

Influence of Farmer Group Membership on the Practice of Improved Agricultural Technologies: A Case of Nyamusi Division, Nyamira County Kenya

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Abstract: The study examined the influence of farmer group membership on the practice of improved agricultural technologies by farmers in Nyamusi division of Nyamira County. Multi-stage and stratified sampling techniques were applied for sample selection. Data collection was done by use of semi-structured questionnaires. Both descriptive and inferential statistical techniques were used for data analysis. Among the descriptive statistic techniques used included Mean, Standard Deviations and frequencies. For Inferential statistics, chi-square and cross tabulation were used to establish relationships between dependent and the independent variables. A total of 332 questionnaires were filled by the sampled farmers but only 304 were completely and adequately filled and analysed. The analysed data was presented using tables. From the analysis 229(75.3%) of the farmers belonged to a farmer group while 75(24.7%) were not members of any farmer group. The results indicated that the relationship was significant at 0.005 and 0.006 for the practice of greenhouse farming and Artificial insemination respectively. It can be concluded that membership in a farmer group increased the chance of a farmer practice of greenhouse farming and Artificial insemination. The study recommends that government should facilitate the Farmer Groups to transform their organizations into cooperatives in order to gain legal identify to transact business, increase their bargaining power and intensify their collective voices in policy engagement.

Keywords: Farmer group membership, improved agricultural technologies, agricultural productivity.

1. INTRODUCTION

Agricultural productivity is one of the fundamental elements of high and continual agricultural growth, and in fact a key determinant of its growth over longer term. Faster agricultural growth has put countries on the path of a much wider transformation process: rising farm incomes, raising demand for industrial goods, lowering food prices, curbing inflation, inducing non-farm growth, and creating an additional demand for workers (Adeleke *et al.*, 2010). Indeed, the practice of improved technologies is heralded as a major factor in the success of the green revolution experienced by Asian countries (Ravallion & Chen, 2004).

Additionally, agricultural growth is particularly effective in reducing hunger and malnutrition given that most of the extreme poor depend on agriculture and related activities for significant part of their livelihoods (IFAD, 2012). Improving food security by investing in agricultural productivity, infrastructure, social protection and the opening of markets is very crucial. Food security underpins all other developments. This is the strongest weapon any country can have for its citizens to survive.

According to African Development Bank (2010), growth in agriculture has a powerful impact on poverty across all country types. Estimates show that Gross Domestic Product (GDP) growth originating in agriculture is at least twice as effective in reducing poverty as GDP growth originating outside agriculture. Agricultural GDP per farmer has over the last two decades risen by 2% per annum in Asia, nearly 3% in Latin America but less than 1% in Africa. Farmers have been working harder, more people have taken up farming, but productivity has not increased. When agriculture stimulates growth in Africa, the growth is twice as effective in reducing poverty as growth based in other sectors. In China, agriculture-based growth is 3.5 times more effective in reducing poverty than growth based on other sectors. In Latin America, the effectiveness is 2.7 times. Agricultural growth also means more production of food, and greater food security.

Currently, 30 per cent of the children in Sub-Saharan Africa suffer from protein malnutrition. According to the United States Department of Agriculture (2009), 16.2 million children under 18 in the United States live in this condition. They are unable to constantly access nutritious and sufficient amounts of food necessary for a healthy life. The United Nations (FAO) estimated in 2008 that nearly one billion people go hungry every day. Furthermore, FAO's 2003 report quoted that around 852 million people worldwide were chronically hungry due to extreme poverty.

According to World Bank (2007), the average farmer in sub-Saharan Africa produces only one ton of cereal per hectare less than half of what an Indian farmer produces, less than a fourth of a Chinese farmer's production, and less than a fifth of an American farmer's production. Sub-Saharan countries therefore need to draw on the experiences of land-scarce Asian countries where yield increases in crops were the defining characteristic of the Green Revolution and transformation of the rural sectors between the 1960s and the 1990s. The success of the Asian Green Revolution hinged on smallholder-focused productivity transformation with crucial implications for poverty reduction, food security and economic growth.

The availability of modern agricultural technologies to end users and the capacities of the end users to adopt and utilize these technologies are critical (Mamudu *et al*, 2012). For example, food security and farm incomes have markedly increased in West Africa, while use of 'smart' subsidies for key inputs in countries like Malawi has greatly impacted yields, showing that smallholder farming can respond to properly targeted economic policy interventions. The crop yields of cereals and root crops have also increased significantly in some farming systems in Western and Eastern Africa. The widespread productivity gains from New Rice for Africa (NERICA) in Uganda, increases in cassava production in Nigeria and maize hybrids in East and Southern Africa are further evidence of growth in the sector over the recent past (ADB, 2010). Additionally, the World Bank reports showed that adoption of improved seeds was associated with a 21% increase in crop yields for Ugandan farmers (World Bank, Annual Report, 2006).

Agriculture is the largest contributor to Kenya's Gross Domestic Product (GDP) directly contributing about 25.4% of and another 27% indirectly via linkages to agro-based industries and the service sector, giving an overall 52% contribution. The agricultural sector is mainly dominated by smallholder farmers and contributes a significant impact on Kenya's food security, income generation, employment creation and poverty reduction efforts. The sector accounts for over 65% of Kenya's total exports, and provides 18% of formal and 60% of total employment respectively, contributes 60% of Kenya's income and supports >80% of the rural population. About 33% of manufacturing sector output is based on agricultural products. This, in turn, has significant implications on income generation, food security and poverty reduction efforts in the country.

Ensuring food security and eliminating hunger in Kenya still remains a challenge with more than 40 percent of the population lacking access to adequate food due to poverty (Ministry of State for Planning, 2008). More than three quarters of the population live in rural areas in which most of the rural economy households mainly depend on smallholder farming. About 98% of Kenya's agricultural systems are rain-fed and susceptible to climate change and variability which would jeopardize attainment of the projected sector contribution to the national economic growth. The changes in climate and weather patterns will expose the rain-fed farming systems, especially the arid and semi-arid lands, to more climate related vulnerabilities thereby predisposing farming communities to food insecurity and poverty through erosion of the productive assets and the weakening of coping strategies and resilience. Innovative and transformative measures are therefore urgently required to assist stakeholders in the sector across the agricultural value chain to cope with effects of current and projected change in climate patterns.

In Nyamusi Division Specifically; the role of Government and Development Agencies in spearheading farmers' capacity building on improved agricultural technologies is worth noting. A large number of promising technologies are already available in Nyamusi and have generally been promoted through farmer group trainings and input support to farmers organized in groups. These include improved livestock breeds, tissue culture banana, green house farming, modern bee keeping, and value addition among others. Unfortunately, while available in principle; farmers' contact with new technology is distinctly limited in practice. This translates to low rates of technology adoption as farmers' ability to practice these technologies has not kept pace. With the understanding that the practice of agricultural technologies is an essential factor for transformation of agriculture, it is of necessity to determine whether farmer group approach influences practice of improved agricultural technologies in Nyamusi Division, Nyamira County, Kenya.

2. LITERATURE REVIEW

Agricultural research provides an opportunity to bring creativity, scientific methods, and indigenous knowledge to bear upon the opportunities and problems faced in the agricultural sector. In doing so, research leads to the generation and adaptation of technological, sociological and economic innovations for use by farmers and other actors in the agricultural sector (FARA, 2006). Adoption of yield-enhancing technology and practices leads to increased productivity, incomes and improved more sustainable livelihoods, including food security. Therefore, investments in agricultural research are also investments in growth. For the urban and rural poor, the results of agricultural research help to keep food affordable and available.

Different factors influence the practice of different agricultural innovations and technologies. According to Mamudu *et al*, (2012), the factors influencing farm households' practice of modern agricultural production technologies are grouped into three main categories namely economic, social and institutional factors. The economic factors included farm size, cost of adoption, access to credit, expected benefits from the adoption and the off-farm income generation activities that farm households engage in. The social factors included the age of farmers, the level of education, membership to a farmer group and gender. The institutional factors included access to extension services.

Influence of Farmer Group Membership on Practice of Agricultural Technologies:

Farmer group is a method of organizing people together to solve their individual and collective problems. This method is used by the government, NGO's and others worldwide to improve agricultural productivity and productivity in other sectors. The use of FG approaches to deliver development services to small holder farmers has proven to be an effective institutional device for lowering the delivery costs of these services and for promoting small-scale farmer self-development. They are important in mobilizing small-scale farmer for collective self-help actions aimed at improving their own economic and social situations and that of their communities (FAO, 2006).

In Kenya the Baraza approach (Village gathering) was adopted immediately after independence to provide farmers with updated technologies, information and techniques. The Baraza was a complete top-down method that excluded women. On average baraza lasted two to four hours and extension officers lectured and explained their activities to farmers (Kitetu, 2005). This approach failed to meet the expectation of the Kenyan Authorities (Action Aid, 2011). In the next couple of decades, the Government tried other approaches to address the past failures of top down system such as Farmer Groups strategy. As part of transforming the agricultural extension services, the Government formulated the National Agricultural Sector Extension Policy (NASEP). This policy encouraged farmers to interact with each other while sharing knowledge, resources and experience by using the Farmer-Group Approach (Jayne & Muyanga, 2006).

In the year 2000, the government of Kenya launched National Agriculture and Livestock Extension Programme (NALEP) to implement the demand driven extension service through use of groups. The major thrust was to build capacity of CIGs to improve their performance and demand for extension services. Extension officers would attend the farmer meetings disseminate information and take notes to be considered by the government officials when making policies. Local-level farmer groups, the most common and diverse type of farmer organization, operate at a level where members have face-to-face relationships and are likely to have multiple connections through religious, kinship, community trade, and other economic and social relations (Bingen & Simpson, 2015).

Previous studies attempt to explain the role farmer group membership on agricultural productivity. Farmer groups form important avenues for mobilizing farmers around a common objective especially in delivery of services and formulation

of policies that support agriculture development. In countries such as Tanzania and Ghana, farmer groups are at the center of the poverty reduction strategy, extension delivery and crop marketing (Uliwa & Fischer, 2004).

According to FAO, (2013) rural organizations are essential mechanisms for promoting rural development and sustainable rural livelihoods. Farmer groups have been formed to facilitate access to better agricultural technologies (Gibson, *et al* 2008), to improve access to better earning markets for produce (Aliguma *et al*, 2007) and to facilitate produce transport to markets. Extension systems face challenges in delivering information services to large numbers of smallholder farmers scattered all over and sometimes in inaccessible areas. Farmer groups make extension services more accessible to small-scale farmers by providing economies of scale in service delivery and a mechanism for producers to express their demands for services.

Working with farmer groups may enable extension programs to reach more farmers and rural households, facilitate participation in extension activities, and develop human resources and social capital (increasing equity). Farmer groups help extension services to reach members but more importantly, served to necessitate demand-driven extension services (Muyanga & Jayne, 2006). They enable members to participate in defining objectives and needs, provide feedback to help programmes deliver more relevant services, become more accountable to clients, and establish a base for co-financing and eventual self-financing of services. The farmer group role entail facilitating delivery of services, providing services to members or financing services.

The work by the Cooperative League of the USA (CLUSA) best illustrates this approach by strengthening economic participation and governance and increasing market access through cooperative enterprises and other member-owned democratically controlled organizations. Their approach includes providing functional literacy and numeracy education as an integral component in cooperative management training and institutionalizing the cooperative development capability of members. Illustrations of their work include the Rural Group program in Angola, which seeks to increase food security and incomes of smallholders; the Mali Agricultural Production Initiative, which seeks “to foster sustainable, environmentally sound economic growth”; the Mozambique Rural Group Enterprise Development program, which seeks to “consolidate and strengthen producer organization and marketing capacity, improve farm productivity and crop diversification, and enhance farmer capacity to influence the agricultural policy environment”; and the Uganda Agricultural Productivity Enhancement Program, which aims “to create new, and strengthen existing, producer organizations. (Bingen & Simpson, 2015)

Similarly, in Rwanda, a United Kingdom Department for International Development-supported a program to enhance the adoption of relevant agricultural technologies for cassava, potato and maize production focusing on strengthening social networks and farmer organizations as a basis for strengthening the collaborative relationships among farmers and farmer cooperatives, researchers and extension personnel (Nederlof *et al.*, 2011). Farmer organizations have also been used for financial security and household investments (Mutoro, 1997).

Dissemination of agricultural technology information to many farmers by extension agents mostly occurs in group training and awareness creation contexts like farmer field days and demonstrations. A research by (Adonga *et al*, 2012) on factors that determine membership to farmer groups in Uganda identifies education levels of the household head, marital status, participation in nonfarm activities, age, gender, household size, availability of transport infrastructure, farm size and regulations as some of the potential factors that would influence the decision of households or individual to participate in farmer groups.

Currently, Kenya National Farmers Federation (KENAFF) was established in the late 1990s as an umbrella body of farmers' organizations. Today, it represents the interests of 1.8 million farm families. KENAFF is a member of the Kenya Private Sector Alliance (KEPSA), the Eastern Africa Farmers Federation (EAFF), the International Federation of Agricultural Producers (IFAP) and the International Land Coalition (ILC). Its purpose is to amplify the voices of Kenyan farmers through strategic partnerships and to empower them to make informed agricultural production choices. The organization is supposed to provide or support extension services for all agricultural enterprises in Kenya, though it has narrowed its AES to various locations around the country.

Findings by Hogset, (2005) indicate that partnerships between government agencies and non-government organizations and community based groups represent a cornerstone of Kenya's development strategy. The government encourages self-help groups to get registered with a government office, in order to establish channels of communication. These groups are

often referred to as farmers' groups, women's groups, and youth groups, according to their membership base. Additionally, Eaiene *et al*, (2009) observed that membership in an association positively influences farmer's decisions in agriculture as it creates opportunity for improved information dissemination as well enabling a farmer to access credit facilities using their collective produce as a collateral.

A study by Annet *et al*, (2015) indicates that farmer groups are known to be avenues that facilitate and link farmers to new technologies and production practices. They observed that households with a member in a group were more likely to access modern agricultural technologies compared to their counterparts with no household member in a group. This is in agreement with the study by Augustine *et al*, (2008) who noted that farmer to farmer interaction and membership in farmers' associations played a significant role in determining farmers' decisions to adopt improved maize varieties in Mozambique.

According to World Food Programme(2011), Agricultural cooperatives play an important role in supporting men and women small agricultural producers and marginalized groups by creating sustainable rural employment. Producer cooperatives offer men and women smallholders market opportunities, and provide them with services such as better training in natural resource management, and better access to information, technologies, innovations and extension services. In several countries, FAO provides quality seeds and fertilizers to farmers and agricultural cooperatives and works with them in applying more suitable and productive farming practices. IFAD works with local agricultural cooperatives in Nepal on goat resource centers that help farmers develop markets for a sustainable supply of high-quality breeding goats. Under the Purchase for Progress (P4P) pilot initiative, World Food Program (WFP) and partners are working with smallholder farmers' organizations in 21 countries to help them produce surpluses, gain access to markets and increase their incomes.

A study by Meike *et al*, (2008) revealed that participation in both farmer-based groups and organic markets have a positive effect on the number of soil conservation practices adopted. Additionally, households that received extension services with respect to soil conservation are more likely to apply multiple practices. With respect to socio-demographic characteristics, their analysis showed that households are more likely to adopt conservation practices, if the household head works on the farm. This was in tandem with the observation by (Mohammed *et al*, 2012) who concluded that the factors that determine the probability of a farmer adopting an peanut improved variety in Northern Ghana included membership in a farm organization (i.e., social capital), number of bicycles owned by the farmer (i.e. private asset) and early maturity (i.e. characteristic of technology)

Majority of the literature studied on farmer groups focused on their benefits as outline in the foregoing. However some empirical studies have demonstrated that membership in farmer groups or cooperatives can have limited benefits for certain activities such as access to extension services(Ajah, 2012). There is limited systematic research into the impacts of farmer group membership on adoption of agricultural technologies yet such study would be essential in building more effective ways of organizing and working with farmer groups by creating room for innovation and participation in decision making by farmers. This study sought to fill the gap.

3. MATERIALS AND METHODS

Study area:

The study was conducted in Nyamusi division, Nyamira County Kenya. The division is covered by two major agro-ecological zones; the highland (LH1 and LH2) and the upper mid land zone (UM1, UM2 and UM3). The latitude is 0° and 30° South and Longitude 34° 45' and 35° 00 east, the area receives long rains (2300-2500mm) and short rains (600-800mm). The annual maximum temperatures range from 10.1° C to 28.7° C while the annual mean temperature is 19.4° C. The vegetation is natural grassland with exotic trees and scattered shrubs while the soil type is red volcanic which is suitable for arable farming.

Research techniques and sampling method:

Multistage sampling was employed in the study. The first stage was purposive selection of Nyamusi division because of the fact that it had recorded a large number of agricultural technologies promotions by the Government of Kenya and other Non-Governmental organizations relative to other divisions within Nyamira North Sub-County. According to the agricultural extension office in Nyamusi Division, there were a total of 2460 farmers in Nyamusi Division reached with agricultural extension services. The distribution of the farmers in relation to farmer group membership was as follows;

Table-1

Farmer Group membership	Total	Percent
Farmer Group members	1760	71.5
Non-Farmer group members	700	28.5
Total	2460	100

To arrive at the required sample, stratified random sampling was used. According to Mugenda & Mugenda, (2003), the sample size can be determined as follows;

$$n = \frac{Z^2 pq}{d^2}$$

Where;

n= the desired sample size (if the target population is greater than 10,000)

z= the standard normal deviate at the required confidence level which is 1.96

p= the proportion in the target population estimated to have a characteristic being measured

q= 1-p

d= the level of statistical significance level set which is 95% for this study

However, since the target population for this study was less than 10,000, then the required sample size was smaller. In that case, the final sample estimate (n_f) was calculated using the following formula;

$$n_f = \frac{n}{1 + \frac{n}{N}}$$

Where;

n_f = the desired sample size (when the population is less than 10,000)

n = the desired sample (when the population is more than 10,000)

N= The estimate of the population size

Therefore using the above formulae;

$$n = \frac{(1.96)^2 (.50).50}{(.05)^2}$$

$$n=384$$

Consequently,

$$n_f = \frac{384}{1 + \frac{384}{2460}}$$

$$n_f=332$$

Using proportions the strata samples were calculated as follows;

Sample of farmers with no education was $\frac{1760}{2460} \times 332 = 238$

Using the above calculation, the sample size for each stratum was obtained as follows;

Table -2: Sample size for each stratum

Farmer Group membership	Total
Farmer Group members	238
Non-Farmer group members	94
Total	332

Therefore, the total number of farmers interviewed in all the strata was 332. Having got the sample sizes per stratum as above, simple random sampling was then be used in selecting appropriate number of subjects for each stratum.

Data analysis:

The independent variable studied was farmer group membership while the dependent variable was the practice of improved agricultural technologies. The data collected was analysed using computer software known as Statistical Package for Social Sciences (SPSS) version 20. The data was scored, edited, coded, categorized and entered into a computer. Descriptive analysis was done to produce frequencies, percentages, mean, and standard deviation to provide statistics that described the basic features of the data of the study.

Further statistical analyses were carried out using cross tabulation and Chi-square. The results were presented using tables, discussed and recommendations and conclusion drawn in line with the research findings.

4. RESULTS AND DISCUSSION

All the sampled farmers were asked to indicate whether they belonged to any farmer group or not and their responses were recorded as shown in figure 1 below. From the analysis 229(75.3%) of the farmers belonged to a farmer group while 75(24.7%) were not members of any farmer group. This finding was in agreement with earlier observation where farmers indicated that farmer organizations played an important role in enabling the availability of agricultural technologies in the division. This is in tandem with the study by Matere(2009) where it was also noted that farmers form commodity based farmer organizations popularly known as Common Interest Groups (CIGs) in banana production in Muranga and that enabled farmers to easily access technical assistance from field extension staff from the Ministry of Agriculture or private agents.

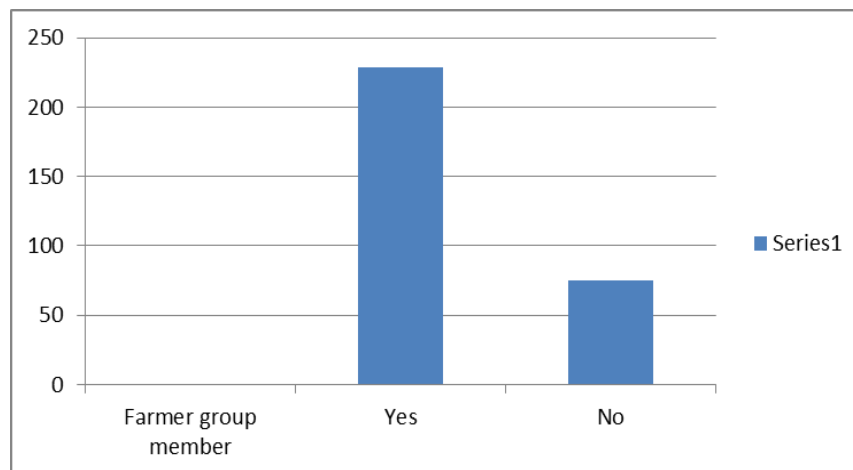


Figure 1: membership to a farmer group

Farmer Group Membership*Practice of Agricultural Technologies:

After cross tabulation of the farmer group membership and practice of agricultural technologies, Chi-square test was done to ascertain the level significance between the variables. Chi-square values and asymptotic significance (2-tailed) were presented as in table 3 below. The two-sided asymptotic significance of the chi-square statistic is greater than $p=0.05$ for most of variables except for the practice of greenhouse farming and artificial Insemination which were observed to be significantly related to farmer group membership at 0.01 and 0.009 respectively.

Table-3Farmer Group Membership*Practice of Agricultural Technologies Chi-square tests

Pearson Chi-square	Value	Degree of freedom	Asymp.Sig.(2-sided)
Certified seeds	0.821	4	0.936
Crop value addition	2.113	3	0.549
Green house farming	11.408	3	0.010
Tissue culture banana	0.755	4	0.944
Artificial Insemination	13.435	4	0.009
Dairy goat farming	1.925	3	0.588

To further ascertain the significance between the farmer group membership and practice of greenhouse and Artificial Insemination among farmers, further analysis was done by introduction of a control variable ("farmer participation in agricultural trainings") so as to establish how the relationship between the variables (farmer group membership and practice of greenhouse and Artificial Insemination) changes when you "control" for the effects of the third variable ("farmer participation in agricultural trainings"). The results indicated that the relationship was still significant at 0.005 and 0.006 for the practice of greenhouse farming and Artificial insemination respectively. It can be concluded that membership in a farmer group increases the chance of a farmer practice of greenhouse farming and Artificial insemination. This finding was in agreement with a study by Annet *et al*, (2015) which indicated that farmer groups serve as avenues that facilitate and link farmers to new technologies and production practices. They observed that households with a member in a group were more likely to access modern agricultural technologies compared to their counterparts with no household member in a group. Additionally, Augustine *et al*, (2008) noted that farmer to farmer interaction and membership in farmers' associations played a significant role in determining farmers' decisions to adopt improved maize varieties in Mozambique.

Given that some agricultural technologies such as greenhouse farming are capital intensive, The study is also in tandem with a study by Eaiene *et al*, (2009) observed that membership in an association positively influences farmer's decisions in agriculture as it enables farmers to access credit facilities using their collective produce as a collateral.

Additionally, Nyamira County government prioritized Dairy value chain as priority number one in County development. The County government moved in to support dairy by deploying agricultural staff, procured 40 motorbikes for Inseminators. Additionally, 5500 dairy cows were synchronized with hormones to trigger the fertility followed by insemination, a process that was rolled out in all the 20 wards in Nyamira County.

The observation is consistent with the results of the study by (Sulo *et al*, 2012) which indicated that membership in farmer groups showed a positive and very significant relationship (at 1% probability level) with the adoption of agricultural technologies by women in Marakwet County under the Women In Agriculture (WIA) Project supported by Catholic Diocese of Eldoret. In Uganda, It was also found that, in the initial stage of the diffusion process, access to information was critical for the adoption of NERICA rice and that households with membership in farmers' groups were more likely to adopt NERICA rice(because farmer groups facilitated social learning through information sharing (Sserunkuuma, 2011).

The study revealed that majority of the farmers generally agreed that the County government, non-state actors (NGOs) and farmer groups played a role in enabling the availability of the agricultural technologies. About 246(80.9%) farmers attributed the availability of agricultural technologies to NGO support, another 175(57.5%) to County Government support while 164 farmers (53.9%) agreed farmer organizations played an important role. Further analysis on cross tabulation of gender and group membership indicates that majority of farmer groups were composed of females 157 (51.6% compared to males 72(23.7%). This is in agreement with World Food Programme report(2011) which indicated in several countries, FAO provides quality seeds and fertilizers to farmers and agricultural cooperatives and works with them in applying more suitable and productive farming practices. IFAD works with local agricultural cooperatives in Nepal on goat resource centers that help farmers develop markets for a sustainable supply of high-quality breeding goats. Under the Purchase for Progress (P4P) pilot initiative, World Food Program (WFP) and partners are working with smallholder farmers' organizations in 21 countries to help them produce surpluses, gain access to markets and increase their incomes.

5. CONCLUSION AND RECOMMENDATIONS

The results indicated that the relationship between farmer group membership and practice of agricultural technologies was significant at 0.005 and 0.006 for the practice of greenhouse farming and Artificial insemination respectively. It can be concluded that membership in a farmer group increased the chance of a farmer practice of greenhouse farming and Artificial insemination.

In view of the findings from the study, the author offers the following recommendations:

- The government should facilitate the Farmer Groups to transform their organizations into cooperatives in order to gain legal identity to transact business, increase their bargaining power and intensify their collective voices in policy engagement.

- The study recommends that the government officers should consider working with all Farmer Groups and individual farmers as well instead of concentrating only on active groups that have benefited from the government or NGO support
- This study should be replicated in other areas in Kenya to find out whether the influence of Farmer Group membership on practice of agricultural technologies is the same. Such evidence is important to Kenyan farmers and organizations championing agricultural policy reforms.

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