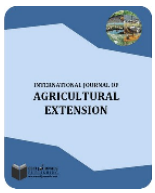

Available Online at ESci Journals
International Journal of Agricultural Extension
ISSN: 2311-6110 (Online), 2311-8547 (Print)
http://www.escijournals.net/IJAE

CLIENT FOCUSED EXTENSION APPROACH FOR DISSEMINATING SOIL FERTILITY MANAGEMENT IN CENTRAL KENYA

[a]Serah W.K. Muchai, [b]Monicah W.M. Muna, [c]Jane N. Mugwe, [d]Daniel N. Mugendi, [e]Franklin S. Mairura

[a] Department of Social and Development Studies, Mt. Kenya University P.O Box 342-01000 Thika, Kenya.
[b] Department of Environmental Science, Kenyatta University P.O Box 43844 Nairobi, Kenya.
[c] Department of Agricultural Resource Management, Kenyatta University P.O Box 43844 Nairobi, Kenya.
[d] Embu University College P.O Box 6 – 60100, Kenya.
[e] Tropical Soil Biology and Fertility, P.O Box 30677, Nairobi, Kenya.

A B S T R A C T

Land degradation and soil nutrient depletion have become serious threats to agricultural productivity in sub- Saharan Africa. To improve agriculture production, research has led to recommendation of a range of integrated Soil fertility Management (ISFM) options, of proven effectiveness, for soil fertility improvement. Although many factors contribute to the low adoption of ISFM by farmers, communication gaps between extension agents and farmers lie at the heart of the problem. Hence, the study sought to investigate factors considered by agricultural extension agents in selection of communication channels to disseminate soil fertility information in the central highlands of Kenya. Structured questionnaires were used to elicit information from 105 extension agents. Both descriptive and inferential statistics were used for data analysis. In choosing the communication method to be used in dissemination of soil fertility management (SFM) practices, target group was scored as the most relevant factor followed by type of SFM, time available then number of staff sequentially. Education was perceived to highly influence the selection of workshop (M= 3.4) while age was perceived to highly influence the selection of video showing (M= 2.8) as extension methods in dissemination of SFM. The implication of the study is that diverse communication channels should be utilized to get to farmers of different socio economic characteristics.

Keywords: Dissemination, Education, Extension agents, Target group

INTRODUCTION:

Soil fertility replenishment in sub Saharan Africa (SSA) is critical to the process of poverty alleviation (Place et al., 2003). Although researchers have developed many soil fertility improving technologies, adoption of the technologies still remains low. One of the reasons for the low adoption is inadequate awareness of the technologies (Nyambati *et al.,* 2003). The agricultural extension service has been in the forefront in educating farmers about new technology and providing technical assistance (Ford, 1995). Extension system acted as liaison between the researcher and farmer. They are endowed with the responsibility of conveying research findings from the scientists to the farmers and feeding back the impressions of the farmers to the scientists. Dinar *et al.* (2006) emphasized that agricultural extension not only accelerates the diffusion process and the adoption of new varieties and technologies but also improves the managerial ability of farmers and affects the efficient utilization of existing technologies by improving farmers' know-how.

The success of dissemination of soil fertility management technologies will largely depend on the teaching methods used by extension agents in conveying information to the farmers. According to Ogunwale (1991) effective extension agents must not only rely on variety of extension teaching methods to do their job well, they must also know where and how to use them. Overall, public extension services have consistently failed to deal with the site-specific needs, characteristics and problems of the farmers (Ahmad, 2000). Given all

* Corresponding Author:
Email: sarahmuchai@yahoo.com

the training and skills that extension agents possess, the approach and methods of interaction with farmers is critical in the evolvement of the rapport that develops between extension agents and farmers. According to Nyambo and Ligate (2013) no single source of information can be used to deliver new technologies where there are diverse targets because of differences in social cultural relationships and institutional arrangements. It was thus considered essential to analyse the extension system in dissemination of soil fertility management practices in the central highlands of Kenya. The main objectives was to assess the extension methods used by the extension agents and investigate factors considered in selection of the methods used by extension agents in Central Kenya.

METHODOLOGY

The study was conducted in four districts Embu, Maara, Meru South and Mbeere South districts in the central highlands of Kenya. Purposive sampling was drawn based on the districts with significant ISFM research investment. Research design was a descriptive survey method. A draft questionnaire was pre-tested on two agricultural extension officers from the four districts (Mbeere South, Embu, Meru South and Maara). Those respondents who participated in the pre-test exercise were excluded in the actual survey where 105 extension officers were interviewed. The data was analyzed in Statistical Package for Social Science (SPSS16.0) software. Descriptive statistics such as percentages, frequencies, mean and standard deviation was used to display the data.

RESULTS AND DISCUSSION

The mean age for extension agents in Maara, Meru South, Mbeere South and Embu districts was 45, 48, 46 and 47, respectively. Most (53.3%) of the extension officers ranged between 41-50 years of age, however out of the 19 extension agents from Maara , 36.8% were between 51-60 years while 31.6% ranged between 25-40 years of age (Table 1). Most (50.5%) of the extension officers were certificate holders followed by 29.5% with diploma certificates. A higher percentage (38.5%) of the extension officers who had attained degree certificates were from Maara district. Only 2.9% of the sample had attained Masters Degree. Out of the 105 extension agents, 78.1% of the extension agents had more than 15 years of experience. However 31.6%, of the extension agents from Maara district had less than 10 years of experience (Table 1).

Table 1. Social demographic characteristics of extension agents in Central Kenya.

Gender	Districts				Total
	Maara	Meru south	Mbeere south	Embu	
Male	9 (47.4)	17 (73.9)	16 (64)	14 (36.8)	56 (53.3)
Female	10 (52.6)	6 (26.1)	9 (36)	24 (63.2)	49 (46.7)
Total	19 (100)	23 (100)	25 (100)	38 (100)	105 (100)
Age Category					
25-40	6 (31.6)	1 (4.3)	4 (16)	3 (7.9)	14 (13.3)
41-50	6 (31.6)	14 (60.9)	14 (56)	22 (57.9)	56 (53.3)
51-60	7 (36.8)	8 (34.8)	7 (28)	13 (34.2)	35 (33.3)
Total	19 (100)	23 (100)	25 (100)	38 (100)	105 (100)
Level of education					
Certificate	9 (47.4)	11 (47.8)	14 (56)	19 (50)	53 (50.5)
Diploma	4 (21.1)	7 (30.4)	8 (32)	12 (31.6)	31 (29.5)
Higher diploma	0	0	1 (4)	0	1 (1)
Degree	5 (26.3)	2 (8.7)	2 (8)	4 (10.5)	13 (12.4)
Masters	1 (5.3)	1 (4.3)	0	1 (2.6)	3 (2.9)
Others	0	2 (8.7)	0	2 (5.3)	4 (3.8)
Total	19 (100)	23 (100)	25 (100)	38 (100)	105 (100)
Years of experience					
< 5 years	3 (15.8)	0	3 (12)	2 (5.3)	8 (7.6)
5-10years	3 (15.8)	0	0	1 (2.6)	4 (3.8)
10-15years	2 (10.5)	2 (8.7)	2 (8)	5 (13.2)	11 (10.5)
> 15 years	11 (57.9)	21 (91.3)	20 (80)	30 (78.9)	82 (78.1)
Total	19 (100)	23 (100)	25 (100)	38 (100)	105 (100)

N.B: Numbers in parentheses give the percentage of respondents

Majority (51%) of the extension agents were field extension workers while only 11.4% had their responsibilities in soil conservation. Approximately 46% and 30.4% of the extension workers from Mbeere South and Meru South respectively had their responsibilities in crop development (Table 2). Majority (51%) of the extension agents were field extension workers while only 11.4% had their responsibilities in soil conservation. Approximately 46% and 30.4% of the extension workers from Mbeere South and Meru South respectively had their responsibilities in crop development (Table 2).

Table 2. Key areas of responsibility by extension agents in Central Kenya.

Key areas of responsibility	Districts				Total
	Maara	Meru south	Mbeere south	Embu	
Soil conservation	4 (22.3)	3 (13)	1 (4)	3 (7.9)	12 (11.4)
Crops development	3 (6.8)	7 (30.4)	9 (46)	5 (13.2)	24(23.1)
Agribusiness	1 (5.6)	2 (8.7)	1 (4)	2 (5.3)	6 (5.8)
Home economics	1 (5.6)	2 (8.7)	3 (12)	3 (7.9)	9 (8.7)
Field extension worker	9 (50)	9 (39.1)	11 (44)	24 (63.2)	53 (51)
Total	18 (100)	23 (100)	25 (100)	38 (100)	104 (100)

N.B: Numbers in parentheses give the percentage of respondents

Farmers who attend trainings: Most of the extension agents (47.4%) in Maara indicated that the percentage of farmers who attended trainings ranged between 41-60% while in Meru South, 43.5% mentioned that attendance of farmers ranged between 21-40%. In Embu, 34.2% of the extension agents indicated that farmers who attended trainings ranged between 81-100% yet, overall 13.3% of the extension agents mentioned that less than 20% of the farmers in their areas of operation attended the trainings (Table 3).

Table 3. Percentage of farmers who attend trainings by districts in Central Kenya.

Percentage of farmers who attend trainings	Districts				Total
	Maara	Meru south	Mbeere south	Embu	
< 20%	2 (10.5)	5 (21.7)	5 (20)	2 (5.3)	14 (13.3)
21-40%	6 (31.6)	10 (43.5)	8 (32)	8 (21.1)	32 (30.5)
41-60%	9 (47.4)	4 (17.4)	8 (32)	15 (39.5)	36 (34.3)
81-100%	2 (10.5)	4 (17.4)	4 (16)	13 (34.2)	23 (21.9)
Total	19 (100)	23 (100)	25 (100)	38 (100)	105 (100)

N.B: Numbers in parentheses give the percentage of respondents

It is also likely that external factors associated with information flow in a system are likely to inhibit uptake and wide use of validated technologies. The current study identified challenges that hinder follow up on farmers who have been trained on SFM. The challenges were scored according to the level of severity as 1= not severe, 2=least severe, 3= moderately severe, 4= most severe. Extension agents considered resource constrain as the most severe constrain, followed by limited time, poor infrastructure and poor planning respectively. There were significant differences among districts on scoring of resource constraint at 1% probability level where it was scored most severe in Mbeere South and least severe in Meru South. Poor infrastructure was also significantly different at 1% probability level, where it was scored most severe in Mbeere South and least severe in Maara district (Table 4).

Table 4. Constraints that hinder effective follow up on farmers that have been trained on SFM by extension agents in Central Kenya.

District	Resource constraint	Poor infrastructure	Limited time	Poor planning
Maara	2.8 ±1(17)	1.9 ±1.1(15)	3.2 ±0.7(17)	1.8 ±0.9(15)
Meru South	2.2 ±0.8(22)	2.5 ±0.9(22)	2.7 ±1.2(21)	2 ±1.1(21)
Mbeere South	3.6 ±0.5(24)	3.2 ±0.9(25)	2.4 ±0.9(24)	1.9 ±0.9(24)
Embu	2.7 ±1.1(36)	2.6 ±0.8(36)	2.8 ±1(36)	1.9 ±1(36)
Total	2.8 ±1(99)	2.6 ±1(98)	2.7 ±1(98)	1.9 ±1(96)

Values are arranged as mean followed by standard deviation and number of respondents in parenthesis.

Extension methods used by extension agents in dissemination of soil fertility management practices: In the quest to promote agricultural development, extension agents have been using various methods including farmer group approaches, individual farmer approaches and mass media approaches. The most commonly used approach by extension agents was group approach (88.6 %) while 75.8% of the extension agents had not used mass media approach at all. About 59.2% of the extension agents moderately used individual contact method while only 1% had not used it at all. Majority (72.4%) of the extension officers frequently used field days as a method of communicating to farmers on soil fertility management. However, 46.6% of the respondents had frequently used demonstration while only 1% had not used demonstration as a method of communicating on soil fertility management practices. Among the respondents who were interviewed 72.9% and 72.6% had not used video documentaries or TV/radio, respectively (Table 5).

Teaching aids used by extension agents: Extension officers used varied visual aids while teaching farmers. Charts were the most commonly used by (31%) of the respondents followed by exhibits (21%). Teaching aids such as plays and video were never used by 60.9% and 76.6% of the respondents, respectively (Table 6).

Table 5. Extension methods used by extension agents in Maara, Meru South, Mbeere South and Embu districts.

Method of communication	Respondents (%)			
	Very frequent	Frequent	Rare	Never
Demonstration (N=103)	46.6	48.5	3.9	1
Field days (N=105)	17.1	72.4	8.6	1.9
leaflet /brochures (N=96)	3.1	26	51	19.8
video documentaries (N=96)	2.1	0	25	72.9
Exchange visits (N=96)	5.2	28.1	52.1	14.6
lecture method (N=100)	22	34	33	11
*mother baby (N=96)	9.4	44.8	28.1	17.7
Farmer field school (N=100)	9.7	47.6	34	8.7
TV /Radio (N=95)	0	7.4	20	72.6
Agricultural shows (N=99)	6.1	25.3	62.6	6.1
Magazines/books (N=98)	3.1	8.2	55.1	33.7

*Mother-Baby (MB) trial model is a methodology designed to improve the flow of information between farmers, extension agents and researchers. This design consists of two types of trials: The "Mother" trial is replicated within-site under researcher management. The "Baby" trials consist of a few treatments chosen by the farmer from the mother trial and are farmer managed.

Table 6. Teaching aids used by extension agent in Maara, Meru South, Mbeere South and Embu districts.

Teaching Aids	Percentage of respondents				
	Never	Rarely	Often	Very often	Total (N)
Charts	4	19.8	44.6	31.7	101
Plays	60.9	25	12.5	1.6	64
Video	76.6	17.2	4.7	1.6	64
Exhibits	2	32	45	21	100

Factors considered when choosing the communication channel for the different SFM practices: The rank order on the relevance of factors considered in choosing dissemination of SFM was identified through score values of the factors. The factor that got the highest score was taken as the most relevant. In choosing the communication method to be used in dissemination of SFM practices target group was scored as the most relevant factor followed by type of SFM, time available then number of staff respectively. However, extension agents scored availability of time as most relevant in choosing exchange visit while finances was considered as most relevant in selection of print media and workshops as communication methods. Type of SFM was considered very relevant while choosing farmer to farmer extension method (Table 7).

Table 7. Factors considered in choosing communication methods by extension agents in Central Kenya.

Communication methods	Factors considered				
	Target group	Type of SFM	Time available	Finances	No. of staff available
Demo	3.6	3.48	3.56	3.26	3.07
Field days	3.61	3.3	3.44	3.3	3.34
FFS	3.51	3.35	3.45	3.2	3.12
Video showing	2.81	2.56	2.49	2.41	2.01
Exchange visit	2.76	2.71	2.85	3.1	2.32
Farmer to farmer	2.87	3.06	2.85	2.33	2.34
Print media	2.59	2.54	2.27	2.67	1.74
Radio /TV	2.68	2.6	2.47	2.7	1.79
Workshops	3.45	3.12	3.25	3.54	3.15
Overall mean	3.1	2.96	2.96	2.95	2.54

Scores used 1=Not relevant, 2=Least relevant 3= moderately relevant 4= very relevant

Social economic factors considered in selection of Communication methods used in dissemination of SFM: Extension recognizes that farmers differ in their social economic characteristics which influence the choice of extension method used in dissemination of soil fertility management. To respond to the different groups of farmers, extension agents in the Central highlands rated the influence of the social economic characteristics in their choice of extension method using the following scores, 1= no influence, 2= little influence, 3= moderately influence, 4=highly influence. Education was perceived to highly influence the selection of workshop (3.39) and use of print media (2.93) as extension methods in dissemination of SFM while age was perceived to influence the selection of video showing (2.83). Gender was perceived to have least influence in selection of all the listed extension methods in selection of print media and radio/TV where social participation has least influence (Table 8).

Trainability potential of different target groups: In order to rate the trainability potential of different target groups for the different SFM practices, extension agents used the following scores where 1=not easy to train, 2=easy to train, 3=Very easy to train. Extension agents perceived male farmers above 40 years to be very easy in training on animal manure (2.43), followed by male farmers between 30-40 years(2.4), then female farmers between 30-40 years(2.25) while female farmers between 20-30 years had the least trainability potential in training on animal manure (1.86). Overall, male farmers between 30-40 years (2.41) had the highest trainability potential on SFM while the least scored were female farmers between 20-30 years with mean score of 1.96 (Table 9).

Table 8: Social -economic factors considered in selection of Communication methods used in dissemination of SFM

Extension method	Age	Education	Gender	Wealth status	Social participation	Experience in farming
Demonstration	2.95	3.13	2.59	2.84	2.94	3.4
Workshop	3.12	3.39	2.6	2.59	2.62	2.88
Field day	2.65	2.76	2.34	2.47	2.55	2.95
Farmer field school	2.61	2.73	2.25	2.43	2.63	2.91
Video Showing	2.83	2.73	2.22	2.38	2.37	2.3
Exchange visits	2.49	2.56	2.42	2.46	2.65	2.81
Farmer to Farmer extension	2.71	2.57	2.52	2.67	2.64	2.84
Print media	2.51	2.93	2.28	2.53	2.15	2.36
Radio/ TV	2.5	2.73	2.12	2.56	2.07	2.37
Total	2.71	2.84	2.37	2.55	2.51	2.76

Table 9. Trainability potential of different target groups for the different SFM practices

SFM practices	Target Group					
	Male 30-40yrs	Male > 40 yrs	Female 30-40yrs	Male 20-30	Female > 40 yrs	Female 20-30yrs
Animal manure	2.4	2.43	2.25	2.09	2.16	1.86
Compost	2.41	2.2	2.15	2.19	1.9	1.88
Green manure	2.2	1.98	2.05	1.95	1.82	1.78
Fertilizer	2.61	2.44	2.41	2.4	2.15	2.2
Combination of manure & fertilizer	2.52	2.4	2.37	2.29	2.2	2.14
Legumes	2.26	2.16	2.13	1.95	2.03	1.88
Cover crops	2.31	2.3	2.16	2.01	2.06	1.87
Crop rotation	2.48	2.43	2.26	2.17	2.09	2.06
Soil erosion control measures	2.52	2.35	2.27	2.24	2.07	1.97
Overall mean scores	2.41	2.3	2.23	2.14	2.05	1.96

Involvement of stakeholders: Responding to decline in soil fertility in the region requires multiple stakeholders to participate and plan for changing conditions and uncertainty. Majority (76% and 75%) of the extension officers involved the Ministry of Agriculture and farmers respectively during their field days. About 32%of the extension officers involved researchers during their field days while only 30% involved them during demonstration (Table 10).

Table 11. Involvement of stakeholders in different activities by extension agents in Central Kenya.

Stakeholders	Field day	Demonstration	Workshop	Farmer field school	Excursion
Ministry of Agriculture	80(76)	71(68)	46(44)	46(44)	37(35)
Farmers	79(75)	71(68)	26(25)	43(41)	38(36)
Provincial administration	62(59)	31(30)	5(5)	13(12)	12(11)
NGOs	51(49)	25(24)	13(12)	13(12)	10(10)
Agro input dealers	51(49)	21(20)	12(11)	3(3)	6(6)
Researchers	34(32)	31(30)	13(12)	5(5)	6(6)

N.B: Numbers in parentheses give the percentage of respondents.

Only 5% of the extension officers involved provincial administration during the workshops and 3% involved agro input dealers during farmer field school (Table 12). The general conclusion that could be made from the observation is that the main stakeholders involved during promotion of SFM practices were mainly the Ministry of Agriculture, researchers and farmers.

Constraints that hinder effective dissemination of SFM practices as perceived by the extension agents: Little participation of extension officers during research innovation was mentioned as the most critical challenge by 48% while lack of basic infrastructure for example computers was mentioned to be most critical by 49%. Lack of adequate time was considered as most critical by only 12.7% of the extension agent. A higher percentage (48%) of extension agents perceived inadequate resource materials as moderately critical while lack of opportunity to attend short term courses was indicated to be most critical by 41.2%.

Table 12. Constraints that hinder effective dissemination of SFM practices as perceived by the extension agents in Central Kenya

Stakeholders	Field day	Demonstration	Workshop	Farmer field school	Excursion
Ministry of Agriculture	80(76)	71(68)	46(44)	46(44)	37(35)
Farmers	79(75)	71(68)	26(25)	43(41)	38(36)
Provincial administration	62(59)	31(30)	5(5)	13(12)	12(11)
NGOs	51(49)	25(24)	13(12)	13(12)	10(10)
Agro input dealers	51(49)	21(20)	12(11)	3(3)	6(6)
Researchers	34(32)	31(30)	13(12)	5(5)	6(6)

N.B: Numbers in parentheses give the percentage of respondents (N=102).

Poor networking among stakeholders was perceived as moderately critical by 44.1%. Overall little participation on research innovation was the most scored constrain while limited time available was the least scored in hindering dissemination of SFM by extension agents (Table 12).

Discussion

In the present study, diverse methods were being used by extension agents in the four districts.Out of the 105 extension agents interviewed 53.3% were male and 46.7% were female. Most of the extension agents ranged between 41-50 years. This could mean that there was a predominance of middle- aged extension agents who are energetic and creative in carrying out extension work prior to this study. The key to effective teaching and successful extension delivery of SFM practices lies with the competency of extension agents on SFM practices. Anderson (2008) explained that extension has a dual function in bridging blocked channels between scientists and farmers. It also has an important role to play in helping the research establishment tailor technology to the agro ecological and resource circumstances of farmers.

Teaching aids were not often used by majority of the extension agents in training farmers on soil fertility management practices. However, Mulogoli (1996) emphasizes that use of visual aids increases the listening and retention capacity of the audience. Hence it is valuable if extension agents are encouraged to use teaching aids such as exhibits, charts or plays for effective communication of SFM practices.

In the past, much extension effort was concentrated on the progressive farmer who was expected to spread new ideas to others. However, creative and adequate mechanisms must be used or developed to address the problem of inhibition and reluctance to sharing practices. The current study found out that education, years of experience and age were among the most important social demographic characteristics of farmers considered by extension agents in selection of extension methods. According to Leeuwis and Aarts (2011) an innovation was either adopted or rejected by an individual depending on all kinds of social conditions. Male farmers who ranged between 30-40 years were said to have the highest trainability potential while the group that had the lowest trainability potential on SFM were female farmers between 20-30 years. To facilitate more responsive planning of extension services, there is need for a greater understanding of target group make more judicious selection and application of participatory approaches

The general conclusion that could be made from the results was that the main stakeholders involved during promotion of SFM practices were mainly the Ministry of Agriculture staff, researchers and farmers. For widespread SFM dissemination and scaling- up, there is need to invest in broad partnerships, including farmers' organizations and service providers such as agro dealers, extension, CBOs and local NGOs for farmer mobilization, capacity building and linking farmers to credit and markets (Spielman *et al*., 2007). In this perspective adoption and diffusion of soil fertility technologies should not be limited to the agricultural extension agents alone but also include other societal agents who will interact with each other in numerous settings.

Little participation of extension officers during research innovation, lack of basic infrastructure for example computers and inadequate resources were mentioned as some of the challenges that hinder effective dissemination of SFM by extension agents. This finding agrees with that of Arnon (1987) in which field level extension service providers are inadequately involved in research innovations, consequently, extension agents do not have the chance to express their opinions about new technology based on the existing farmers needs. However according to Agbamu (2000) participation of extension workers in adaptive research trials allows them to become familiar with the technologies they are expected to promote and also helps to ensure that the sociological dimensions of farming are not neglected.

CONCLUSION AND RECOMMENDATIONS

The agricultural extension service in the study area has been in the forefront in educating farmers about soil fertility management practices and providing technical assistance. The most commonly used methods by the extension agents are field days while there is less use of modern technologies such as video documentaries, TV and radio. Socio demographic characteristics of farmers such as age, education gender and years of experience influence the methods of communication used by the extension agents. The trainability potentials also differ by age and gender. Hence it can be concluded that extension approaches need to match the socio-demographic context of the communities as well as soil fertility technology being disseminated. The research

recommends an in-depth analysis on the weakness and strengths of extension methods and approaches used in dissemination of soil fertility technologies. In addition more resources are required for improvement of existing extension systems.

Acknowledgements

The authors acknowledge the financial support of the Association for Strengthening Agricultural Research in East and Central Africa (ASARECA NRM/09/01) project on accelerated uptake and utilization of soil fertility management best bet practices in Eastern and Central Africa sub region in this study. Special thanks are also due to the staff of Kamurugu Agricultural Development Initiative (KADI) and Ministry of Agriculture Staff in Maara, Meru South, Mbeere South and Embu districts for their cooperation during data collection.

REFERENCES

Adesope O.M., C.C. Asiabaka. & A.C Agumagu. (2007) Effect of personal characteristics of extension managers and supervisors on information technology needs in the Niger Delta area of Nigeria, International Journal of Education and Development using Information and Communication Technology (IJEDICT), 3(2) 4-15.

Agbamu, J.U. (2000). Agricultural research–extension linkage systems: an international perspective: Agricultural Research & Extension Network (AGREN) Network paper No.10. ODI London

Ahmad, M., A. P. Davidson & T. Ali. (2000) 'Effectiveness of public and private sectors extension: implication for Pakistani farmers'. Paper presented at 16th annual conference of AIAEE held at Arlington VA

Anderson, J. R. (2008). Agricultural advisory services, A background paper for "Innovating through science and technology", Agriculture and Rural Development Department, World Bank, Washington, DC

Arnon, I. (1987). Modernization of Agriculture in Developing Countries: Resource, Potential and Problems. 2nd Edition. Wiley- Interscience Publication, Wiley, ISBN: 04719

Dinar, A., G. Karagiannis & V. Tzouvelekas. (2007). Evaluating the impact of agricultural extension on farms performance in Crete: a non-neutral stochastic frontier approach. Agricultural Economics, 36 (2) 133-144

Ford, C.L. (1995). Educational Priorities of Small Farmers in West Tennessee Journal of Agricultural Education, 31(36), 31-36.

Leeuwis, C. & Aarts, N. (2011). Rethinking Communication in Innovation Processes: Creating Space for Change in Complex Systems. The Journal of Agricultural Education and Extension, 17(1), 21-36.

Mulagoli, I. J.W. (1996). Working on "Review of the development and adoption of participatory methodologies in agricultural and rural development in the South". Wye College, University of London, Wye

Ngathou, I. N., J.O. Bukenya & D. M. Chembezi, (2006). "Managing Agricultural Risk: Examining Information Sources Preferred by Limited Resource Farmers." Journal of Extension, 44 (6), Article 6FEA2

Nyambati E, M., J.G. Mureithi & J. M. Wamwongo. (2003). Soil fertility improvement technologies for western Kenya: Synthesis report of the Soil Management Project Research (1994-2002). Special Technical Report, Soil Management Project, KARI, Nairobi Kenya.

Nyambo, B. & E. Ligate. (2013) Smallholder Information Sources and Communication Pathways for Cashew Production and Marketing in Tanzania: An Ex-Post Study in Tandahimba and Lindi Rural Districts, Southern Tanzania. Journal of Agricultural Education and Extension, 19(1), 73-92

Ogunwale, A. B. (1991). Extension communication patterns in Oyo North Agricultural Development Project. Unpublished M. Phil Thesis Obafemi Awolowo University,

Place, F., B. B. Christopher., H. Freeman., J. J Ramisch. & B. VanLauwe. (2003). Prospects for integrated soil fertility management using organic and inorganic inputs; Evidence from small holder African agricultural systems, Food Policy 28 (4), 365-378

Spielman, D.J., F. Hartwich and and K. Von Grebmer. (2007). Sharing Science, Building Bridges and enhancing impact: Public-private partnership in CGIAR. The international Food policy Research Institute (IFPRI) Discussion paper No 00708. Washington, D.C