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Performance of farmers-led extension system in agricultural technology transfer and adoption

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Abstract

The formers' Organisation component is one of the seven components of Agricultural Sector Programme Support (ASPS), which has been operating in 41 districts of Uganda to increase farmers' welfare through activities of their own organisations. In each district, the component has established an extension system comprising of district-based staff, Parish Executive Committees (PEC), Extension Link Farmers (ELF), Special Interest Groups (SIGs) and farmers. Through the PEC, farmers initiate their training needs and the district technical staff train the Extension Link Farmers who in turn transfer the acquired knowledge and skills to other member farmers. By end of 2002, over 100,000 farmers had been trained in different agricultural technologies. However, the performance of the extension system in terms of technology transfer to and adoption by farmers was not known, hence the need for an adoption assessment study. The study, conducted in 12 districts, estimated adoption rates attained through transferring knowledge and skills using the established extension system as the performance indicator. With focus on four priority enterprises in each district, 12 Extension Link Farmers and 60 member farmers were randomly selected and interviewed from each district. Defining adoption as repeated application of acquired knowledge, adoption rate was computed as a ratio of practices a farmer applied to the number of practices in an enterprise-technology package. Adoption rate was estimated at 35%, meaning that farmers applied about 35% of the practices in which they were trained. The rate was lower (30%) among women than male farmers (37%) due to a combination of economic and cultural reasons. Higher yields and income expectations were the major reasons for adoption. In some enterprises, household size, formal education, number of district Farmers' Organisation staff visits to farmers and training methods used had positive and significant association with adoption, while distance to the market and farmers' sex (farmer being a woman) had negative association. Regular farmer visits by the technical staff, emphasis on training especially using demonstrations and availing inputs closer to farmers were therefore recommended.

Key words: Adoption, agricultural technology, farmers' Organisations

Introduction

The Farmers' Organisations Component (FOC) has been operating in 41 districts of Uganda. The FOC is one of the seven components of Agricultural Sector Programme Support (ASPS) with support from Danida whose development objective is to "increase farmers' welfare through activities of their own organisations".

Among other activities that have been carried out to achieve the above objective are institutional establishment and strengthening, capacity building, conducting training courses, and improving information flow and farmers' production through their own advisory services. This has largely been implemented through an extension system that was put in place consisting of district-based technical staff, Parish Executive Committees (PEC), Contact Farmers referred to as Extension Link Farmers (ELFs) through their Special Interest Groups (SIGs) and Farmers. To monitor and evaluate the performance of the FOC extension system in terms of knowledge and skills transfer, and specifically agricultural technologies in which farmers had been trained, an adoption study was conducted in March 2003. The specific objectives of the study were to estimate the adoption rates attained through transferring technical knowledge and skills using the established extension system, and assess factors affecting adoption of knowledge and skills. It was hypothesised that adoption of knowledge and skills was favoured/retarded by economic and social constraints as well as farmers' attitudes towards innovations.

Methodology

Study area and enterprise selection

The study was conducted in 12 districts selected by stratified sampling to represent the seven agro-ecological zones of Uganda. These are Apac, Bushenyi, Iganga, Kabarole, Kisoro, Luwero, Masindi, Mukono, Ntungamo, Rakai, Soroti and Tororo. In each district, farmers have been trained in different priority interventions/agricultural enterprises.

A meeting with respective District Farmers Organisations Coordinators (District technical staff) was held to get district priority enterprises and to develop a checklist about the technologies transferred. The Coordinators provided four most highly ranked enterprises on which the study concentrated. These are presented in Table 1.

Sample selection and data collection

For each enterprise, three ELFs were randomly selected from a list of ELFs provided by the District Coordinators. For gender balancing, at least one of the selected ELFs was a woman, except in few cases where there were no women ELFs or for some reasons were not available during the survey period. Each selected ELF provided us a list of farmers he/she had trained from which five farmers, of whom at least two were women, were randomly selected for the interview.

A structured questionnaire, the data collection instrument, was administered in direct face-to-face interviews. In addition, a checklist showing the various specific intervention packages given to farmers was also used. During the survey, some farmers' fields (field observations) were visited to ascertain the extent of technology uptake in reference to what farmers were taught; except where enterprise or practice in question was out of season, respondents' views were entirely relied on. Some of the key information that was gathered included socio-economic characteristics (education, sex, age, status in the community, household size, income) of farmers; land size; access to information/extension services; knowledge/skills received from ELFs; reasons for not applying the acquired knowledge/skills; and benefits of applying the received knowledge/skills.

Data analysis

Most of the data analysis used descriptive statistics (means or mean scores/ranks, frequencies and percentages) as commonly used in related studies. To determine the rate of adoption for a given enterprise technology package, a ratio of the number of practices of a technology package repeatedly applied by the farmer to the total number of recommended practices in the package was computed. That is, $r = \frac{p_a}{p_t} * 100$

where, r is the adoption rate in percent, p_a is the number of practices of a technology package repeatedly applied and p_t stands for the total number of recommended practices in the package.

Cases where a farmer had applied a practice for less than two years were excluded from the analysis. Similarly those who had applied practices for over eight years were also not included, the fact that no ELF had served for more than this period. The limitation with this approach is the assumption that all the practices in a technology package are equally important hence assigned the same weight. In addition, correlation analysis was used to establish the relationship that existed between knowledge and skills adoption and socio-economic characteristics of farmers.

Results and discussion

Technology transfer

The Farmers' Organisations extension system is built up as follows: Parish Executive Committees (PECs) identify agricultural enterprise priorities as well as parish training needs. The PEC informs district technical staff of these priorities and needs who, in response organise training meetings with farmers at parish level. During the meetings, the staff give farmers technical knowledge and skills on the enterprises of interest. For each enterprise, farmers select among themselves contact farmers, known as Extension Link Farmers (ELFs) that keep on advising them on improved agricultural practices.

After getting trained by the District Technical staff or other Extension Service Providers depending on the enterprise, the ELFs organise and conduct farmer-training sessions within their communities. The ELFs use a combination of training methods. The common ones are demonstrations used by almost all the ELFs (91%), farmer-to-farmer visits and meetings (Table 2). Study tours were not commonly used (only by 29% of the ELFs) due to lack of financial resources that would be involved. Farmers ranked all the four training methods as either useful or very useful, with demonstrations ranking highest followed by farmer-to-farmer visits, meetings and field tours in that order.

It was noted that farmers did not only receive agricultural related information from ELFs, Uganda National Farmers Federation / Farmers Organisation (UNFFE/FO) district staff, but also from other sources including different Non-Governmental Organizations (NGOs), other farmers and radio. Among the information sources that were reported as very useful and extremely useful, Extension Link Farmer system scored highest followed by UNFFE/FO (Table 3) both of which are channels of Farmers' Organisations service delivery system. The ranking criteria were accessibility of the extension agent and information; practical aspect, mainly demonstrations, of the information

Table 1: Four priority enterprises by district, March 2003

District		Enterprises
Apac	1. Oil seed crops production	3. Agro-forestry
	2. Upland rice management	4. Fish farming
Bushenyi	1. Banana management	3. Pig management
	2. Horticulture (vegetables)	4. Dairy/Zero grazing
Iganga	1. Maize production	3. Rice production
	2. Horticulture (Pineapple)	4. Banana management
Kabarole	1. Banana management	3. Soil and water conservation
	2. Bee keeping	4. Dairy/Zero grazing
Kisoro	1. Potato production	3. Coffee management
	2. Horticulture (Cabbages & tomatoes)	4. Post harvest handling
Luwero	1. Banana management	3. Maize production
	2. Vanilla production	4. Dairy/Zero grazing
Masindi	1. Banana management	3. Maize production
	2. Bee keeping	4. Dairy/Zero grazing
Mukono	1. Banana management	3. Poultry production
	2. Vanilla production	4. Maize production
Ntungamo	1. Banana management	3. Bee keeping
	2. Coffee management	4. Pig management
Rakai	1. Banana management	3. Maize production
	2. Fish farming	4. Dairy/Zero grazing
Soroti	1. Local poultry farming	3. Horticulture (oranges & tomatoes)
	2. Post harvest handling	4. Oil seed crops production
Tororo	1. Rice production	3. Poultry production
	2. Maize production	4. Horticulture (Fruits and vegetables)

delivered; timeliness in delivering and receiving information; provision of handouts and other facilities such as credits; content of the information delivered in respect to the farmers' needs; and benefits realized by applying the knowledge/skills acquired.NGOs were also considered very useful because most of them used similar extension approaches to those of Farmers' Organisations. Although government extension workers and radios were very useful sources of information, the former had very limited contacts with farmers, while the latter lacked demonstration and practical skills.

Factors affecting adoption of knowledge and skills

The study estimated the overall level of technology adoption at 35%. Table 4 shows that the rate was lower among women farmers (30%) than men farmers (37%). These rates mean that at national level farmers correctly and repeatedly applied about 35% of the practices in which they were trained. Women farmers applied about 30%, while men applied 37% of the practices.

The overall average adoption rate for women was largely lowered by relatively lower adoption in fish farming (20.8%), pig management (14.7%), oilseed crop production (15%), agro-forestry (16.7%), bee keeping (8.6%) and coffee management. The management of these enterprises to the recommended standards requires a lot of inputs some of which are expensive. Although this limits the adoption for both men and women, the effect is more pronounced among women whose purchasing power is usually lower than that of men. In the study areas, coffee is an importance cash crop, and hence its production dominated by men who own land. This is similar to fish farming which, in addition, has been regarded as an enterprise for men. Agro-forestry requires full possession/control of land, a property whose ownership and decisions regarding its utilisation are male-dominated. Adoption rate for women was lowest in bee keeping mainly because of the cultural belief that it is an enterprise for men.

Table 2. Training methods used by ELFs

Training method	Percent (n =142)
Demonstrations	91.0
Farmer-to-farmer visits	87.3
Meetings	78.2
Study tours	28.7

Results from Pearson correlation showed that sex of farmers was negatively association with technology adoption rate in bee keeping. The correlation was small in magnitude (-0.127) but significant at 1%. A farmer being female has a negative impact on adoption in bee keeping enterprise. This was because of the cultural belief that women do not keep bees.

Low adoption of knowledge and skills in rice production was mainly a result of expensive practices (chemical application) and tedious practices especially row planting, similar to observations made by Apio and Miiro (1997) in a study on soil and water conservation technology adoption. In all the enterprises where adoption was low, the fact that the enterprises could have been district priorities but not

Table 3: Farmers' responses on information source and useful

Information source	Percent responses on usefulness (n=717)			
	Not Useful	Useful	Very useful	Extremely useful
ELFs	0.3	17.2	46.0	36.5
UNFFE/FO	0.3	25.6	40.3	33.8
NGOs	0.0	27.8	41.7	30.6
Government extension workers	1.3	27.7	38.5	22.5
Other farmers	0.9	43.0	39.3	16.8
Radio	0.4	48.2	43.9	7.9

Table 4: Farm level adoption rates by enterprise by gender

Enterprise	Adoption rates (%)		
	Men	Women	Overall
Rice production	19.4	17.8	18.8
Banana production	59.6	45.1	53.0
Coffee management	45.3	33.0	40.0
Horticulture (fruits)	24.4	23.2	23.9
Horticulture (vegetables)	33.3	24.7	28.9
Maize production	42.1	40.5	41.2
Poultry production	27.1	28.7	28.0
Dairy/zero grazing	39.0	39.9	40.0
Fish farming	38.3	20.8	33.3
Pig management	23.1	14.7	18.3
Potato production	77.8	75.9	76.7
Oilseed crop production	26.0	15.0	21.9
Agro-forestry	33.3	16.7	30.0
Vanilla production	50.0	42.9	47.5
Bee keeping	20.5	8.6	18.7
Soil & water conservation	44.4	26.7	37.3
Postharvest handling	28.1	32.1	30.0
Overall average rate	37.2	29.8	34.6

Table 5: Adopters' responses on reasons for taking up practices

Reasons for adopting practices	Percent (n=395 for men and 322 for women)		
	Men	Women	Total
Expected higher yields and income	84.3	89.4	86.6
I was taught like that	17.0	17.1	17.0
Expected free or subsidised inputs	14.2	14.6	14.4
Easier management of enterprises	13.9	14.0	13.9
Expected higher social status	14.9	10.9	13.1
Availability of ready market	11.1	8.1	9.8
Availability of capital	2.3	3.4	2.8

necessarily individual farmer priorities cannot be ruled out. If these enterprises are still priorities of farmers and/or districts, it is a needs indicator to Farmers' Organisations technical staff and ELFs for more farmer training and follow-up visits. It was found out that the number of district technical staff visits to farmers had a positive (0.083) and significant (at 5%) association with the rate of adoption in horticulture (fruits). Elsewhere, Abadi and Pannell (1999) found out that the frequency of extension visits has a positive and significant influence on adoption of agricultural technologies.

Related to farmer visits was the training methods used; use of demonstration as a training method and adoption rate was positively correlated in coffee production (0.223), vanilla (0.312) and post harvest handling (0.292) all significant at 1%. Demonstrations have a big impact on the quality of learning, which accelerates adoption of technologies. Training meetings also had positive (0.189 at 5%) association in fish farming, while farmer-to-farmer methods were positively (0.167) correlated with adoption in agro-forestry at 5%.

Expectedly, distance to the market was negatively associated with adoption rate in horticulture - vegetables (-0.116) and rice (-0.079) and significant at 1% and 5%, respectively. The longer the distance to the nearest agricultural markets, the less profit farmers derive from an enterprise, and hence a disincentive to adopt recommended practices.

Total household size had a small (0.146) but significant (at 1%) and positive correlation with adoption rate in horticulture (fruit) production. This indicates the importance of family labour to the enterprise. A relatively large number of household farm-active members are therefore imperative. It was also the case in agro-forestry where the correlation coefficient (0.164) was small but significant at 1%.

Farmers' years of formal education and adoption level of technologies were only significant (at 5%) and positively correlated (0.079) in horticulture (fruit) production. Previous studies (Lin, 1991; Saha *et al*., 1994; Mugisha unpublished data)) found formal education a significant factor that favours technology adoption as it exposes farmers to useful information and increases their ability to synthesize and apply it. In this study, the non-significance of farmers' formal education in most of the enterprises, as it was the case in the study by Beyene *et al*. (1998), is attributed to the training the interviewed farmers had got from their ELFs that had put them to an almost uniform level of knowledge, reflecting the important role played by the latter. This also explains the non-significance of other socio-demographic variables.

Results from descriptive analysis indicate that adoption of practices was mainly favoured by economic-related factors. These included expected higher yields, higher income and subsidised inputs as well as easier management of enterprises (Table 5). The majority of the adopters (86.6%) took up the practices with expectations that their yields and income would increase, similar to observation by Negatu and Parikh (1999). Such benefits as good quality products; controlled weeds, pests and diseases; increased output; and healthy animals were reportedly expected and realised.

Adoption was also accelerated by the fact that some practices make some activities like weeding, drying and storage easy and convenient. However, some farmers adopted the practices expecting that Farmers' Organisation would give them subsidised inputs, while a significant number of farmers seemed not to know the benefits of applying the acquired knowledge and skills, but adopted simply because that was how they were taught.

Adopter farmers reported that applying some of the practices had, however, associated problems (Table 6). The major ones were inputs that were expensive as reported by 53% of the farmers and high labour requirements by 53 %. Fewer farmers reported inadequate training and inputs not readily available (29% and 29.1%, respectively) as other problems associated with adopting practices.

The study further found out that not all the knowledge and skills in which farmers were trained were repeatedly applied, despite the fact that they were aware of their benefits and/or had identified them as priorities. Most of the reasons farmers gave were economic factors (Table 7), actually similar to those that favoured adoption. The majority (34%) reported lack of money to purchase inputs some of which were expensive. Other reasons were inputs not readily available reported by 23%, inadequate training by 22% and tedious practices by 21%. Some farmers (12%) feared to risk with new technologies, while others (11.%) believed the practices were not any better or uncalled for. In his study, Elyanu (2002) found out unavailability of improved seed and high cost of seed as the major reasons given by farmers for not adopting and/or de-adoption of technologies.

Conclusions and Recommendations

Results from the study show that training of farmers carried out by ELFs has been instrumental in promoting adoption of agricultural practices. Farmers valued the different methods used to train them and suggested that the training be sustained.

Adoption rate was estimated at 35 % implying that farmers were applying about 35% of the acquired knowledge. The rate was lower (30%) for women than for men (37%) attributed to physical and financial resource constraints as well as cultural beliefs. Generally, adoption of knowledge and skills was largely affected by farmers' expectations (higher yields, income and subsidised inputs), training received, availability and affordability of inputs.

From the study findings, the following recommendations were drawn:

Table 6. Adopters' responses on problems associated with taking up practices

Associated problem	Percent (n=395 for men and 322 for women)		
	Men	Women	Total
Expensive inputs	54.4	50.9	52.9
High labour requirements	49.9	55.9	52.6
Inputs not readily available	27.8	30.7	29.1
Inadequate training	31.4	26.1	29.0
Negative attitude towards a technology	2.3	3.1	2.6

Table 7. Adopters' responses on reasons for not taking up practices

Reason for non-adoption	Percent (n=395 for men and 322 for women)		
	Men	Women	Total
No money to purchase inputs	35.4	33.2	34.4
Inputs not readily available	24.3	20.5	22.6
Inadequate training	22.0	22.7	22.3
Tedious practices	21.5	21.1	21.3
Fear to risk new technologies	12.2	13.0	12.6
Do not think the practices are any better	9.9	11.2	10.5
No interest	6.6	7.5	7.0
Practice not profitable	2.8	3.4	3.1
Lack of land	2.0	2.8	2.4

1. Farmers' Organisations technical staff should regularly visit and monitor ELFs-organised training sessions, especially the demonstrations to ensure that farmers are being taught the right skills/practices. This will necessitate having more Field Advisors, which definitely has a cost implication to farmers organisations. .
2. Given the highly expressed need for demonstrations, there is need to consider facilitating the setting up of more demonstrations in various farmer-accessible localities, preferably at parish level on farms of member farmers. This is currently done but the demonstrations are few.
3. The problem of unavailable or expensive inputs needs a collective action. As district FO staff and ELFs train farmers, they need to go beyond addressing production practices to issues regarding strengthening the farmer's voice, especially in the market, such as group production and group marketing, credit services and issues related to supply and availability of agricultural inputs.

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