-30 years in fishing experience. ICT devices used includes mobile phones, radio, television, internet, journals and magazines among. Fish farmers needed information on pond construction, sources of fingerlings, sales and marketing, diseases treatment, weather/temperature among many more. ICTs play the following roles in fish farming: information exchange, knowledge sharing, promotion of education, monitoring illegal fishing and price information provisioning. The challenges facing them includes high cost of device, low level of education, power supply, network problem among others. It was recommended that education and training be given to the farmers by the extension agents, power supply and network services should be improved the various bodies responsible for the services

Keywords- Fish farming, ICTs, temperature, marketing, Rivers state.

Introduction

The Nigerian fishing industry comprises of three major sub sectors namely the artisanal, industrial and aquaculture. The awareness on potential of aquaculture to contribute to domestic fish production has continued to increase in the country. This stems from the need to meet the much needed fish for domestic production and export. Fish species which are commonly cultured include *Tilapia spp*, *Heterobranchus bodorsalis*, *Clarias gariepinus*, *Mugie spp*, *Chrysichthys nigrodigitatus*, *Heterotis niloticus*, *Ophiocephalus obscure*, *Cyprinus carpio* and *Megalo spp*. Fish culture is done in enclosures such as tanks. The aquaculture sub sector contributes between 0.5% and 1% to Nigeria's domestic fish production ((Adewuyi et al., 2010).)

The rapid growth in the demand for productive agriculture of which fish farming is a major sub-sector calls for provision of efficient flow of information and knowledge to the fish farmers, without gender prejudice, for better decision making. Agriculture draws upon infinite sources of widely dispersed, locally contextualized knowledge and considerable body of research materials. It relies upon continuous flow of information from local and world markets (Rutger, 2000). It involves such sub-sectors as fish farming, crop production and livestock rearing. Fish farming has become a common practice to increase income of practitioners and in the process reduce the wage bill expended on fish importation. Fish farmers thus need information to optimize production.

In most developing countries, agriculture is the most important economic activity which provides food, employment, foreign exchange and raw materials for industries. Agriculture provides livelihood for at least 53% of the economically active population of Africa (Ajala and Ononogbo, 2008). Among the different aspects of agricultural practices is fish farming, which has gained prominence in Nigeria since the advent of the fourth democratic republic in 1999. Fish provides cheaper source of protein (Moses, 1983), it makes a vital contribution to the food and nutritional security of about 200 million Africans and provides income for over 10 million people, consisting mostly small scale fish farmers and entrepreneurs who are engaged in fish production (World Fish Centre, 2005). In agriculture, the role of information in enhancing agricultural development cannot be over emphasized. Information is vital for increasing food production and improving marketing and distribution strategies (Oladele, 2006). According to Aina *et al.* (1995), information has a vital role to play in improving and sustaining agricultural production of any nation. Information as a factor of production is necessary to increase productivity. It has been established that poverty

in Nigeria has a strong linkage with agricultural stagnation due to decline in productivity as a result of low use of information and improved technologies (FAO, 1999). The enhancement of local fish production can be achieved by improving capacity in terms of enhancing access to information which can be achieved through enhanced information seeking behavior by the use of information communication technologies (Akinbile and Alabi, 2010). Information can be said to be knowledge based on facts which arises as a result of generated data or experience. Aina (1995) defined information as the data for decision making. It is a resource that must be acquired and used in order to make an informed decision. Those who possess appropriate and timely information are likely to make a more rational decision than those without information.

The fact remains that at various levels of human endeavors good communication is absolutely imperative also information as a factor of production is necessary to increase productivity. Fish farmers thus need information to optimize production. Due to the growing population of fish farmers, different kinds of information are being made available to those interested, particularly on how to start fish farming, management of fish farming and what to do when one is at a cross road. Seminars and workshops are often organized to enlighten and educate people on fish farming management practices (Akinbile & Alabi 2010).

Problem of Research statement

Many fish farms focus on catfish, as they can have a market value of two to three times that of tilapia (Longhurst, 2000). The major constraints to fish farming were identified to be those of environmental impacts of aquaculture operations that is water pollution (Olagunju *et al.*, 2007) inadequate supply of fingerlings, inadequate information and feeds supply (Assiah, 1997). Information and communication technology (ICT) is enhancing the capacity building of different communities. The fishermen as one of the big community farmers in Rivers State, Nigeria are facing different problems and hindrances to enhance their income. Fisheries productivity can be increased in the State through usage of ICT among fishermen. It could bring changes in economic development and enhance the quality of life especially fishermen community. Fish farmers face many financial and economic problems in use of ICT. Similarly many fishermen do not take interest to use ICT (Hosseini *et al.*, 2009). There are many other factors observed such as lack of interest of ICT service providers in rural areas and low quality of service as major causes of not using ICT tools among fishermen community. The fishermen community do not have proper access to connect directly with market due to lack of proper usage of computer and mobile phones (Odada *et al.* 2004). Omar *et al.* (2011) indicated that fishermen are facing many problems

and hindrances in ICT usage including the expensive cost particularly computer and sonar. Fishermen still depend on the traditional way having no exposure towards ICT usage and ICT benefits. They are not able to judge the status of the trade and could decide whether to sale their product or to remain at sea to continue fishing. The fishermen hesitate to learn about ICT from experts. Fowler & Etchegary (2001) revealed that mobile phones were still relatively expensive for the poor farmers and fishermen. In addition to the cost of the phone itself, maintenance factors such as cost of recharging the phones are also important considerations in developing countries regions (Fowler & Etchegary. 2001).

Munyua (2007) indicated in the African context that uncoordinated ICT initiatives have created several problems including the high cost of the technology, poor ICT connectivity, skills and lack of local contents. Furthermore, there is a lack of information sharing culture and low awareness of the role of ICT in development at all levels. These issues raise the questions of finding out the appropriate ICT tools. While mobile phones may be suitable for certain aspects of improving lives of fishermen community, similarly other technologies such as radio or internet could play an equally important complementary role in significant changes of the recent world. We could say that media strongly presented important role in human development. Unfortunately in most fishing communities, empowerment projects are not in the habit to think about ICT tools as a pivotal component toward this change. There is dearth of information and data in this important area of agriculture in the study area, therefore necessitating this research. The specific objectives therefore were to : a) describe the socioeconomic characteristics of the responding fish farmers in the area; b). identify ICT devices used by respondents in the area; c) examine fish farming/production information needs of respondents; d) ascertain ICT roles in promoting fish farming and production in the study area; and e) identify problems of ICT use by fish farmers in the study area.

Methodology

This study was carried out in Rivers State of Nigeria. The state is bounded on the South by Atlantic Ocean, on the north by Anambra state, Imo state and Abia state, on the east by Akwa Ibom state and the west by Bayelsa and Delta state. Rivers State which is in the Niger Delta has topography of flat plains with a network of rivers and tributaries. These include new Calabar, Orashi, Bonny, among other Rivers. Rivers State lies between latitude five (5°N') North and mid-way between longitude five (5°s') South of the Greenwich meridian (**RSADP,2000**). The state is divided into 3 agricultural zones as show in table 1, by the Rivers State Agricultural Development Project (RISADP), and **Zone II (FISHING**

ZONE) made up of 8 local government areas was chosen for the study. The 3 zones are made up of 23 Local Government Areas (LGAs) of Rivers State. Fish farmers in the state constituted the population for the study. A multi-stage random sampling technique was used to select respondents. Five LGAs were purposively selected because of their natural endowment for fish production. Three (3) communities were also randomly selected from each of the five LGAs to give a total of fifteen (15) communities. Ten fish farmers were then purposively selected from each of the fifteen communities. This gave a sample size of 150. Data for the study were collected through a semi-structured interview schedule. Data from the study were analyzed by use of descriptive statistics to characterize the respondents on their socio-economic status such as educational level, fish farm experience, household size etc (objective 1) and to identify ICT devices in use (objective 2). Accordingly, objectives 3,4 and 5 were analyzed using frequency and percentages.

Table 1: Agricultural Zones in Rivers State

Zones I – Crop Zone Headquarters: Bori	Zone II – Fishing Zone Headquarters: Andoni	Zone III – Crop/Livestock Zone Headquarters: Omuma.
Port Harcourt	Abua/Odual	Ahoada East
Obio/Akpor	Akuku-Toru	Ahoada West
Khana	Andoni	Emohua
Gokana	Asari-Toru	Etche
Oyigbo	Degema	Ikwerre
Tai	Wakirike	Ogba-Egbema-Ndoni
Eleme	Opobo/Nkoro	Omuma
Ogu-Bolo	Bonny	

Source: Rivers State Agricultural Development Programme Annual Report (2000)

Results and Discussion

Socioeconomic characteristics of Respondents

Table 1 at a glance shows the socioeconomic characteristics of the respondents. The table revealed that majority (91.3%) were males, while 8.7% were females. The high number of males shows their dominant position in the farm family decision making and as heads of families. Majority (43.3%) were within the age bracket of 41-50 years, 33.3% were within the age of 31-40 years. The mean age was 42.5 years showing that they are healthy and strong to

perform the task of fish farming. On marital status of the respondents, 76% were married, 10% were widowers with 8.7% and 5.3% being widows and singles respectively. Majority (63.3%) had a household size of 1-4 members, 31.3% had 5-8 people, while 6.7% had 9-12 dependents. The mean household size was 4.3 members. This shows that the respondents have family members who help in the fish farming business. The respondents have put in many years in fish farming. The table revealed also that 50.6% had put in 21-30 years, 24.6% had put in more than 31 years in fish farming. The mean fish farming experience was 24.5 years. This implies that the respondents have a good knowledge of fish farming. More than 80% of the respondents were literates as shown by 56% that had attended secondary school, 31.3% attended primary school, while 8% had tertiary education. Education helps in socialization, exposure of people, and in the adoption of recommended farm practices. Majority (84.6%) belonged to social organizations, where they socialize and come to know the events taking place in their world. Social organization helps educate members through interaction and socialization. On extension visit, 56.6% had no extension visit at all, 36.7% had it once in a month and 6.6% had twice monthly.

Table 1: Socioeconomic characteristic of Respondents

Characteristic	Frequency	Percentage
Sex		
Male	137	91.3
Female	13	8.7
Age		
21-30	10	6.7
31-40	50	33.3
41-50	65	43.3
51-60	25	16.7
Marital status		
Married	114	76.0
Widow	13	8.7
Widower	15	10.0
Single	8	5.3
Household size		
1-4	93	63.3

5-8	47	31.3
9-12	10	6.7
Education		
No. formal education	7	4.6
Primary	47	31.3
Secondary	84	56.0
Tertiary	12	8.0
Fishing Experience		
1-10	15	10.0
11-20	22	14.7
21-30	76	50.6
31 & above	37	24.6
Membership of organization		
Yes	127	84.6
No	23	15.3
Extension visit		
No visit	85	56.6
Once monthly	55	36.7
Twice monthly	10	6.6

Field survey data, 2016

Information and communication Technology Devices

The identification and use of ICT devices by fish farmers was pursued and the result is given in Table 2 below. The fish farmers indicated that the most available and used ICT devices/tools were mobile phones (100%), radio (96.6%), television (87.3%) and Newspapers and magazines (74.7%). Other devices used by the respondents included video CD (28.6%), CD-ROM (36%), journals/pamphlets (67.3%) and internet (49.3%), diskett (27.7%) email (28.6%. and GPS (5.3%). This is in line with Gangadhar, (2011) who posited that digital and other electronic technologies are transforming our economies, societies and lives. Technology has had an especially profound impact on the information and communications activities that have always been central to sustainable development. Information and communications

technologies (ICTs) refers to technologies that facilitate communication and the processing and transmission of information by electronic means¹,” a definition encompassing the full range of ICTs, from radio and television to telephones (fixed and mobile), computers and the Internet. ICT usage has evolved in an unstructured way through a combination of market forces, the ingenuity of civil society and varying favourable government frameworks. New technological applications are being used across the fisheries value chains (maritime, inland and aquaculture). Some are specialist applications with a particular role in fishing such as sonar for locating fish. Others are general purpose applications such as Global Positioning System applications (GPS) used for navigation and location finding, mobile phones for trading and emergencies, radio programming targeted at – and in many cases compiled by – fishing communities and Web-based fisheries-specific information and networking resources (FAO,2007).

Table 2: ICT Devices used by Respondents

DEVICES	FREQUENCY	PERCENTAGE
Mobile Phone	150	100
Television	131	87.3
Radio	145	96.6
Video CD	43	28.6
CD-ROM	54	36
Email	43	28.6
Internet	74	49.3
GPS	8	5.3
Newspapers/ magazines	112	74.7
Journals and Pamphlets	101	67.3
Diskette	43	28.6

Field survey data, 2016

Areas of Information Need in Fish Farming and Production

Fish farmers need information on every aspect of fish farming and production. Entries in Table 3 revealed that all the respondents (100%) needed information on fish pond construction, sources of fingerlings (96.6%), feeds/feeding type (82.6%), diseases prevention (95.3%), diseases treatment/sanitation (90.6%), fish harvesting time (83.3%), suitable land/size (92.6%), water quality/management (88.6%) financial advices/services (94.6%, and

sales and marketing of fish, weather/temperature condition (97.3%) and training/education (91.3%). Other area of information were fish processing & preservation (73.3%), feed storage (83.3%), equipment purchase/repairs (69.3%), and general pond management (71.3%).

There is therefore, a recognized need for accurate, trustworthy and readily available market information since this is required for both short and medium term planning of production, harvesting, processing and sales. Farmers are a social group that is especially prone to the costs associated with information asymmetries, lacking data on prices, market conditions, regulations and new opportunities (Greenwald and Stiglitz, 1986). It should be recognized through that the same is true of the urban consumers and agri-business sector that may also lack information with which to make decisions. Farmers who are the direct sources of this information are often located in relatively remote communities resulting in delays in the transmission of important data in both directions.

This information is potentially useful to farmers themselves, their organisations and communities, as well as various other stakeholders interested in the improvement of farmers' well-being. For example, the role played by farmers who agree to cooperate in agricultural development via the provision of information can be crucial in modernising the agricultural sector using information and communication technologies. It should also be recalled that many farmers in developing countries are women, and ICT access can potentially fulfil an important gender empowerment role through providing women farmers access to communication and information on issues beyond agriculture (Hafkin and Odame, 2003).

Table 3: Areas of Information Needs of Fish farmers

Information Areas in Fish Farming	Frequency	Percentage
Pond construction	150	100
Sources of fingerlings/types	145	96.6
Feeds and feeding type	124	82.6
Disease prevention	143	95.3
Disease treatment & Sanitation	136	90.6
Fish harvesting time/technique	125	83.3
Fish processing/ preservation	110	73.3
Suitable site (land)	139	92.6
Water quality/ management	133	88.6
Financial advices / services	142	94.6
Feed storage	125	83.3
Equipment purchase/ repair	104	69.3
General pond management	107	71.3
Sales and marketing	148	98.6
Training / education	137	91.3
Weather/ temperature	146	97.3

Field survey data, 2016

Roles of ICTS in fish farming and Production

The roles of ICTs are numerous and important in fish farming and production. Table 4 showed that knowledge sharing among fish farmers and monitoring of illegal fishing are the major roles of ICTs in fish farming as indicated by 100% response. Other major roles were information exchange and emergency alerts (95.3%), sales and marketing (91.3%), prices information provisions (98.6%), food & livestock security issues (83.3%), increasing safety at sea (91.3%), promotion of education/ training (94.6%), receiving weather reports (88.6%) and protecting local fisher-folk through surveillances with 98.6% response. ICT also acts to reduce vulnerability among fisher folk (72.6%) and social inclusion (50%) which makes farmers have right sense of belonging.

The above means that good and timely knowledge is essential for competing in local and global markets. Information about prices and availability can be shared across value chains, increasing the power of smaller or otherwise disadvantaged groups while reducing the volatility of fish prices and wastage of fish. Valuable information that can be made available through ICTs includes fishing and processing techniques and equipment, sales and marketing

advice, financial advice and services and legal issues. Access to and exchange of key information can assist fishing communities in making informed decisions on a variety of matters from whether to engage in specific fishing operations to trading at a local market to participating in a meeting – decisions that can help reduce their vulnerability and improve their opportunities. ICTs can also assist people to be heard, encourage networking and knowledge-sharing and increase access to the governance process and political agency. Food and livelihoods security issues and the lack of extension support for fishers and fish farmers can be addressed through information networks. New opportunities can emerge from combining mobile and newer networking technologies such as WiFi and WiMax, digital radio satellite broadcasting (such as WorldSpace or the Indian national satellite systems) and continuing developments in low-cost, low-power computers (2007). This can enable access to a range of government services (e-government), for example, by marginalized, mobile and/or remote fishing communities. If supported by capacity-building, this also opens up educational, health and other content of crucial importance to livelihoods. For example, the pilot Fishnet set up by the Ilaje local government in Ondo State, Nigeria, used meetings, television, leaflets, radio, posters and other methods, supervised by fisher cooperative groups, to share user-driven content on fish production techniques. The success of the project's listening groups also showed the value of targeting such ICT products to groups rather than individuals (FAO,2007).

The vulnerability of fishing communities is highly linked to the sensitivity of their livelihoods systems to risks. These risks, the means to recognize and address them, as well as the confidence to do so, need to be identified and communicated to reduce vulnerability, According to the International Collective in Support of Fishworkers, “fishing is probably the most dangerous occupation in the world the tragic consequences of accidents at sea are borne by the fishers’ dependants and the fishing community at large (2007). ICTs are increasingly being used to ensure safety at sea. Fishers can have access to up-to-date weather information before setting out, through community radio stations, loudspeakers and telecentres collecting and broadcasting information. Mobiles and radios also allow better communication with other boats and the shore.

ICTs can empower fishing communities in local and national campaigning and advocacy work to facilitate dialogue with policy-makers. In Senegal and Chad, for example, the Sustainable Fisheries Livelihoods Programme (SFLP) ran workshops and a photo exhibit to showcase post-harvest fisheries, targeting representatives of local and central government

authorities. Radio, and particularly participatory video, are valuable tools for empowering people to speak to wide audiences in a direct and emotionally charged way (FAO,2007).

Table 4 : ICT Roles in Promoting Fish Farming and Production

Roles of ICT in Promoting Fish Farming	Frequency	Percentage
Information exchange and emergencies	143	95.3
Knowledge sharing	150	100
Online trading	137	91.3
Marketing / Price information provisioning	148	98.6
Food/ livestock security issues	125	83.3
Vulnerability reduction	109	72.6
Increasing safety at sea	137	91.3
Social inclusion	75	50.0
Promotion of education and training	142	94.6
Monitoring of illegal fishing	150	100
Protecting local fisher-folk through surveillance	148	98.6
Receiving weather report	133	88.6

Field survey data, 2016

Challenges of ICT use by fish farmers

Many problems plague fish farmers use of ICT devices in the study area. The major problems as shown in table 5 were high cost of device (92.6%), low income of farmers (98.6%), erratic/unstable power supply (96.6%), low scale agricultural production (95.3%), lack of training on ICT (80.6%), low level of education (86.6%), poor access to ICT devices (87.3%) and poor connectivity/network problem (82.6%), problems of ICT devices maintenance (88.6%), lack of awareness/knowledge of ICT facilities (72.3%), lack of skills to operate ICT devices (79.3%). ICT face a number of unique barriers in rural communities that will have to be overcome. As Kenny et al (2000) observe, geography plays a very strong part in the determination of communications costs and functionality. In rural communities, where a sparse population implies that potential users live in area of low demand density, communications costs will be higher and services will be less well developed. This is due to what is known as the economics of networks. Thus ICT in rural areas cost more per line both because each connection is further from the next, and because it is not possible to achieve economies of scale in switching.

Table 5: Challenges of ICT use in Study Area

Challenges	Frequency	Percentage
High cost of device	139	92.6
Low income of farmers	148	98.6
Low level of education/illiteracy	130	86.6
Poor access to ICT device	131	87.3
Erratic power supply	145	96.6
Poor connectivity/network problem	124	82.6
Lack of enabling government policy	110	73.3
Problems of ICT facilities maintenance	133	88.6
Low scale agricultural production	143	95.3
Lack of skills to operate ICTs facilities	119	79.3
Lack of awareness/knowledge of ICT	109	72.6
Lack of training on ICT	121	80.6
Field survey data, 2016		

Conclusion

ICT can play an important role in enhancing the capacity of people specially fishermen community. ICT devices such as mobile phones, radio, television and internet were available to the farmers. They need information on pond construction, marketing, fingerling, weather/temperature among others. ICT helps the famers in knowledge sharing, training and education, vulnerability reduction and social inclusion. The problem they encounter includes low income, erratic power supply, cost of ICT devices.

References

- Aina, L.O. (1995). Information and Agriculture in Africa in Agricultural Information in Africa. Aina L.O.; A.M Kaniki, J.B Ojiambo (Eds.), Published by Third World Information Services Ltd. Ibadan, pp. 1 – 11.
- Aina; I.O, Kaniki, A.M. Ojiambo, J.B (1995), Agricultural Information In Africa, Third World Information Services Ltd. Ibadan Pp12-31.
- Ajala, C. G. and Ononogbo, U. N. (2008). An overview of HIV/Aids scourge among the rural residents of Benue State, Nigeria. Proceedings of the Seventeenth Annual Congress of

Nigeria Rural Sociological Association (NRSA) held at National Root Crops Research Institute, Umudike, Abia State, Nigeria, 19th – 22nd August, 2008: 23 – 30.

Akinbile L.A, and Alabi, O.E (2010). Use of ICTs among Fish Farmers in Oyo State. J. Agric. Ext., 14(1).

FAO. (1999). The State of World Fisheries and Aquaculture. 1998 Food and Agriculture Organization, Rome, Italy.

FAO (2007) Information And Communications Technologies Benefit Fishing Communities New Directions In Fisheries A Series of Policy Briefs. Food and Agriculture Organization, Rome, Italy.

Fowler, K., & Etchegary, H. (2008). Economic crisis and social capital. The story of two rural fishing communities. *Journal of Occupational and Organizational Psychology*, 81 (2), 319-341.

Gangadhar, M. (2011) The Role And Relevance Of Ict Use In Fisheries Sector In India: Emerging Policy Implications *International Journal Of Advanced Research In Management And Technology Vol. 1 No. 1 (January-June 2011) Pp. 1-14*

Greenwald, B. and J.E. Stiglitz (1986), Externalities in economies with imperfect information and incomplete markets, **Quarterly Journal of Economics**, 101: 229-264.

Hafkin, N.J. and Odame, H.H., (2002), Gender, ICT and Agriculture, A Situation Analysis for the 5th Consultative Expert Meeting of CTA's ICT Observatory meeting on Gender and Agriculture in the Information Society.

Hosseini, S. J. F., Niknami, M., & Chizari, M. (2009). To determine the challenges in the application of ICTs by the agricultural extension service in Iran. *Journal of Agricultural Extension and Rural Development*, 1 (1), 27-30

Kenny, C., Navas-Sabater, J. and Qiang, CZ., (2000), ICT and Poverty, World Bank, Washington, DC

Moses, B.S. (1983). Introduction of Tropical Fisheries, Ibadan University Press, Ibadan, Nigeria. pp 120.

Munyua, H.. (2007). ICTs and small-scale agriculture in Africa. A scoping study. International development research centre. (IDRC).Ottawa. Retrieved from http://web.idrc.ca/uploads/userS/12212542261Final_Report_HMunyua.pdf. Accessed on 29 February, 2012

Oladele, O.I. (2006). Multilingualism of farm broadcast and agricultural information access in Nigeria. *Nordic Journal of African Studies* 15 (2): 199 – 205.

Odada, E. O., Olago, D. O., Kulindwa, K., Ntiba, M., & Wandiga, S. (2004). Mitigation of environmental problems in Lake Victoria, East Africa: Causal chain and policy options analyses. *A Journal of the Human Environment*, 33 (1), 13-23.

Omar, S. Z., Hassan, M. A., Shaffril, H. A. M., Bolong, J., & D' Silva, J. L. (2011). Information and communication technology for fisheries industry development in Malaysia. *African Journal of Agricultural Research*, 6 (17), 4166-4176.

RSADP (2000). Rivers State Agricultural Development Programme Annual Report. *Rivers State Ministry of Agriculture, Nigeria* 36 pp

Rutger JE (2000). Technical. Policy and Institutional Trends in Information and Communication. Proceedings of a CTA Seminar

World Fish Centre, (2005). Fish and Food Security in Africa. World Fish Centre, Penang, Malaysia.