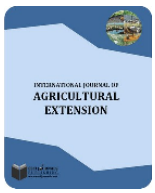

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THE EFFECT OF PLURALISTIC AND DEMAND DRIVEN APPROACH ON AGRICULTURAL TECHNOLOGY TRANSFER AMONG SMALL-SCALE FARMERS: CASE OF SIAYA COUNTY IN KENYA

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A B S T R A C T

This study assessed the status of agricultural technology transfer after the implementation of Pluralistic and Demand Driven Approach (PDDA) among small-scale farmers in Siaya County. The approach was recommended for implementation by the National Agricultural Extension Policy (NAEP) and the National Agricultural Sector Extension policy (NASEP) that was developed after the review of the NAEP. Ex-post facto survey design, purposive, proportionate, simple and snowball sampling were used to select the study areas and all the extension workers and one hundred and fifty households from the sampling frame. one interview schedule, one questionnaire, an observation and two focus group discussion schedule were used to collect data. Data were analysed using t-test and descriptive statistics. The results show that PDDA improved transfer of agricultural technologies. The improvement was due to use of farmer groups as avenue for transfer of technology and collaboration among agricultural extension service providers. However, the improvement was affected by: inadequate government funding for collaborative activities.; technology packages recommended by researchers that were beyond small-scale farmers ability due to low economic status and discouraged the use of cultural values and practices that influence crop production; lack of sustainability of farmer groups; and inadequate technical knowledge necessary for engaging in demand for extension services. The paper concludes that the Division of Extension and Training of the Ministry of Agriculture should plan on how to capacity build small-scale farmer groups formed purposively as avenues for agricultural technology transfer to ensure competencies in basic requirement demanded by funding organizations; a policy framework should be developed that will emphasis on farmers participation in agricultural technology development that are within the means their means , Extension organization should also develop guidelines on how to scale up extension approaches so that they do not create avoid when the programmes ends a particular area.

Keywords: Pluralistic and Demand Driven Approach, Agricultural Technology Transfer, Small-Scale Farmers, National Agricultural Extension Policy.

INTRODUCTION

Agricultural extension and its advisory service plays an important role in ensuring effective and efficient transfer of technology for agricultural development consequently improve the welfare of over 80% farmers who live in rural areas and rely on agriculture as a livelihood (International Initiative for Impact Evaluation (3ie), 2010). Parvan (2011) defines agricultural technologies as new, scientifically derived; often complex input such as mineral fertilizer use, High-Yielding Variety (HYV) seeds, crop protection and livestock pests and disease prevention agrochemicals and the improved agronomical practices such as modern methods of farming and livestock rearing that are important for improved agricultural productivity. Parvan (ibid) points out that majority of the existing agricultural technologies that are disseminated to farmers for adoption are focused on Green Revolution (GR) technologies which include use of irrigation, commercial fertilizer use, adoption of HYV seeds and pesticides. The process of transfer of agricultural technology which is the act of dissemination of the agricultural input to farmers by the technical expertise

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to support and improve agricultural productivity is accomplished by agricultural extension service organizations that support and facilitate people engaged in agricultural production to solve problems and obtain information, skills and technologies to improve their livelihoods and wellbeing (Parvan, 2011; Birner *et al*., 2006; Davis, 2008).

Until 1999 to 2000, the performance of the agricultural sector for most of the developing countries such as Bangladesh, China, Ghana, Mali, Nigeria and Kenya mainly depended on government extension and advisory services (World Bank (WB), 2000, as cited in Yuan Zhou, 2009). During this period, the government agricultural extension service system was the sole service provider and depended mainly on funding from international organizations such as International Funding for Agricultural Development (IFAD), the Food and Agricultural Organization (FAO), United States Agency for International Development (USAID) and the Swedish International Development Agency (Sida). Inspite the high cost of financing public sector extension in most of the developing countries, especially in Africa and Asia, agricultural production continued to be low and even declined (Madukwe, 2006). The decline in agricultural production was blamed on the agricultural extension services provision system for being ineffective and inefficient (Rivera *et al*., 2002; Gustafson, 2002).

The failure of extension systems to meet their goal of increased agricultural productivity for improve livelihood and poverty alleviation effectively coupled with limited budgets to support the Public sector extension led to call for reforms in most of the developing countries Kenya included (Anderson, 2007). The call for reform in agricultural extension sector in 1999 to 2000 were to allow the private sector to play a greater role in delivery of extension services to farmers (Kibett *et al*., 2005).The reform advocated for introduction of pluralistic service provision, demand driven and participatory approaches (ibid). The need for reforms were anchored on the premise that pluralistic extension, which is the delivery of extension service by appropriate mix of players from public sector and private funded organization and delivery mechanisms, which comprised of demand driven and participatory approach would achieve differing agricultural goals and serve diverse target population (Anandajayasekeram et al., 2008; GoK, 2001). The mix of players included mainstream government agricultural extension services, non-profit making non-governmental organizations (NGOs), community based organizations (CBOs), and the profit making private sector that would ensure farming related information and technologies and services were available and accessible to the farmers (GoK, 2005).

In order to implement the reform initiatives in Kenya, National Agricultural Extension Policy (NAEP) was formulated to guide and harmonize the management and delivery of pluralistic and demand driven approach modes of extension service system (Kibett *et al*., 2005). The policy was implemented in the year 2001in selected counties (ibid) which included Siaya County and then later scaled up to the rest of the Country. Various extension models aimed at improving extension services for improved agricultural productivity were implemented under these reforms. The models include Pluralistic system initiative which comprised of public, private, Non-Governmental Organizations (NGOs), Farmers Field Schools (FSS), and National Agricultural and Livestock Extension Programme (NALEP): sector wide, focal area, demand-driven, group based approach.

The purpose of the study: The purpose of this study was to establish the effect of Pluralistic and Demand Driven Approach on the transfer of agricultural technology among small-scale farmers in Siaya County.

Specific objectives of the study were to identify the demographic characteristics of the extension workers and the small-scale farmers, and to establish the status of transfer of agricultural technologies to small-scale farmers after implementation of pluralistic and demand driven approaches.

The following null hypothesis was stated for the study in relation to the first objective:

HO1. The implementation of the pluralistic and demand driven approaches did not significantly improve the transfer of agricultural technologies among small-scale farmers in Siaya County.

METHODOLOGY

Study Area: The study was conducted in six sub-counties of Siaya County. The sub-counties were Yala, Ugunja and Wagai. Siaya County is one of the forty three Counties in the Kenya found in Western region of the Country. The County covers an area of 132,000 hectares of land and is divided into six sub-counties with an estimated population size of 603,693 persons. It has five ecological zones with an estimated 37% of the high potential arable land. The area receives a bimodal rainfall pattern ranging from 1,800mm-2000mm per

annum on the higher altitude and 800mm to 1600mm on the lowlands and the temperature ranges between 15oC –21oC. Most of the agricultural activities are subsistence farming. The main crops grown are maize, sorghum, beans, sweet potatoes and finger millet and most farmers' plant local seeds. The County experience a general food deficit in maize production as it is able to meet about 65% of its requirements (GoK, 2013).

The Research Design: Ex-post-facto survey was used in the study. The design allows for the observation of the dependent variable and retrospectively studies the independent variable for its effect on the dependent variable (Kerlinger, 1973). It allows for the collection of information from a sample that is drawn from a pre-determined population and examination of effect of naturally occurring treatment after the treatment has occurred (Russel, 1995; Kathuri & Pal, 1993). The design was appropriate for the study since the research aimed at observing and understanding the effect of pluralistic and Demand Driven approach on transfer of agricultural technology long after its implementation had taken place from a sample drawn from a target population. The design also allowed field exploration and the use of questionnaires to gather information at just one point in time.

Population of the study: The target population of the study was 603,693 while the accessible population of farmers for the study included: 1) 51,490 households among whom the Pluralistic and Demand Driven Approach was implemented; 2) a saturation of all Agricultural Officers from the Ministry of Agriculture, private non-profit making (NGOs) and private profit making organizations who were involved in agricultural extension services delivery in the field.

Sample selection: The study used a combination of purposive sampling, snowball sampling, simple random and proportionate random sampling. First, purposive sampling was used to select the County in which the Pluralistic and Demand Driven Approach was implemented but did not translate to increased agricultural productivity. Simple random sampling was then used to select the three sub-counties. Snow ball sampling was used to select all Agricultural extension officers from the Ministry of Agriculture, Non-Governmental Organizations and private profit making organizations who participated in the implementation of the approach in the county and may have been transferred thereafter. Proportionate random sampling was used to select 150 small-scale farmers. For successful data collection in the field, an interview schedule, a questionnaire and observation schedule were used for various categories of respondents. One set of semi-structured interview schedule was developed and administered to extension workers by the researcher to collect data on status on the availability of agricultural technologies to small-scale farmers prior to and after the implementation of pluralistic and demand driven approach. The instrument allowed for probing of the respondents especially in more complicated situations. One set of questionnaire with a high visual content was developed and administered to households by enumerators to collect demographic data and details on accessibility to agricultural technologies prior to and after the implementation of pluralistic and demand driven approach. The instrument was suitable for small-scale farmers since it allows for collection of data from a large number of respondents. Observation schedule was used in making observation on the condition/performance of the agricultural productivity in the field.

Validity: For successful collection of data, validity of the instruments was confirmed before being used for data collection in the field. The validation was done for both the questionnaire and the interview schedule. This was important to ensure standardization of the instruments. The questionnaire and the interview schedules were presented to five (5) individual experts in the area of agricultural extension to assess the extent of external and internal validity of the instruments. Their comments were then incorporated into the instruments before being used in the field.

Reliability: Internal consistency reliability of the questionnaire was confirmed before being used for data collection in the field. This was important so as to ensure standardization of the instruments and thus reliable data. To determine reliability, a pilot test was administered to a sample of 20 respondents in one of the focal areas in the County. The sample was appropriate because according to Kathuri & Pals (1993) a sample of twenty is adequate for a subgroup. The sample was selected from one of the focal areas, which was not among the study area to ensure that the pilot testing is carried out to a sample with similar characteristics as the target population and to avoid contamination of the study subjects. The scores obtained in one item were correlated with score obtained from other items in the

instruments. Cronbach's coefficient Alpha was computed to determine reliability coefficient. From the computation, the mean of inter item correlation was 0.0023. From this mean, a coefficient of 0.82 was obtained. According to Mugenda (2008), coefficient of 0.70 or more implies that there is a high degree of reliability of the instruments. This was used as the threshold. Cronbach's coefficient was appropriate for the study because it allowed for the comparison of the interrelated variables and was suitable for analysis of dichotomous variables which was the main focus of the study (Kerlinger, 1983).

Data collection: Sampling frame for small-scale farmers from the selected focal areas was obtained from the County Director of Agriculture's office. Arrangements were then made on when to collect data from extension workers and with individual FEWs on when to visit the field and administer the questionnaire to the selected sample of small-scale farmers.

Data analysis: Data regarding objective one and two were analysed using statements from interviews, while descriptive statistics such as percentages and inferential statistics, paired sample t-test were calculated using the Statistical Package for Social Sciences (SPSS).

RESULTS AND DISCUSSION

Demographic attributes of Small-Scale Farmers: The identification of farmers' characteristics such as gender proportion, the age, education level, land tenure systems, land holding, land utilisation, crop and livestock diversification was important because they are the crucial characteristics that could have an influence on the outcome of the implementation of the Pluralistic and Demand Driven Approach recommended by NAEP. Data in this regard is given in Table 1.

Table 1. Demographic attributes of the Small-scale Farmers in Siaya County (n=150).

Variable		Percentage
		Siaya District
Gender	Female	52.0
	Male	48.0
Age in years	Young (18-35)	24.7
	Middle age	33.3
	Old (over 50)	42.0
Education Level	None	18.0
	Primary	49.3
	Secondary	20.4
	Tertiary	12.3
Land Tenure System	Hired	2.0
	Individual (inherited, bought)	98.0
	Communal	0.0
Land Holding (Hectares)	>one	22.0
	≤one	78.0
Livestock keeping	None	10.2
	one	68.3
	≤one	21.5

Note: > means greater than ; ≤ means equal or less than

Gender: The results show that there were slightly more female farmers than male in the study areas. Female farmers were 52%. The findings agree with those of Lastarria-Cornhiel (2006) who observed that half of the labour force in agriculture, particularly in rural Africa and Asia are women. The type and depth of participation varies widely over regions and culturally differentiated areas.

Age: Majority of respondents were within age bracket of 50 years and above. Farmers within the age bracket of 50 years and above may not effectively access and utilize agricultural extension services and they tend to be more conservative and accepting change becomes difficult. Nganga, Kungu, de Ridder, and Herrero (2010) asserts that aged farmers of over 50 years tend to exhibit higher levels of inefficiency due to reduced ability to practice the contemporary innovation packages and show low energy output.

Education level: Most of respondents (82%) had formal education with 49.3% having attained up to primary level of education. The high percentage of farmers with formal education is pointer to anticipation of high rate of adoption of technology for enhancing agricultural production. Acquisition of formal education encourages

individuals to interact and engage in negotiations that take place among farmers and outsiders who introduce interventions to the farming community. These findings agree with those of Lockheed et al. (1988, in King, 2004,) who identified that at least four years of primary schooling are required to have a significant effect on farm productivity in terms of efficiency and gains. Lockheed et al. explained that primary education generates skills useful for adoption of innovations. The study findings also agree with those of Ong'ayo & Akoten (2007) who found that education is important for farm production in a rapidly changing technological and economic environment than in traditional agriculture.

Land tenure system: The most common (80%) land tenure system was the 'individual' (personal) type. The type of land tenure systems may influence farmers' response and adoption of appropriate agricultural technologies. Observations made in the field indicated that the individual land tenure system influenced the type of investment the farmer engaged in. But the delayed demarcation of inherited land which is done when the head of the family is old or incapacitated affected economic utilization and investment in long term projects. The finding are supported by studies done by Garrity et al. (2006) who found that farmers applied somewhat more labour and intensive use of sustainable inputs such as manure, which has long term positive impact when cultivating their private plots than on hired and communal land.

Land Holding: Majority (78.0%) of respondents owned less than one hectare of land and over 50% owned more than one hectare. The size of land holding may influence farmers' adoption of agricultural technologies. Observations made in the field indicated that land acreage influenced the type of investment the farmer engaged in. Farmers with individual acreage of more than one hectare utilized it economically by using farm yard manure and invested in long term projects. The finding are supported by studies done by Ogada *et al.* (2014) who found that the size of plot cultivated by a household was positively correlated with joint adoption of inorganic fertilizers and improved maize varieties. Ogada *et al.* (ibid) found that an increase of a household's cultivated land area by one acre on average, increased the probability of joint adoption of inorganic fertilizers and improved maize varieties by five percent.

Livestock diversification: Most (62.1%) of the respondents kept one livestock. Observations made in the field showed that most of the households kept a combination of cattle, shoats, local poultry, pigs and domestication of birds especially guinea fowls with a negligible number keeping only one livestock. Most households kept an average of one cow, less than three goats or sheep mainly for security purposes in case of emergencies such as sickness and funerals. Poultry served immediate need that may have required special attention in terms of food or cash. The results imply that although livestock diversification among farmers is an important practice as it contributes to household food security, especially in times of crop failure and as an income generating enterprise, small-scale farmers were not zealous on livestock keeping as a form of livelihood which could enhance their socio-economic status. They had not considered livestock as a practice with high economic returns and sustainable to the household's food security and economic stability.

Status of Transfer of Agricultural Technologies to Small-Scale Farmers after Implementation of Pluralistic and Demand Driven Approaches: Two areas i) availability of agricultural technologies disseminated to small-scale farmers and ii) small-scale farmers' accessibility to agricultural technologies was investigated.

Availability of agricultural technologies disseminated to small-scale farmers: To obtain information regarding the status of transfer of agricultural technologies, agricultural extension officers in Siaya County were asked questions pertaining to this area. Results with respect to the questions are presented in Table 3.

Table 2 revealed that there was an increase in the percentages of the Agricultural extension officers who were in agreement that the transfer of agricultural technologies and information improved after the introduction of more agricultural extension services providers. This was as a result of the introduction of other agricultural oriented organization other than mainstream government extension service provider being allowed to provide same services directly to farmers in the field. However, the collected data indicated that Farmers Field Schools, an extension approach that was used to implement the reforms under the stewardship of KARI and sponsored by FAO did not introduce more extension officers in the field. Instead, KARI incorporated one extension worker from the Ministry of Agriculture in their extension service

delivery section by either contracting-in for the duration of the project cycle. When the project ended, the extension officer returned back to mainstream government agricultural extension service delivery system but became less active due to the absence of incentives. Agricultural extension officers who agreed that using farmer groups as an approach emphasised by the reforms improved the transfer of agricultural technologies and information were more than half. The observed improvement is purported to be due to use of farmer group approach that was introduced by the NAEP reforms. Farmer group approach allowed agricultural extension officers to meet more farmers at one point in time and that time and resources were saved. The results are consistent with those of Madukwe (2006), Muyanga &Jayne (2006) and Byrnes (2001, cited in Rivera, 2009) who found that the use of group approach enables agricultural extension officers to reach a large number of farmers at one point in time, and in the process plays valuable role in realizing economies of scale. Byrnes (ibid) argued that agricultural extension officers can effectively carry out their mandate, not by working directly with individual farmers but by working indirectly with and through farmers groups or organization.

Table 2. Availability of agricultural technologies disseminated to Small-Scale Farmers in Siaya County before and after Implementation of Pluralistic and demand driven approaches (n=22).

Availability of agricultural technology and information was better before or after the following:	Time	EWs in Siaya County (n=22)					
		Agreed		Neutral		Disagreed	
		F	%	F	%	F	%
1. introduction of more agricultural extension services providers in the field	before	12	56.3	2	11.2	8	36.4
	after	19	87.5	0	0	3	12.5
2. Use of farmer groups	before	10	43.8	5	22.0	7	31.8
	after	19	87.5	0	0	3	12.5
3.Collaboration among agricultural extension services providers	before	7	31.3	5	22.0	10	46.7
	after	22	100	0	0	0	0
4. Extension officers frequency of interaction with farmers	before	3	15.3	5	22.2	18	62.5
	after	22	100	0	0	0	0
5. Improvement in demonstrations and field days held on farmers' farms as a means of transferring technologies and information	before	9	41.3	6	27.0	9	31.7
	after	19	87.5	0	0	3	12.5

Agricultural extension officers who were in agreement that the transfer of appropriate agricultural technologies and information improved with introduction of collaboration among agricultural extension officers in various activities such as transport and holding of field days and farmers' training registered 100% response. Collaboration encourages mobility, interaction, sharing of ideas and exchange of new technological knowledge from research necessary for agricultural production among individuals from different organization with different experience and this provides agricultural extension officers with opportunity for technical capacity building. The capacity building that emanates from collaboration among scientists and technical experts from different organizations and training background makes the Agricultural extension officers more competent in their work.

Availability of agricultural technologies which included the information on: practice of recommended agronomical practices such as land preparation and timely planting, use of new, scientifically recommended inputs such as mineral fertilizers, HYV, use of agrochemicals for crop and livestock protection against pests and disease to small-scale farmers by agricultural extension officers was made possible through collaboration encouraged among extension workers from the private organizations, Parastatals and the Government mainstream extension services providers. Holding of collaborative activities such as field days, joint on farm demonstrations, transport for farm visits and meetings by agricultural extension services providers improves FEWs accessibility to agricultural technologies that they may disseminate to farmers. It also avoids duplication of technologies in the field and saves on resource use as it allows the extension interventionists to meet farmers at one point. However, effective collaboration may be hampered by financial constraints and lack of coordination in collaboration

among extension interventionists as noted in the study and therefore requires effective planning and commitment by all parties that are involved.

However the following observations were made by respondents: Collaboration among many stakeholders in provision of agricultural services to farmers was only possible in circumstances where the collaborating organizations were financially able to meet the cost of joint activities such as joint transport to the field by agricultural extension service providers and equitable financial contributions to field activities like farmers' field days and tours. While accessibility and proximity among extension officers from various organizations enhanced consultation and sharing of ideas and information. These findings are consistent with those by Hanyani-Mlambo (2002) who noted that lack of funds can affect a project's collaboration with others, especially in activities such as training, seminars and transport. Scarborough *et al*. (1997, cited in WB, 2003) and Hanyani-Mlambo (2002) noted that collaboration is a strategic alliance that ensures financial survival for virtually all public-funded providers of agricultural extension services, especially if the country is experiencing a decline in socio-economic status and dwindling operating budgets. Hanyani-Mlambo (ibid) further observed that collaboration is important for some programmes as it provides unification and coordination of agricultural extension services, various stakeholders' resources, skills, expertise and experience. Swanson et al. (1998) also noted that the global emphasis of National Agricultural Extension Policy reforms would achieve improvement in transfer of agricultural technologies by encouraging greater government support and collaboration with NGOs.

The frequency of interaction of Agricultural Extension Officers' with small-scale farmers increased by 100%. The increase was attributed to improved collaboration among agricultural extension officers when carrying out agricultural extension services such as farm visits as a team comprising of both gender. As a team it is easier to overcome cultural barriers that may limit a particular gender from interacting with the extension agents and in the process improve the frequency of interaction with farmers especially in the study area where the ratio of female to male is higher as reflected in the bio data (Table 1). Similar findings were reported by Farrington (1997, as cited in Swanson *et al.,* 1998) who established that collaboration provided opportunity for interaction which is essential for exchange of ideas and technology capacity building among the participants. These finding are also in line with those of Kwamboka (2008) and FAO (2006) who found that age old cultural barriers in sub Saharan Africa may forbid or discourage male agricultural extension officers from dealing with women farmers yet over half (65.5%) of the extension staff preferred dealing with women farmers due to their ability to adopt information and new technologies faster than men. FAO (2006) explains that such interaction can only have positive results in regions where women are not discriminated against by the community to interact with male in the absence of male member of the household.

The extension officers who agreed that agricultural oriented demonstrations held on farmers' farms as a means of transferring agricultural technologies and information were adequate increased to over 50%. The improvement was attributed to the use of group approach that encouraged agricultural extension officers to hold more group demonstration on farmers' farms and encouraged group members' participation. It was observed that the use of group, participatory on farm activities and holding of demonstrations as a means of dissemination of agricultural technologies and information was effective due to availability of funds acquired through group loans and grants. However, it was noted that most agricultural technologies that were demonstrated and promoted in the field were unsustainable as they encouraged market dependence for external inputs and extra labour that was elusive amongst small-scale farmers. For instance, some agricultural extension officers during a FGD explained that the new maize seeds that were promoted made farmer to be 100% reliant on the market for farm inputs. They further explained that 'the poor small-scale farmers cannot afford farm inputs due to the prohibitive cost and this poses a challenge when it comes to influencing adoption of technologies that requires external inputs such as commercial fertilizers, the HYV seeds and crop protection agro chemicals for pests and disease control meant for increased agricultural food productivity'. The forgoing narrative implies that agricultural extension officers found it difficult to convince farmers to adopt agricultural technologies recommended by researchers for increasing agricultural food production after the implementation of the reforms due to prohibitive costs.

Small-scale farmers' Accessibility to Agricultural Extension Services in Siaya County: To determine accessibility to agricultural extension services by small-scale farmers, the study solicited information from farmers using a series of questions related to accessibility to extension services before and after the implementation of the policy reforms (Table 3).

Table 3. Siaya County's Small-scale Farmers' Accessibility to Agricultural Extension before and after Implementation of Pluralistic and Demand Driven approaches (n=150).

Accessibility to agricultural extension services before and after the NAEP reforms	Time	Siaya District's Small-scale farmers (n=150)			
		Agreed		Disagreed	
		n	%	n	%
If aware of extension approach used by FEWs	before	75	50.0	75	50.0
	after	100	66.7	50	33.3
Membership to agricultural oriented groups	before	60	40.0	90	60.0
	after	123	82.0	27	18.0
If attended farmers training	before	46	30.7	104	69.3
	after	72	48.0	78	52.0
If the frequency of interaction with agricultural extension officers: Twice/ more than twice per month	before	20	13.4	130	86.6
	after	132	88.0	18.0	12.0
Per month/seasonally/none	before	130	86.6	20.0	13.4
	after	18	12	132	88.0
If consulted agricultural extension officers whenever there was need	before	72	48.0	78	52.0
	after	100	66.7	50	33.3
If had agricultural demonstrations implemented on their farms	before	44	29.3	106	70.7
	after	49	32.7	101	67.3
If participated in agricultural demonstrations and projects implemented in the field	before	52	36.4	98	63.6
	after	89	59.3	61	40.7
If they lived more than 4 Km from the agricultural extension offices	before	116	77.3	34	22.7
	after	116	77.3	34	22.7
Access to funds for project activities	before	60	40	90	60.0
	after	17	11.3	133	88.7

Based on respective questions the results in Table 4 revealed that most (66.7%) of small-scale farmers agreed that they were aware of the agricultural extension approach used in the field after the reforms. The increased awareness may also be attributed to effective sensitization by agricultural extension officers and interaction of majority of farmers with agricultural extension officers or other farmers who were aware of the new approaches used in the field.

Over 82% of small-scale farmers agreed that they were members to agricultural oriented groups. Observations made in the field and data gathered during small-scale farmers' FGDs revealed that: 1) membership to farmer groups emphasised during the implementation of the reforms improved farmers' accessibility to agricultural extension services. Farmers were obliged to join groups in order to access agricultural extension services such as information on marketing of farm produce, financial credits, grants and agricultural technologies and information. 2) Some farmer groups disintegrated when they failed to access funds. The most affected were those groups that engaged in projects that required funds to sustain group activities and consequently constrained their access to agricultural extension services. During a FGD, one farmer explained that 'it was not easy to access funds despite being in a group due to a requirement that individual groups have to write proposals and our group had no knowledge on proposal writing especially with low level of education among most members of the group'. The farmer argued that writing a proposal was not easy and some groups paid specialists to do it for them. 3) Some respondent did not participate in group activities. They felt that there was no comparative advantage of being in groups as they would be delayed in the course of making decision on their farm activities due to individual differences.

The results revealed that membership to groups played a crucial role in ensuring that farmers accessed agricultural extension services such as marketing information. However groups were not sustainable as they disintegrated after having been formed due to the extrinsic reasons such as land ownership financial ability of individual members. Disintegration of groups affects viability of networking formed in a particular area which is necessary for sharing knowledge and skills gained during training. These findings are supported by Muyanga & Jayne (2006) and Ong'ayo & Akoten (2007) who found that farmers in groups could organise demand for and access to agricultural extension services and encourage individual participation for development. Ong'ayo and Akoten (2007) found that membership to farmer group encouraged interactions between farmers and agricultural extension officers and among farmers themselves. In the process of interaction, farmers share experiences and build synergies which can be harnessed to collectively address a particular problem.

Less than 50% of small-scale farmers indicated that they attended training before and after the implementation of pluralistic approach. However, the study indicates that the number of training held for farmers was small and in most cases, training was basically held for group leaders who were trained to disseminate agricultural information gained to the rest of the group members. These findings are supported by those of Feder *et al.* (2004) who found that intensive training per farmer group is not very common since it is expensive based on economy of scale when considered from a national perspective. World Bank (2003) suggests that cost effectiveness and financial sustainability in farmer training could be improved perhaps with significant community funding.

The results show that the percentage of small-scale farmers who agreed that the frequency of interaction with agricultural extension officers for of twice or more than twice per month and after the implementation of the policy reforms increased to 88% from 13%. The increase in the frequency of interaction on fortnightly basis or more improved farmers contact with extension officers and this could improve farmers' acquisition of agricultural technical knowledge and skills. Increased frequency of interaction between farmers and agricultural extension officers is an indication of improved access to agricultural extension services, which provided an opportunity for sharing and exchange of ideas among farmers and outsiders. This allowed farmers to share and gain new ideas in agricultural production. The increased interaction was also attributed to the slight increase in percentage (44% to 49%) of on-farm demonstrations as sites for dissemination of knowledge and skills for various agricultural technologies. On-farm demonstrations are considered to be important and suitable practical methods for convincing farmers to engage in adopt process of new agricultural technology and management practices. These results are supported by those of Scarborough et al. (1997, cited in WB, 2003) who found that recognition of technical and economic interactions, which exists within the farm, is important in shaping farmers' responses to alternative technologies.

The percentage of small-scale farmers who agreed that they consulted agricultural extension officers whenever there was need increased (48% to 66.7%). The observed increase may be attributed to the Shifting Focal Area Approach (SFAA), demand driven and project approaches (implementation of projects to address farmers needs in specific areas) that were used to disseminate agricultural technologies and information. However, it was observed that some farmers considered these approaches not to be the best. Some farmers felt that they could not consult agricultural extension officers after up-scaling projects activities to other areas due to increased distance and inability to carry specimen of plants or animals infested or infected by pests and diseases to the agricultural offices since majority of them could not record observations of such incidence, a limitation caused by their level of education and advanced age Majority of the farmers in the study area had primary level of education and most (42%) of them were in the age bracket of over 50 year as shown in table 2. Farmers explained that the knowledge they had was not adequate enough to enable them to identify problems and consequently seek timely advice. They preferred the traditional approach which allowed agricultural extension officers to visit them on regular basis to assist them in identifying problems other than the SFAA and demand driven approach in which they were left on their own after a given period of time, and agricultural extension officers did not make follow ups of the implemented activities in areas where they had moved out unless farmers called them. The percentages of small-scale farmers who agreed that they had agricultural demonstrations implemented on their farms

and participated in these demonstrations and projects implemented in the field increased by 3.4% and 22.9% respectively. The increase may be attributed to the use of farmer group as meeting points and use of their farms as sites for dissemination of knowledge and skills for various agricultural technologies. Demonstrations held on farmers' farms can be very important and suitable practical methods for convincing farmers to engage in adopt process of new agricultural technology and management practices especially when they are involved. However, it was noted that some respondents viewed some particular innovations in these demonstrations and projects as not motivating for them to adopt. These are innovations that required external inputs of which farmers could not afford to trade-off with other crops. These innovations included growing of crops such as cotton, soya bean and sunflower, which could not be used or processed easily as food and lacked local market. Similar findings were obtained by FAO (2001) in a study of farmer participation in projects as a motivation factor for adoption. FAO (ibid) found that participation in demonstrations and projects is important as it allows farmers to influence the design, implementation and evaluation of extension activities. FAO argues that increased participation of members in their organization's activities is of central importance in such efforts to promote farmers' organizations. The objective is to empower farmers and improve the adoption of technologies, especially if they are exposed to technologies coming from outside their communities. The more than 4 Kilometre to extension offices remained the same. The long distance that farmers covered to agricultural extension offices and the introduction of the cost sharing for essential services such as veterinary services is a pointer to farmers becoming targets to village quacks and may avoid engaging in production of some crops that require regular consultation of the professional and expert thus more financial obligation. Studies by Studies by Chowa *et al.* (2013) noted that distance is not a significant factor in the frequency of small-scale farmers' interaction with agricultural extension officers. They argued that long distance could be addressed by individual members joining groups of which together they generated synergies for solving their farming problems such as meeting the cost of travelling and consequently able to access agricultural extension services that require financial obligation.

Frequency of farmers who agreed to accessing funds for group projects' activities declined (40% to 11.3%). The decline in respondents accessible to funding was due to stringent rules that required them to write proposals. One group member in FGDs stated that 'It is not easy for groups to write proposals as they lack the capacity. Most of the group members are of old in age and the young educated members of the community with the capacity to write proposal are not there, they have all migrated to other areas in such of paying jobs and if they have to write for us, they do it at a fee yet group finances are low'. Inadequate or inaccessibility to funds, grants or loans suggests that sustainability new and existing groups that had been formed on the basis of market oriented projects that use external inputs and relied on funding from credit institutions and grants were affected.

Hypothesis testing on Transfer of Agricultural Technologies and Information by Frontline Agricultural Extension Officers: In order to ascertain any significant differences between the level of agricultural technology and information transfer before and after the implementation of the pluralistic and demand driven approach as reforms in extension service delivery, a paired sample t-test was performed at significance level of 0.05 on the hypothesis that "The implementation of the pluralistic and demand driven approaches did not significantly improve the transfer of agricultural technologies among small-scale farmers in Siaya County".

The results as shown in Table 4 indicate that the t-values for the two tailed significance levels of the difference between sample means for the response was 0.002 for improvement in the transfer of agricultural technologies due to introduction of more agricultural extension officers, 0.002 for introduction of group approach, 0.000 for collaborative activities among agricultural extension services providers, 0.020 for increase in the frequency of agricultural extension officers interaction with farmers and 0.001 for demonstrations held on farmers' farms by agricultural extension officers, which were all less than 0.025. The results indicate that there was statistically significant differences at $P \leq 0.025$ observed in all the five variables tested for improvement in agricultural technology transfer due to pluralistic and demand driven approach.

On the basis of the results, the means for most items used to measure improvement in transfer of agricultural

technologies and information to farmers showed statistically significant difference at α = 0.05 when both end of the distributions were added together and therefore the null hypothesis was rejected. Despite the observed statistically significant difference, it was not possible to conclude that the implementation of pluralistic and demand driven approach significantly improved agricultural technology transfer in the study areas due to the small sample size of agricultural officers used in the study. Therefore, the findings were to be interpreted with caution based on the understanding of the undying factors that influence the ratio of extension officer to charge with dissemination of technologies to farmers in a specific region. Despite the failure to make the conclusion, the statistically significant differences are attributed to farmer groups that were effective due to presence of projects supported by international development partners, private non-profit making and profit making organizations and implementation of reforms using NALEP-Sida sponsored by Sida and the effectiveness of collaboration that took place among the various agricultural extension service providers.

Table 4. Paired Sample Statistics t-test on Improvement of Agriculture Technologies and Information Transfer to Small-Scale Farmers by Agricultural extension officers in Siaya County.

Transfer of agricultural technologies and information before and after	Siaya County(n=22)					
	NAEP implementation	Mean	Mean	t-test	df	Sig (2-tailed)
introduction of more agricultural extension services providers in the field	before	1.44	-0.50	1.861	21	0.002
	after	1.13				
Introduction of group approach	before	1.41	-0.50	1.691	21	0.002
	after	1.12				
Introduction of collaboration among agricultural extension services providers	before	1.69	0.69	5.745	21	0.000
	after	1.00				
Frequency of FEWs interaction with farmers was better before or after the reforms	before	1.44	0.31	2.611	21	0.020
	after	1.13				
Demonstrations held on farmers' farms by agricultural extension officers as a means of availing technologies and information were adequate	before	1.68	0.03	4.524	21	0.001
	after	1.18				
consulted agricultural extension officers whenever there was need	before	1.68	0.34	8.071	149	0.000
	after	1.34				

Note: P≤ 0.025

CONCLUSION AND RECOMMENDATIONS

The study has demonstrated that pluralistic and demand driven approach aimed at improving transfer of agricultural technology to small-scale farmers is more than increasing number of extension agents. The approach is effective when the availability of agricultural technologies to farmers and farmers' accessibility to these technologies is ensured through collaborative efforts from the various organizations involved in dissemination of agricultural technologies to small-scale farmers and effective use of farmer groups. However, the effectiveness of pluralistic and demand driven approach on transfer of agricultural technologies can be hampered by weak collaboration which could be attributed to financial constraints, inability of small-scale farmers to afford the inputs due to their prohibitive costs, lack of cohesion and stability of farmers groups for the purpose of serving as avenue for dissemination of agricultural technologies and demand for extension services.

On the basis of the key findings and conclusions of this study, the following recommendations were made for the development of a policy that will cover the following aspects:

Collaborative planning: Development of a policy to guide all stakeholders involved in the collaborative activities for the benefit of the farmers to contribute equally toward financial requirements of extension activities carried out in the field for the purpose of ensuring effective transfer of agricultural technologies. This will ensure all the stakeholders have equal and shared responsibilities.

Development of agricultural technology packages: The Ministry of Agriculture should develop a policy that

will endeavour to enhance development of agricultural technologies that are generally farmer-centred to ensure sustained implementation pluralistic and demand driven approach in projects and programmes. Farmers will accept technologies that they participated in developing and one that meets their needs and suits their life-style and culture practices and values especially at the initial stage of need identification. This will ensure that the technologies that are developed and disseminated to small-scale farmers are affordable and easily practiced.

Effective farmer groups: Development of a policy that will guide the Ministry of Agriculture and development partners in their endeavour to promote farmer group that are effective as avenue for transfer of agricultural technologies. The developed policies should promote effective institutional mechanisms necessary for mobilization, capacity building and empowerment of farmers groups as avenues for agricultural technology transfer to enable them to attain competencies. Such structures will ensure farmers groups that are formed can afford to demand for extension services and participate in technology development

Guidelines on implementation and scaling–up of projects and programmes: The division of Extension organization should develop guidelines on scaling-up and scaling-out of extension approaches to avoid creation of a avoid the process is carried out in a particular area. This will ensure sustainability of the project activities especially in regions where farmers do not have the ability to demand for extension services.

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