Impact of micro-finance on terracing and small scale irrigation in Sondu, Mogusi and Gucha River Catchment in South West Kenya

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Abstract

Low productivity and rampant poverty characterise the Gucha, Mogusi and Sondu river catchment areas. Largely semi-arid, rainfall is insufficient for fruit and vegetable crops, although demand for these commodities in rural and urban markets is rarely met. Soils are suitable for raising crops under irrigation, and there are many sources of water. Rain water harvesting for subsistence crops is feasible. Findings of a study conducted in the area with objectives of assessing the impact of small scale irrigation and construction of terraces and analyzing factors influencing this adoption are presented. Methodology involved a survey of 298 members of the Homa Bay Agriculture and Environment Program (HB-AEP) of the Catholic Diocese of Homa Bay, following the rapid appraisal techniques and group discussions. Data analysis involved extraction of descriptive statistics and logistic regression.

Farmers adopted terracing first, raising grain production, then bucket irrigation. Terraces on crop land increased by 77 meters (mean), facilitating a 12% increase in grain production during 1997-2000. Two systems, (bucket and T-pump) were adopted by 22% for irrigating kitchen gardens and raised beds. Factors affecting adoption and impact were land tenure, micro finance, and extension methods. The micro-finance system allowed access to local and external capital, contributing to entrepreneurial acumen and household welfare. Policy should address the Village Bank development.

Key words: *Water harvesting, irrigation, land tenure, terracing, village banks, extension, methods.*

Introduction

Intensification of farming had, by the early 80s, become a matter of growing importance. The Smallholder Farm surveys that were carried out in Agro-ecological Zones1 (AEZ) 2 and 3 in the area (Jaetzold and Schmidt 1982) indicated that average farm size was 3.4 ha. About half of this was under crops. Country wide, the government set about putting in place several measures such as reduction of controls on trade in farm inputs and farm produce (Nyoro 1996). Agricultural education and extension services were strengthened through implementation of the National Extension Project (NEP 1 and 2). Adaptive research activities were intensified, into a number of technologies. Improved varieties of maize, sorghum, millet, cowpeas, pigeon peas, beans, cassava and sweet potatoes as well as appropriate husbandry practices were developed and evaluated widely by smallholders in the region. Yields remained low, and most of the produce harvested was consumed within the region.

Post-independence public investments in education, land and other institutional reforms over the 1960-80 period has yielded impressive dividends in terms agricultural modernization and increased productivity of smallholder systems. The impacts of these achievements were more pronounced in the high potential agro-ecological zones than in the semi-arid regions. Moreover, population growth rates during the period were high, resulting into intense pressure on land and consequential threats to the environment. In consequence, smallholder farming now faces declining soil fertility, increased erosion, reduced bio-diversity and declining productivity. Both public and voluntary sector strategies to improve the welfare of smallholders now incorporate sustainability and equity considerations. The private and voluntary sectors complement the roles of the government sector by providing extension services and other resources that are needed for smallholder development.

The study region and the main issues

The the Gucha, Mogusi and Sondu river basins fall within Homa Bay, Rachuonyo, Suba, Migori and Kuria administrative Districts in south-western Kenya. The area is characterized by high infant mortality, lack of appropriate farm tools, implements and other inputs, poor access to markets, environmental degradation, food shortages, low productivity and low income, lack of appropriate grass-roots level institutions which can foster and promote adoption of improved farming techniques, and information on appropriate land use practices and complimentary technology such as irrigation and lack of financial resources. The area is largely semi-arid; the amount of rainfall received is too low for most fruit and vegetable crops. The Smallholder Farm surveys that were carried out in Agro-ecological Zones1 (AEZ) 2 and 3 in the area (Jaetzold and Schmidt 1982) indicated that average farm size was 3.4 ha.

Thus, demand for vegetables by rural households and the expanding market in the area is rarely met. The diets of rural households are generally deficient in vitamins and minerals and diseases such as scurvy are common especially among the fishing communities and pastoral communities. Most of the soils, however, are suitable for raising reasonable crops under irrigation, and there are many sources of water that can be used for such purposes. With the consequences for the management of water resources from rainfall precipitation, surface run off, rivers, ponds and the lake.

Note: Temperature zones LH, U/LM designate Lower highlands (15-18?C), Upper Midlands, (18-21?) and Lower Midlands (21-24?C). Mean annual temperatures are enclosed in parentheses. Temperature zones are combined with humidity zones 2 (sub-humid), 3 (semi-humid), 4 (transitional), 5 (semi-arid) and 6 (arid) respectively.

Raising productivity requires a more efficient use of water resources which in turn requires knowledge, technology, knowledge distribution and institutions to facilitate knowledge transfer and resource mobilization. Many NGOs in the dev world implementing various forms of intervention usually in collaboration with the relevant government and state authorities. HB-AEP, CARE-Kenya, ... Are the involved.

Development practitioners such as HB-AEP were promoting mobilization of farmers into grass roots structures. The laying of soil conservation structures, the bucket and T-pump technologies were some of the interventions offered. Both are simple, labour intensive and productive and, if adopted on a wide scale, would increase productivity of the rural labour thereby reducing unemployment.

The extent of adoption and factors that may have encouraged this adoption are not known. This presentation seeks to fill in the need for analysis and summary of the investigation of soil conservation and irrigation. The aims of this investigation were ... The questions asked were ... Answers to these questions would ... for the benefit of ... In this paper, results of a study conducted with the objective of assessing the extent of adoption of sustainable use of soil and water resources namely, construction of terraces and small scale irrigation within these river basin systems and to analyze the factors influencing this adoption which was conducted in the area in 2000 are presented.

Procedures and Methods

Field methodology involved a sample survey of 298 out of the 3600 members of the HB-AEP sponsored groups following the rapid appraisal approaches and focus group discussions. Secondly, focus group discussions (FGDs) with a representative sample of Farmer Groups (FGs) and also Farmer Committees (FCs) would be undertaken. Thirdly, views and opinions of key persons within collaborating institutions would need to be sought.

Questionnaires and check lists were developed. Enumerators received training and briefing for seven days covering general principles of surveys in social studies, and the purpose and objectives of the survey, structure, question wording and sequence, point by point. In the session preceding the field pre-testing, participants were exposed to techniques for approaching interviewees, introduction and securing interviews as well as managing time. Roles of the enumerators and supervisors were spelt out. The questionnaire was pre-tested within the local farming community prior to formal administration. Actual interviewing took place over a period of seven days.

A stratified random sample of 300 households or 10 per cent of all the members were selected. Due to the need to represent agro-ecological as well as socio-economic variation that obtains in the area, a stratification criterion was devised in such a way that although all districts within the Diocese were covered, distribution within districts was weighted by respective shares of members.

Focus Group Discussions (FGDs) covering collective assessment of benefits of AEP sponsored interventions, placing accent on issues pertaining to adoption costs, information needs, sustainability, and cost of membership were held. Members were encouraged to discuss and raise any other issues they considered to be important. Activities of other institutions involved in agricultural development in the area were also discussed,laying emphasis on prospects for collaboration between AEP and these institutions.

Informal discussions with resource persons within collaborating institutions

Unstructured discussions with relevant officers within selected collaborating institutions were held. The institutions visited were: the Ministry of Agriculture (DALEO, Kuria District; District Livestock Officer, Migori District, and the District Extension Co-ordinator, Rachuonyo District); KARI (Director, RRC, Kisii, RELO, RRC Kisii); CARE Kenya, Homa Bay. Respective roles of these institutions as well as the current arrangements for collaboration were discussed. Opinions on how these arrangements for collaboration could be improved were sought. Recognizing the positions of the officers within the respective institutions as leaders in agricultural development and repositories of highly specialized technical knowledge, they were encouraged to offer evaluation on the content and operation of the AEP components they were familiar with.

Data and analytical procedure

Following further processing and checks for consistency, summary statistics were extracted. Modeling relationships between observations was facilitated through simple cross-tabulations, descriptive statistics and the fitting of the data to logistic regression functions.

Results

The main results were that access to micro finance and information and agro-ecological zones were important factors in adoption of smalholder irrigation systems and construction of terraces. By August 2000, groups affiliated to HB-AEP had recruited 3662 individual members, approximately 1.5 per cent of the households in the area covered by the Catholic Diocese of Homa Bay. A stratified random sample of 300 households or 10 per cent of all the members were selected.
A total of 234 farmers in the sample claimed that they were saving with their respective VBs at monthly frequencies. Of these, 61 had benefited from the loan facilities offered by their VBs. The money borrowed was used to finance general business, crop and livestock production, general farm and general household expenditure.

Savings and credit

The HB-AEP sponsored savings and credit scheme provided opportunities for mobilization of available local financial resources through a flexible and accessible savings facility, this flexibility seemed to extend to the purposes for which the loan proceeds can be used. Most respondents (39 per cent) used loan money to set up, improve or to operate general business, i.e., cattle, cereals, clothing and dress making and general trade. This was followed by crop production (16 per cent) where the money borrowed was spent on purchase of seeds and general crop husbandry. Third place (15 per cent) was taken up by expenditure on livestock. This involved purchases of cows and goats and investment in dairy, poultry and the setting up of zero grazing units. Coming fourth and fifth were general farm (13 per cent) and household (5 per cent) expenditure. The main items of general farm expenditure were purchases of a wheelbarrow and oxen. General household expenditure was incurred on purchase of bicycles and payment of school fees. There were numerous other items of expenditure (12 per cent). Major problems were difficulties with processing of loan applications (53%), delays from the date of application to disbursement, high interest rates and the grace period is too short. Two of the VBs were in the process of putting in place the required infrastructure. Members seemed to be learning, and adjusting to the requirements, obligations, responsibilities and privileges associated with belonging to the VBs. The savings base in this category of VBs was not robust enough to support the credit requirements of the members. These VBs tended to be those that were recently established and they tended to be located in areas of lower agricultural potential.

Thus, the VB system was able to facilitate mobilization of local financial resources, and, indirectly, access to capital from outside the area. There was evidence of contribution to the local entrepreneurial acumen and general household welfare. The VB system still needs to receive external support to the VBs in form of governance, managerial skills and modest infusions of loanable resources until sustainability is attained. The VB system is a potentially important focal point for collaboration with other stakeholders especially those in the private sector and NGO communities.

Soil and water conservation

A total of 48 km (mean, 175 meters per farm) of terraces were constructed by farmers in the sample over a period of three years. Other soil and water conservation measures undertaken were check dams, retention ditches, tree planting, alley cropping, cover cropping and trash lines and mulching. Regression results for determinants of adoption or length of terraces are presented in Table 1.

Table 1. Determinants of the farm level increase in length of terraces for rain water harvesting

Dependent variable = terrace length (m/ha)

	Coefficients		Asymptotic ratio	Significance
	B	Std. Error		
(Constant)	211.005	255.905	0.825	0.431
Extension contact (frequency)	-19.641	23.529	-0.835	0.425
Borrowing from Village Bank	98.297	94.039	1.045	0.323
Crop land size (ha)	-53.912	26.386	-2.043	0.071
Intensity of participation at group meetings	7.998	40.52	0.197	0.848
Gender of household head	-31.281	81.575	-0.383	0.71

Irrigation

Results indicated high adoption rates (7-22 percent for Rachuonyo and Migori Districts respectively) for the bucket system. Both systems were used for irrigating kitchen gardens, raised beds and double dug gardens. The reasons for the low rate of adoption of the T-pump irrigation technology, as it emerged during the FGDs were the cost of the technology, difficulties with accessing loans that operating the pump is tedious. Regression results for determinants of adoption of irrigation are presented in Table 2.

Table 2. Determinants of the adoption of bucket irrigation

Variables in the Equation	Coefficients B	S.E.	Wald	df	Sig.	Exp(B)
Intensity of paticipation at group meetings	0.181	0.215	0.71	1	0.399	1.199
Gender of household head	0.591	0.533	1.23	1	0.267	1.806
Permanency of land tenure	-0.345	0.291	1.4	1	0.237	0.708
Borrowing from Village Bank	0.037	0.588	0.004	1	0.954	1.038
Constant	0.01	1.241	0	1	0.994	1.01

Model Summary

-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
85.075	0.055	0.074

Smallholder Access to Information on Better Farming Practices

The Ministry of Agriculture has traditionally provided agricultural extension services to farmers in the rural areas at no cost to them. Provision of these services has declined appreciably, mainly due to reduced budgetary allocations. Voluntary sector agencies such as AEP are increasing share of provision of extension services to farmers. The purpose of the Agricultural Extension section in the AEP survey was to obtain farmer assessments of the effectiveness with which AEP facilitates the flow of information from source to the final consumers, the farmers. This entailed identification of the farmers sources of information about farming, the type and purpose of the information, the method of delivery and farmer evaluation of the information obtained.

Irrigation was used for raising small horticultural crops on kitchen gardens, double dug seed beds, and raised seed beds. The results of analysis of determinants of these developments are depicted in Table 3a-c.

Table 3a. Determinants of adoption of Kitchen gardens

Adoption of kitchen gardening						
Variables in the Equation	Coefficients					
	B	S.E.	Wald	df	Sig.	Exp(B)
Borrowing from Village Bank	-0.213	1.134	0.035	1	0.851	0.808
Crop land size (ha)	1.712	1.041	2.705	1	0.1	5.541
terrace length (m/ha)	0.002	0.004	0.236	1	0.627	1.002
If irrigation adopted	2.304	1.282	3.23	1	0.072	10.011
Constant	-4.246	2.737	2.406	1	0.121	0.014

Model Summary			
-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square	
24.412	0.264	0.359	

Table 3b. Determinants of adoption of raised seed beds

Adoption of raised seed beds						
Variables in the Equation	Coefficients					
	B	S.E.	Wald	df	Sig.	Exp(B)
Borrowing from Village Bank	-0.053	2.161	0.001	1	0.98	0.948
terrace length (m/ha)	0.002	0.009	0.037	1	0.848	1.002
If irrigation adopted	2.604	1.618	2.591	1	0.108	13.521
Gender of household head	-0.857	2.398	0.128	1	0.721	0.424
Intensity of paticipation at group meetings	-10.772	80.543	0.018	1	0.894	0
Constant	41.739	322.186	0.017	1	0.897	1.3394 7E+18

Model Summary		
-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
9.694	0.466	0.647

Table 3c. Determinants of adoption of double dug seed beds

Adoption of double dug seed beds						
Variables in the Equation	Coefficients					
	B	S.E.	Wald	df	Sig.	Exp(B)
Borrowing from Village Bank	-1.41	0.735	3.674	1	0.055	0.24
If irrigation adopted	1.178	0.703	2.804	1	0.094	3.24
Gender of household head	1.139	0.752	2.295	1	0.13	3.12
Intensity of paticipation at group meetings	0.246	0.311	0.622	1	0.43	1.27
Constant	-2.833	1.491	3.609	1	0.057	0.05
Model Summary						
-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square				
58.37	0.139	0.215				

Sources of information

Farming information was obtained from at least 15 agencies. The most frequently mentioned sources were HB-AEP (88 per cent), the ministry of Agriculture (6 per cent) and CARE-Kenya (2 per cent). The most frequently used methods of passing on information were; verbal exchange between the farmer and extension agent during contact (59 per cent), demonstrations (13 per cent), and tours (12 per cent). Less frequently mentioned methods were seminars (5 per cent), contact with `technicians' (4 per cent), farm visits (4 per cent), and others. Farmer responses indicated that AEP used all the methods of conveying information to farmers. All the other agencies used the `verbal' method. The ministry of Agriculture, Netherlands, C-MAD and DANIDA also used demonstrations. The study on Agricultural Knowledge and Information Systems (ETC 1997, Table 6.) showed that AEP had linkages with all the 25 agencies that were active in disseminating information in the area, the only agency with such comprehensive linkage apart from the Ministry of Agriculture.

Indicators for assessing the effectiveness of delivery of information on farming were frequency of contact with extension agents, and techniques used. While some farmers stated that they rarely were in contact with the extension agent (35 per cent), a fair proportion (34 per cent) reported that they were in contact at intervals of one monthly or less. A further 15 per cent, while not giving a quantitative indication of frequency of contact, stated that they were in contact with extension agents. No fewer than 17 techniques were mentioned by farmers as major subjects of the extension advice. Of these the most frequently mentioned were agro-forestry (25 per cent), organic farming (15 per cent), planting in rows (7 per cent) and general farming (8 per cent). The techniques adopted by the majority were soil conservation (75 per cent), organic farming (6 per cent) and crop husbandry (5 per cent). These indications suggest that the effort directed at passing on information to farmers was effective.

Soil and water conservation

The strategy to promote sustainable land use by smallholders that was adopted by HB-AEP embraced soil conservation, tree planting (including agro-forestry practices), use of manure, composting, kitchen gardening, raised beds, double dug beds and use of organic repellents. No external inputs were required to implement any of these practices. As most these practices are labor intensive, their adoption would promote on-farm employment and possibly, generation of farm income through sales of vegetables and tree products. Survey results as well as the synthesis of Focus Group Discussions (FGDs) suggest that farmer response to these interventions was encouraging. The highest adoption rate was recorded for the use of organic repellents (per cent) followed by composting (per cent) and kitchen

gardening. On farm tree nursery raising was fourth, followed by raised beds and double dug beds. Use of manure and soil conservation came seventh and eighth. Raising tree nurseries involves complicated steps while soil conservation practices are labor intensive. Implementation of either intervention may involve cash outlays.

The monitoring record shows that by the time of the survey, soil conservation and related practices had, been embraced by no fewer than 567 farmers throughout the HB-AEP program area. Farmers adopted more than 10 different ways of approaching soil conservation. Terracing was the most popular soil conservation measure to be adopted by farmers were terracing (20 per cent), grass strips (12 per cent). In the third place in terms of popularity was mixed cropping, check dams and retention ditches (each accounting for 10 per cent). These were followed by tree planting, alley cropping, cover cropping and trash lines (7-8 percent). Some farmers carried out mulching as a soil conservation measure (3 per cent). There were many other miscellaneous approach to soil conservation by the members of AEP interviewed. The apparent popularity of building terraces as a strategy for controlling soil erosion could have been based on perceived effectiveness and promotional effort devoted to it. One expects that retention ditches to be popular in relatively semi-arid locations.

The indicator of the effectiveness of soil conservation measures was the length of soil conservation measures achieved. Out of 298 households in the sample, 241 categorically stated that they had adopted at least one soil conservation practice (68 in Homa Bay, 15 in Rachuonyo, 54 in Suba, 96 in Migori and 6 in Kuria Districts). Assessing the total land area conserved proved to be impracticable. This would have entailed taking measurements of plot sizes and all the difficulties that this involves because it is generally a linear measure. Nevertheless, an attempt was made to gain some quantitative measure of the effort that went into soil conservation practices following intervention by AEP. Farmers were assisted by enumerators to estimate the length of soil conservation measures that had been put in place. A total length of 48 km of soil conservation structures were in place by September 2000. The farm with the shortest structures in place had almost 4 meters (mean 175 and median 88 meters). Other practices like cover cropping, and alley cropping were not quantified because the aim was to provide an estimate of the effort that went into soil conservation.

Irrigation

Jaetzold and Schmidt (1982) classified a significant proportion of the area as semi-arid. Many areas have good soils that are suitable for raising good crops. There are many sources of water that can be used to irrigate crops. Production of vegetables in the area is low and many families do not have access to sufficient quantities of this dietary component. Prospects for development of the market for fruits and vegetables are good. Yet the amount of rainfall received is too low and unreliable for most fruit and vegetable crops. To reliably raise reasonable vegetable crops farmers need to supplement rainfall with irrigation. HB-AEP adopted a number of low cost approaches to promotion of smallholder adoption of irrigation in the area.

The major types of low cost irrigation technology that were promoted by HB-AEP were bucket and T-pump technologies were promoted for adoption. Both are simple, labor intensive technologies which, if adopted on a wide scale, would have the effect of increasing productivity of the rural labor force thereby reducing unemployment. The survey results indicated that bucket method was adopted by the highest number of smallholders. In Migori District 28 smallholders representing 22 per cent of the sample were practicing bucket irrigation. This was followed by Homa Bay (23 smallholders), Suba (7 smallholders), Kuria (4 smallholders) and Rachuonyo (3 smallholders). Adoption of the T-pump technology did not feature prominently in the results of the survey. Only one respondent in Kuria was using the T-pump. Although the questionnaire did not address the reasons for the low rate of adoption

of the T-pump irrigation technology, the were raised during the FDAs. One reason was the cost of the technology and the issues related to accessing a loan to finance its purchase. Another issue was that the pump is very tedious to work.

Crop Production

Parcels of land owned by smallholder households in the area averaged between 8 acres (Kuria and Homa Bay) and 21 acres (Suba). The proportions of total land devoted to crop production ranged between 49 and 69 per cent. Farmers have been adopting the ox plough technology. At the time of the survey, adoption of this technology stood at 23 per cent. The technology is used mainly for plowing (21 per cent) and 'digging' (20 per cent).

Crops

Farmers identified more than 18 food, horticultural and other cash crops. The most important crop in the five districts is maize. Overall, maize was ranked as the first crop by 55 per cent of all respondents. Second, third and fourth in importance were cassava, sorghum and beans. This ordering, however, varied from one district to another. Sorghum received high ranking in Homa Bay and Suba Districts while cassava was the second most important crop in Migori and Rachuonyo Districts. Beans and featured prominently in Kuria and Migori Districts. Vegetables were the second most popular commodity in Kuria and featured in other districts.

This suggests that unless opportunities for supplementation through consumption of milk. meat, eggs, fish or other animal derived food, it is likely that the dietary intake of the residents of the area would be deficient in proteins. This would be an important motivation for investing effort in promoting production and use of grain legumes in the area.

Crop husbandry practices that are promoted by HB-AEP are based on a low external inputs strategy. Use of improved crop varieties in addition to traditional types is a major aspect of this strategy. Important varieties of maize were the Kenya Seed Company Hybrids and Katumani composites (KCB and DLC). Adoption of Pioneer and a variety called Morogoro also featured in the results. Five improved bean (Mwezi moja, Canadian wonder, Rosecoco and Katumani Bean 1), and one improved cowpea (K80) varieties had been adopted by some farmers. The most important Improved sorghum varieties were Seredo, Serena and KARI Mtama 1. Two varieties of cassava (Migyera and SS4) and two varieties of sweet potatoes (K4 and Simama) appeared in the farmers list of the material they have adopted.

Organic farming methods that farmers reported using were, boma manure, composting, kitchen gardening, double dug beds, and many others. Up to 95 per cent of the respondents reported that they were using at least one of the recommended organic farming practices. Total grain production per smallholding was before 1997 and the time of the survey. Possible sources of error would be farmers recall and climatic, market and other influence on the performance of the grain production enterprise. Overall, average grain production before 1997 was 1,600 kg/farm. Farmer estimates indicated that average grain production had increased to 2,033 kg/farm in 2000. Median production levels were 1,165 kg before 1997 and 1,380 at the time of the survey. Effectiveness of the construction of terraces on raising grain production is analysed in Table 4.

Table 4. Determinants of increased grain production

Dependent variable = incremental grain production (kg/ha)	Coefficients		Assymptotic t ratio	Significance
	B	Std. Error		
(Constant)	-12.565	585.989	-0.021	0.983
Borrowing from Village Bank	31.232	240.583	0.13	0.898
Crop land size (ha)	-10.206	115.847	-0.088	0.93
Gender of household head	-50.685	236.487	-0.214	0.832
terrace length (m/ha)	2.2	0.969	2.27	0.031
Adoption of organic fertilizers	207.415	226.736	0.915	0.368

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
	0.457	0.209	0.072	592.158	1.992

Conclusions and recommendations

Many farmers were saving with their respective VBs and some had obtained credit from these. This seems to have resulted from the flexibility that this facility offers. Farmers who borrowed were able to service a variety of needs from this facility. The credit and savings component of HB-AEP still needs continued support from HB-AEP. Participation by collaborating agencies should be encouraged

Ways of simplifying the procedures for processing applications and disbursement should be sought

Adoption rates may be expected to increase as farmers become acquainted with them. Improved access to credit facilities to enable farmers to overcome the capital constraint will contribute to increased adoption of the technology and increased fruit and vegetable production in the area.

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