Asian Journal of Agricultural Extension, Economics & Sociology

38(11): 66-80, 2020; Article no.AJAEES.63392
ISSN: 2320-7027

The Effect of Participation in Farmer Groups on Household Adoption of Sustainable Land Management Practices in Kenyan Drylands

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Authors' contributions

This work was carried out in collaboration among all authors. Author RNK designed the study, performed the statistical analysis and wrote the first draft of the manuscript. Authors CAO and GMO reviewed the study design and the first manuscript. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJAEES/2020/v38i1130454
Editor(s):
(1) Dr. Zhao Chen, University of Maryland, USA.
(2) Dr. Ian McFarlane(Rtd.), University of Reading, UK.
Reviewers:
(1) Svitlana Grygoruk, Khmelnytsky National University, Ukraine.
(2) Ronald Kakeeto, National Agricultural Research Organisation (NARO), Uganda.
Complete Peer review History: http://www.sdiarticle4.com/review-history/63392

Original Research Article

Received 24 September 2020
Accepted 28 November 2020
Published 05 December 2020

ABSTRACT

Land degradation is a major cause of declining yields and loss of dryland ecosystems resilience in the Lake Baringo Basin in Kenya. One of the solutions to land degradation in drylands is the application of Sustainable Land Management (SLM) technologies. Improving farmers' capacity to adopt SLM technologies has been an important strategy of the Kenyan government and her development partners to addressing land degradation. State agricultural extension services are charged with the role of building this capacity. Unfortunately, such extension services have had little impact in the Kenyan drylands. To counter this inadequacy in extension services, farmers have formed grass-root organisations to foster networks of support and information sharing. In this paper, we analysed the effect of participation in farmers organisation in promoting adoption of SLM practices by agropastoralists in the Lake Baringo Basin. Data were collected through in-depth

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household interviews with 150 farmers, 79 of them group members and 71 non-group members. Level of knowledge, sources of information and challenges of SLM adoption were studied. The study revealed significant and positive association between group participation and adoption of SLM practices at X^2 (3, N=150=63.209, P=0.000). Additionally, group partnering with development agencies like Non-Governmental Organisations (NGOs) and government departments was reported to have significant influence on household adoption of SLM practices at X^2 (3, N=79=13.147, P=0.004). The results indicated that farmer groups can effectively be used to leverage farmers' adoption of SLM innovations and potentially improve household income and food security in the Kenyan drylands. We recommended organizational and resource capacity building for farmer groups to promote their effectiveness in provision of resources and services to their members. In addition, government research and extension agencies and academia should consider forming collaborations with farmer groups in generation of SLM technologies that are suited to the farmers location and prevailing context.

Keywords: Words farmer groups; participation; collective action; sustainable land management; agricultural extension; drylands.

ABBREVIATIONS

ASAL : Arid and Semi-Arid Lands
ASDSP : Agricultural Sector Development Special Programme
FAO : Food and Agricultural Organisation
IMF : International Monetary Fund
NGO : Non-Governmental Organisation
SLM : Sustainable Land Management
SSA : Sub-Saharan Africa
TLU : Tropical Livestock Units
UN : United Nations
UNCCD : United Nations Convention to Combat Desertification

1. INTRODUCTION

Global drylands cover 41 percent of the earth's terrestrial surface, support a third of human population, half of the world's livestock and over a third of global hotspots of biodiversity [1]. Yet in most countries, drylands have for long been marginalised from development processes and political discourse and consequently have some of the highest levels of poverty in the globe [2,3]. Processes like expansion of cultivation and diversification of dryland use activities coupled with climatic changes are currently placing increasing burdens on the ecological, economic and social integrity of the drylands leading to their degradation [4]. United Nations Convention to Combat Desertification (UNCCD), [5], estimated that about 24% of the global land is considered to be degrading, and 20-25% of the degrading land is in the drylands. Dryland degradation is more severe in Sub-Saharan Africa (SSA) with an estimated 75 percent of SSA's drylands affected by moderate to high degree levels of degradation [6]. In Kenya, by 2006, about 18 percent of grasslands and 42 percent of shrub land both forming part of Arid and Semi-Arid Lands (ASAL) were degraded. A third of Kenya's population directly depend on the degraded drylands for their livelihoods [7].

Dryland degradation manifests in the forms of decline in vegetative cover, loss of soil productivity, loss of plant and soil organisms' biodiversity and increased soil erosion [8]. With degradation, drylands agro-pastoral resources become less productive, resulting in crop failure and quality decline or loss of livestock to hunger, especially during prolonged droughts [9]. The above result in the decrease of household income levels, food insecurity and loss of livelihoods pushing the communities further into poverty [10]. This in most cases is followed by reduced resilience and adaptive capacity, increasing the vulnerability of dryland communities to shocks from climate extremes [11]. According to United Nations (UN), [6], dryland degradation cost developing countries 4 percent of their national Gross Domestic Product (GDP) each year. International Monetary Fund (IMF) [12], put the cost of land degradation in Kenya at about USD 390 million in 2010 which is equivalent to 3 % of her annual GDP.

Dryland degradation thus, raises key concerns regarding the ability of pastoral and agropastoral systems to accommodate a growing human population in the presence of climatic changes [13]. Consequently, combating land degradation is presently receiving renewed attention from governments, development agencies, research and academia due to the direct link to poverty and food insecurity [5,14,15]. The processes that lead to land degradation involve complex

interplay between natural factors such as biophysical conditions and climatic factors including extended droughts and floods and anthropogenic factors such as poor land management and increasing population pressures [8]. Change in human behaviour towards sustainable land management can mitigate anthropogenic factors and adapt livelihoods to the climatic factors creating resilience.

Adoption of Sustainable Land Management (SLM) practices is considered a possible solution to overcoming dryland degradation [16]. Developed by research and promoted by extension, SLM practices such as soil and water conservation and integrated ecosystem management practices, seeks to increase land value and productivity with the aim of sustaining and improving livelihoods [15]. Even though SLM practices have been cited as having capacity to increase productivity of agro-pastoral ecosystems while preventing degradation and creating resilience to environmental variability, their uptake is still low in SSA. For instance, FAOSTAT [17] estimated that less than 3 percent of total cropland in SSA is under SLM. In Kenya, the estimated adoption rate of SLM practices in rangelands is 14 percent [18].

The success of adoption of sustainable land management technologies and innovations proposed by scientists and technicians invariably rely on dryland communities to implement them and ultimately their actions will determine the status of the environment and associated socioeconomic impacts. Lack of appropriate knowledge and information on suitable SLM practice, failure to integrate relevant stakeholders and lack of recognition of traditional institutions in natural resource management are cited as key factors limiting adoption in drylands [16,19]. Agricultural extension advisory service is associated with diffusion of information, creation of awareness, training, and promotion of SLM practices [16]. Regrettably, state-driven agricultural extension services have had little impact on pastoral and agropastoral systems in SSA countries including Kenya [20, 21]. Attributes of drylands among them harsh environment with poorly developed infrastructure, insecurity and remoteness make the areas unattractive to extension workers and also renders the traditional top-bottom extension models inappropriate for use as they fail to adapt to location and socio-cultural context of the dryland inhabitants [1,20,22].

At independence, Kenya's development policy was to invest in transport and power infrastructure in high agricultural potential areas with *"good land and people receptive to and active in development where it will yield the largest increase in net output"* [23]. Until recently, this policy has formed the basis of subsequent policies and to date the Kenyan drylands have remained the least developed and marginalized in the country. Kenya's state extension agencies have tended to focus on high-potential areas, and on high-value crops and exotic livestock breeds, giving the problems and opportunities of drylands a low priority [24]. Kenya's drylands are hence not only marginalized by distance from major urban centers, formidable topography, cultural and linguistic barriers but also institutionally in that they often are not party to the policy decisions affecting their livelihoods [2,3,25]. This multidimensional marginalisation, makes site-specific environmental knowledge and the aspirations of dryland residents to remain largely unconsidered within expert assessments and management strategies [3]. In recognition of the aforementioned challenges, there is increasing evidence showing development agencies including research and extension advisory services in interactive and participatory efforts with communities and farmers grassroot organisations, towards developing various SLM alternatives in drylands [26,27].

Building farmers' capacity in partnership with existing local community organisations may be a way to address the problem of farmers' empowerment in natural resources management. With recent policy developments and shifts in the agriculture sector, vocalizing the place of farmers within wide-ranging networks of knowledge, the role of community mediated generation of knowledge has become crucial [28]. These developments have seen farmer groups emerge as significant organisations serving the information and learning needs of members. According to [29], farmers' organisations facilitate farmer learning and innovation processes by acting as space for exchange of farmers' know-how and innovations, by setting up support mechanisms for learning activities and by participating in the definition and monitoring of research and extension activities. In this study we studied household participation in an agricultural grassroot organization and how this participation influenced household adoption of SLM practices.

2. MATERIALS AND METHODS

2.1 Site Description

The Njemps Flats is situated along the Southwestern basin of Lake Baringo (Fig. 1) and partly surrounded by Tugen hills [14]. The area falls within agro-climatic zones IV and V, between °45′ and 0°15′N latitude; 35°45′ and 36°30′E longitude [30]. The area is a semi-arid and is inhabited communally by the Il Chamus community. The main livelihood activities include agro-pastoralism, fishing and charcoal burning with livestock being the main source of livelihood. Occasional violent interaction between Il Chamus and her neighbours caused by cattle rustling is a common feature of life in the basin. The area receives low erratic and unreliable rainfall, ranging from 300mm to 700mm annually spread over two seasons and experiences hot and dry periods with an annual mean temperature above 30^0C. The dominant soils in the Njemps Flats are generally shallow silt loam to clay loam, with low organic matter [31]. The vegetation in the area is dominated by acacia woodland and the invasive *Prosopis juliflora* (80%) seasonally flooded grassland (15%), shrub grassland (5%) and a permanent swamp measuring 1.5 Km^2 covered by *Cyperus papyrus*. Intensive grazing pressure, soils prone to degradation and erratic rainfall, has caused large-scale death of annual and perennial grasses leaving most of the ground bare and severely degraded [14].

2.2 Data Collection

Data on land degradation perception, self-assessed level and sources of SLM knowledge, challenges of adoption of SLM practices and group participation patterns were collected through household semi-structured interviews and gender-segregated focus group discussions between January 2019 and May 2019. One hundred and fifty household heads were interviewed. Out of the one hundred and fifty agro-pastoralists interviewed, seventy-nine respondents were members to farmer groups or had an adult household member participating in the groups while seventy-one were not members and did not have a house adult member being in a group. The household heads who were not members to groups were sampled proportionately and systematically in the Il Chamus and Mukutani administrative wards of Baringo South Sub-County. Interviews were done along predefined transect lines using systematic random sampling method where the head of every fifth household was interviewed. Group members were randomly sampled from active farmer groups in the two administrative wards of Il Chamus and Mukutani.

3. RESULTS AND DISCUSSION

3.1 Sample Description

Descriptive statistics for the sample are presented in Table 1. Majority of the households were male headed (78%). Mean age of the household heads was 43.5 years (SD=10.95 years). On average, the household heads had a farming experience of 19.6 years (SD=10.24 years). Only eight (5%) of the household heads had tertiary education while the rest of household heads were distributed almost equally among the other four education levels with 22% of the respondents reporting no formal education. The mean household size was reported at 7 (SD=3). Land tenure in the area was designated as communal, though in practice much of it is sub-divided and operated as individual land. Average household land size of the sampled households was 1.88 ha (SD=0.79 ha). Fifty-eight percent of the household owned land was under annual crops with maize being the main crop. Other grown crops included, beans, sorghum, millet, green grams, water melons and vegetables. The average crop diversity was 3. The households were found to own 6.5 Tropical Livestock Units (TLU) on average with a standard deviation of 5.5 and a livestock diversity of 3.2. More than half of the participating households (52%) reported earning an income of less than 300 dollars annually translating to 0.83 dollars daily income. Respondents with no formal education were relatively older and had larger land sizes but had less income compared to those with higher levels of formal education.

Comparing household's socioeconomic and demographic characteristics as well as household resource endowment for the group members and non-group members revealed that education, extension access, credit access and annual income were statistically different between the group members and non-group members (Table 1). The average age of the group members household heads was 42.32 while that of their counterpart had an average of 44.89 years. The group members had higher household income, higher access to credit, extension and higher level of formal education. On the other had non-group members had on average lightly bigger plots and larger TLU (Table 1).

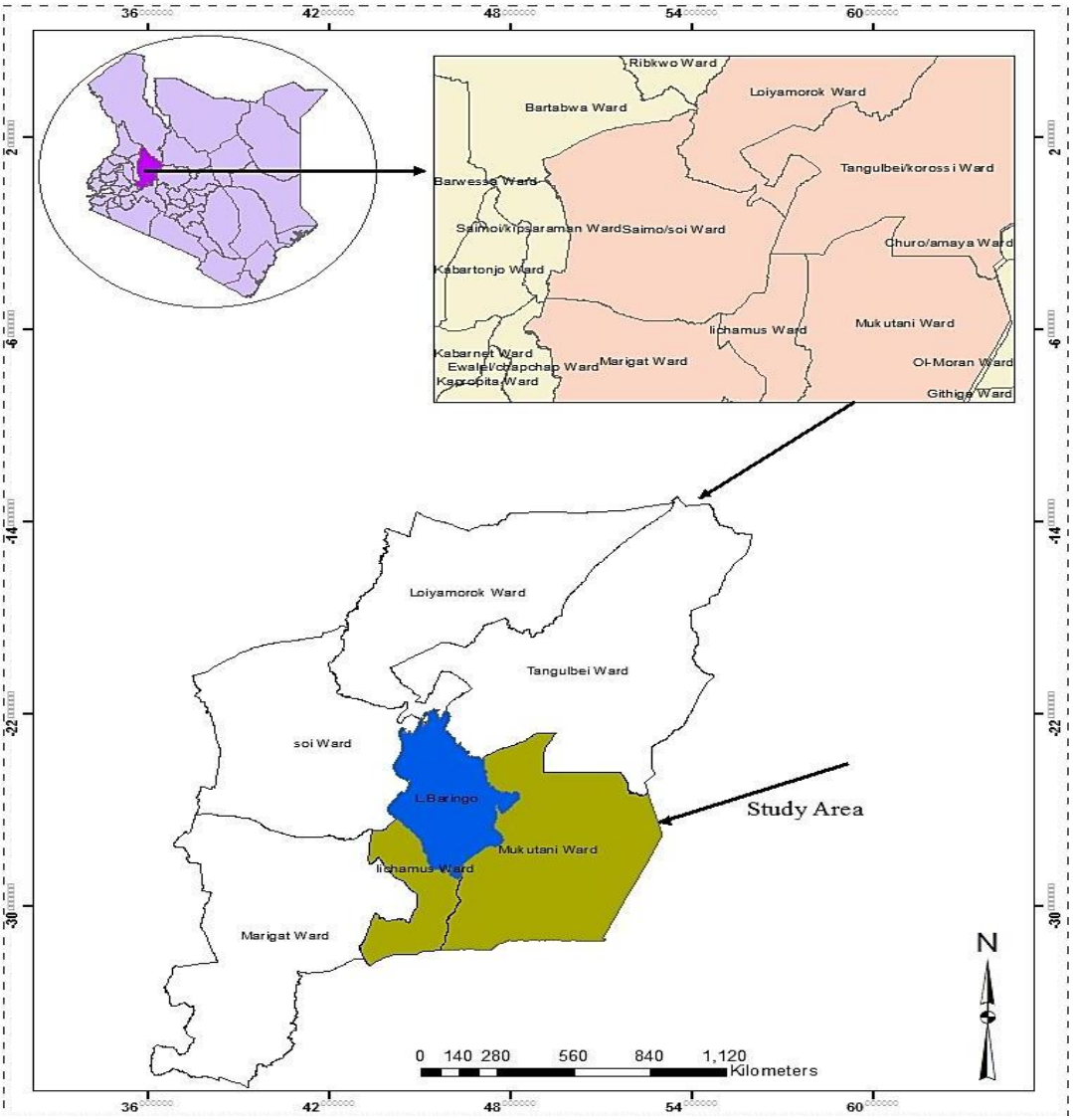

Fig. 1. Map of the study area

Individual farmer characteristics have been found to influence adoption of agricultural innovations. For instance, [32]. found household factors like sex and age, farm characteristics and institutional factors like credit and extension access and soil conservation to influence soil conservation decisions in Ethiopia while [33]) reported literacy and numeracy to influence adoption of appropriate agricultural technologies in India. Education level is also considered important in sourcing of agricultural information and technologies, forming social networks and entering in contractual agreements that collectively contribute towards farmer's empowerment.

Bigger households indicate availability of unpaid labor to adopt labor-intensive practices such SLM practices [34] though they could also indicate higher dependency which may lead to less income committed towards agricultural innovations hence compromising SLM practices uptake. Access to credit and extension have been cited as key underlying factors in SLM adoption [35]. A study by [36] reported that the interplay between poverty and lack of access to credit and extension services hindered adoption of SLM technologies that needed capital investments even when the technologies had long term benefits. In a study on social capital in agriculture [37] noted that being in a group

increased the chances of accessing financial services, agricultural extension as well as having a forum and capacity to push for policy advocacy. Livestock was the main livelihood source in the study area. While a bigger herd could mean more income to invest in SLM practices, if poorly managed it could lead to overgrazing which in turn could amplify land degradation especially in the presence of droughts induced by climate change [10].

3.2 Community Perception on Land Degradation

Ninety-seven percent of the respondents from the household survey perceived land degradation as an issue of concern that threatened their households and local community livelihoods. Perception is important because it could be a motivation to take action to combat land degradation. The study findings are consistent with findings by [38], who reported agropastoralists awareness and concern of land degradation and its connection to food insecurity in Haiti. The awareness towards land degradation can be positively related to both severity of and susceptibility of the land to degradation as is the case of the Njemps Flats and the extent of its impact on their livelihoods [10]. This suggests that awareness and concern towards land degradation would lead farmers to putting in place coping strategies or being open to introduction of SLM strategies by extension agencies or even participating in farmers organisations connected with SLM adoption.

3.3 Level and Sources of Knowledge on SLM Practices

To understand farmers' level of knowledge of existing SLM practices, they were required to self-assess on a Likert scale and also indicate the sources of the information and training (Figs. 2 & 3).

More respondents (63%) in the non-group participants category perceived themselves as having low level of SLM knowledge while more group participants (52%) perceived themselves as having moderate level of SLM knowledge. Only 12 farmers perceived themselves as having high level knowledge on SLM practices and they were all group participants. Farmers interaction with fellow group members and participation in group learning activities was likely to give confidence about self-knowledge and influence adoption of SLM practices. Lack of or low awareness and training in the use of appropriate SLM practices is a major constraint in adoption of SLM practices [39].

Table 1. Sample description

Continuous variables		**Group members**	**Non-group members**	**T statistic**	**P-value**
Mean Age		42.32	44.89	1.441	0.152
Annual income ($)		4,078	2,840	-3.950	0.000***
Mean Land size (Ha)		1.8	1.97	-1.299	0.196
Mean Family size		7	8	1.159	0.248
Mean TLU		5.94	7.04	1.222	0.224
Categorical variables		**%**	**%**	**X^2 statistic**	**p-value**
Formal Education (%)	None	28	19		
	Lower primary	30	17	12.44	0.014**
	Upper Primary	19	30		
	Secondary	22	25		
	Tertiary	1	9		
Credit access (%)	Yes	79	18	56.47	0.000***
	No	21	82		
Extension Access (%)	No access	27	45		
	Low	23	32	76.28	0.000***
	Moderate	35	23		
	High	15	-		

*Note. ***, **, indicates significance level at 1% and 5%*
Source: Author's research (2019)

The major sources of knowledge and information on SLM technologies were segregated according to group participation. The group participants reported groups (61%) as main source for SLM information followed by neighbours (50%), state extension (39%), agro-dealers and NGOS, both at 24% and radio at nine percent. For the non-participants neighbors (56%) were the most important source of information followed agro-dealers at 21%, state extension (17%) radios (11% and NGOs (9%). Fig. 3 presents the sources of information in SLM technologies as reported by the respondents.

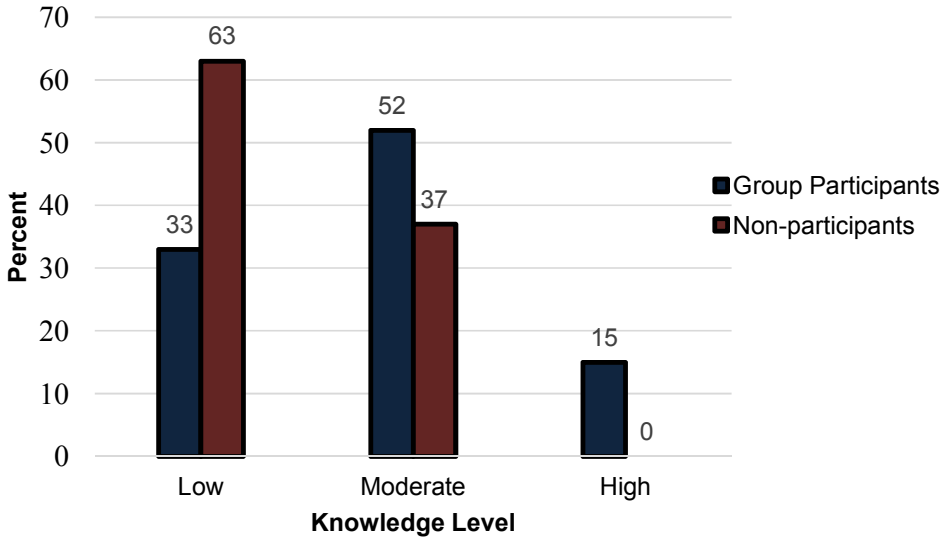

Fig. 2. Level of knowledge on SLM practices by the survey participants

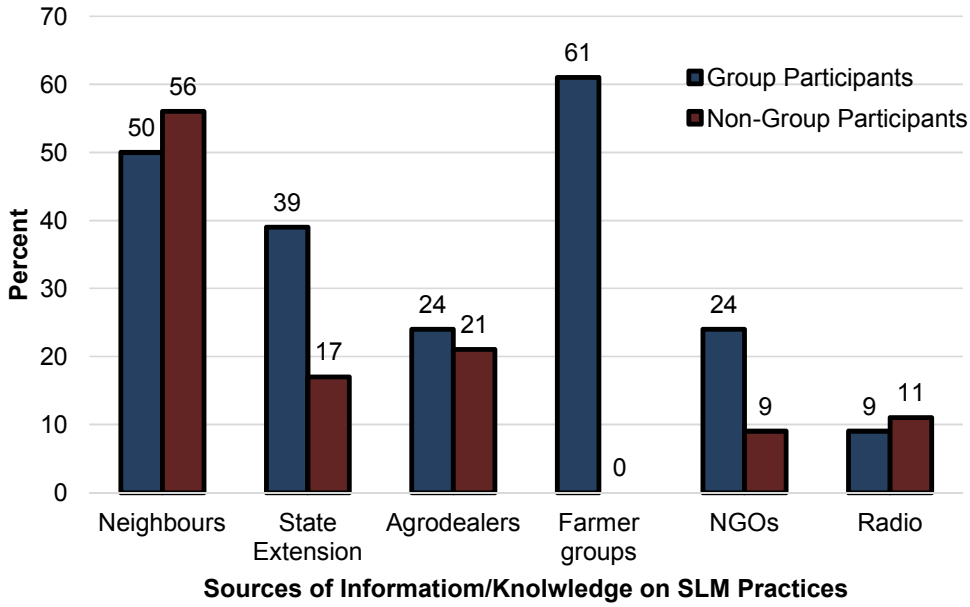

Fig. 3. Source of SLM knowledge and information disaggregated based on group participation

Both neighbors and farmer groups were indicated to play a key role in the dissemination and adoption of SLM technologies pointing to the need for farmers engagement, participation and collaboration when developing SLM practices. Emerging sources of extension like the agro-dealers call for better linkages between the private sector and state extension to protect the interests of the farmer. The proliferation of vernacular radio stations that are airing farmer programmes in the local language makes radios a rising source of extension information. The radios had a call-in facility where farmers could ask and get answers to their queries. Farmers however, cited power availability and cost of radio batteries as an impediment to his method. The study findings are supported by [40] who found farmers to be the key source of information on soil erosion control measures (49.1%), animal manures (27.7%), and inorganic fertilizers (43.2%) in Uganda. [41] also noted the importance of farmers groups as a source of local knowledge and technologies and advocated for their involvement in technology development and adoption research. Findings by [42] reported the most important sources of agricultural information in Nigeria to include extension agents, neighbors, other farmers, opinion leaders and organized groups in that order. [43] concluded that farmer groups, neighbors and family members can be used as a leverage for poor farmers who were more likely to get information about new technologies through them as compared to the rich farmers who had better access to government extension, NGOs agents and programs.

A country-wide household survey done in Kenya by Agricultural Sector development Programme (ASDP) in 2013 reported agro-dealers as a main source of information and knowledge on SLM technologies, followed by government extension, farmer groups, co-operatives and NGOs in that order [44]. A study by [45] noted the significant role played by the NGOs and farmer groups in disseminating agricultural information in rural agricultural communities especially where government extension services are scarce while [44] reported that contact to a local NGO amplified the log count of the number of SLM technologies adopted by thirty-three percent in Kenya.

3.4 Challenges and Determinants of Using SLM Practices

Although conceptually simple, the adoption of SLM is surrounded by many constraints embedded within the stakeholder levels of policy makers, technocrats and households [16]. The survey respondents were asked to indicate the challenges they faced in adoption of SLM technologies and the results were then segregated according to group participation (Table 2).

Both group participants (72%) and non-participants (67%) cited lack of capital to invest in SLM technologies as the main challenge of to SLM adoption, due to their high cost of implementation. More non-group participants (56%) reported lack of knowledge and skills and shortage of labour (51%) compared to 36% and 39% for the group participants respectively. These findings could suggest that groups facilitated access to extension services and reciprocal labour sharing for SLM technologies implementation. Climate variation was more recognized as a challenge by group members (42%) compared to non-participants (35%). This may imply that group participants higher adoption rates enabled them to make firsthand observation on the impact of climate extremes on the SLM structures or that their higher access to knowledge and information enables them to form the link between degradation levels and climate change. The findings concur with a survey by ASDSP and reported by [44] that the most important constraints in the adoption of SLM technologies in Kenya to be their high cost of implementation and lack of knowledge and training in their proper application. A study done in Vietnam also reported inadequate knowledge, climatic calamities, lack

Table 2. Challenges of SLM practices adoption in the study area

Challenge	Percentage	
	Group participants	Non-group participants
Lack of capital/High cost of SLM practices	72	67
Lack of knowledge and skills	36	56
Shortage of labour	39	51
Climatic variation	42	35
Insecurity of land tenure	4	6

N=150

of capital and lack of labor Vietnam as factors determining SLM adoption [46].

3.5 Group Participation and Determinants

Analysis on the household characteristics indicated that participation in farmer groups was strongly associated with the households' socioeconomic and demographic characteristics including age and education (Table 1). Most of the respondents (68%) reported that their groups were formed through community efforts and own mobilization efforts, 22 percent were initiatives by NGOs, 8 percent by government extension projects and 3 percent had by researchers. Individuals mainly made voluntary decisions to join the groups while a few were required to. It was expected that the voluntary choice would elicit high level of participation in group activities. Even though participating in the farmer organisations required voluntary participation, membership was not automatic and members had to meet certain requirements. Conditions for participation as reported by respondents included timely group contributions (89%), paying of a membership fee (78%), readiness to submit to groups' by-laws (65%), attendance to group meetings and activities (59%), being resident to the area (32%) (Table 3). The least group joining fee was 1.5$ while the highest was35$. Groups involved income generating activities had highest joining fee. Groups by-laws were enforceable by penalties.

Motivation for joining and remaining in groups was shown to be related to the services provided by the groups. The respondents cited the availability or the potential availability of the following services as their motivation to join and remain in their groups; social capital and help during emergencies (71%), credit and funding (62%), extension services (48%) and market access (22%) among others. In a study done in Kenya, banks and other financial institutions only allowed agricultural loan application to farmers organized in groups where the group acted as a guarantee that the loan is serviced as required [47]. Motivation for joining and remaining in groups was shown to be related to the services provided by the groups (Table 3).

3.6 Farmers Group Participation and Adoption of Sustainable Land Management Technologies

The study sought to assess how participation in farmers groups affected the level of adoption of SLM practices. Both group participants and non-participants respondents were requested to name the SLM practices used in their farms which were then categorized as non-adoption, low adoption (1 and 2 practices), moderate (3 and 4 practices) and high adoption (5 and 6 practices. Group participants generally adopted more SLM practices than non- participants. Only 5 percent of group participants had not adopted any SLM practice compared to 29 percent in non-group participants (Fig. 4). The observed higher adoption levels in group participants could be attributed to higher access to labour through reciprocal labour sharing in groups, access to information on SLM technology and more access to credit through groups than non-group members.

To understand the association between group participation and adoption of SLM practices, a Chi-Squire test of independence was performed to examine the relationship between participation in groups and the level of SLM adoption. The *p*-value indicated statistically significant relationship between group participation and SLM adoption at X^2(3, N=150=63.209, P=0.000). The households with adult members participating in farmer groups significantly had a higher level of SLM practices adoption compared to households with no participation in farmer groups. Table 4 presents the Chi-Squire test analysis for group participation and level of SLM practices adoption.

The study revealed that group participants had significantly higher SLM practices adoption score than non-group participants. This could be because most SLM practices requires labour, capital and access to knowledge and skills to implement which is available in groups [48]. A study by [16], reported the primary reasons for low adoption and up-scaling of SLM practices in SSA to include lack of information and knowledge on SLM options, lack of financial resources and labor constraints. While examining the efficacy of collective action in farmer groups on adoption of agricultural technologies, [49] noted that the groups facilitated low cost access to extension information and credit, lowered cost of inputs and facilitated labour sharing thereby stimulating agricultural technology adoption. Findings [16], indicated that the social, economic and capacity building benefits availed through farmer group participation as being instrumental to the participants' household adoption of SLM practices. This potential makes farmer groups an attractive instrument to development agencies for

locating and mobilising information and household welfare and sustainable rural resources necessary to advance better development rural areas [50].

Table 3. Group formation and reasons for joining groups N=79

Group Variable	Frequency	Percent
Group formation		
Own effort	54	68
NGOs	17	22
Government projects	6	8
Researchers	2	3
Conditions for joining groups		
Making timely group contributions	70	89
Paying membership fee	62	78
Readiness to submit to groups' by-laws	51	65
Attendance meetings and activities	47	59
Resident to the area	25	32
Motivation for joining groups		
Social capital and emergency help	56	71
To access credit and funding	49	62
To enhance access to extension services	38	48
Enhance Market access	17	22
Manage and access common resources	8	10
Access shared Labour	6	8

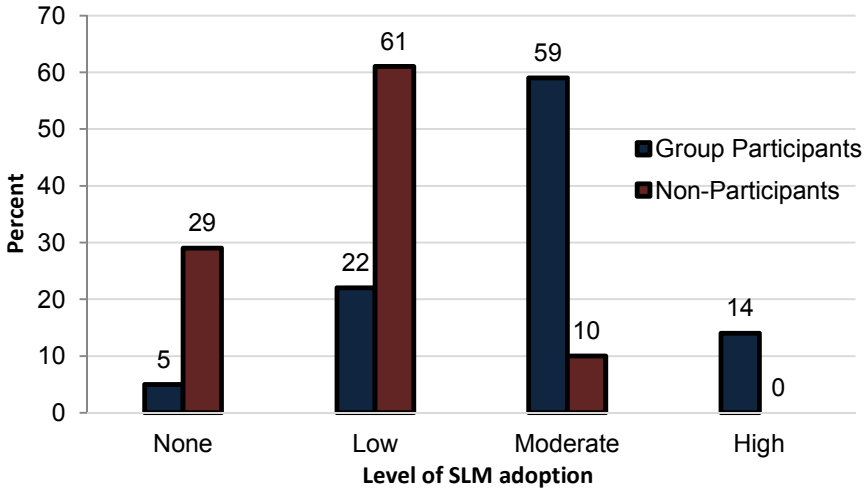

Fig. 4. Level of SLM adoption based on group participation

Table 4. Chi-squire tests for group participation and level of household SLM practices adoption

	Value	Df	Asymptotic significance (2-sided)
Pearson Chi-Square	63.209[a]	3	0.000
Likelihood Ratio	72.351	3	0.000
Linear-by-Linear Association	54.858	1	0.000
N of Valid Cases	150		

In addition, some of the groups had formed partnerships to tap resources and knowledge from the collaborating partners. Out of the 79 respondents who were members to groups, 42 were in groups with no partnerships while 37 were in groups with partnerships. Some of the agencies that the groups had formed partnerships with included government agencies including county extension providers, research bodies, and development authorities, NGOs and agribusiness agencies. Benefits obtained from partnerships were in form of input support and involved training and capacity building, startup assets, market, credit, grants, agricultural inputs and food aid. A Chi-Squire test of independence was performed to examine the relationship between groups partnering with development agencies on the level of household SLM practices adoption (Table 5).

The relationship between group partnering with development agencies and the level of household adoption of SLM practices was found to be significant at X^2 (3, N=79=13.147, P=0.004). Group members whose groups formed linkages and partnerships with other development agencies were more likely to adopt more SLM practices. Furthermore, their mean of SLM practices adoption (3.2) was higher than for groups without partnerships (2.2) and their standard deviation (0.78) was lower compared to the groups without partnerships (0.99) as shown in Fig. 5. These results indicate that the benefits of the partnerships increased the level of availability of factors associated with SLM adoption to members or that groups with forward looking and innovative leadership were more likely to form collaborations partnerships. Services and resources availed through farmer groups partnerships increase capabilities to generate outcomes by promoting mutual learning and increasing adoption of new technologies [51]. Evidently, the study findings infer that the potential of farmer grassroot organisations, in leveraging adoption of SLM strategies for the general improvement of the dryland livelihoods can be unlocked by strategic partnerships that act on jointly agreed priorities. Fig. 5 shows the relationship between number of SLM practices adopted by group members and partnership with development agencies.

Table 5. Chi-squire tests for group partnerships and level of household SLM practices adoption

	Value	df	Asymptotic significance (2-sided)
Pearson Chi-Square	13.147[a]	3	0.004
Likelihood Ratio	15.255	3	0.002
Linear-by-Linear Association	12.855	1	0.000
N of Valid Cases	79		

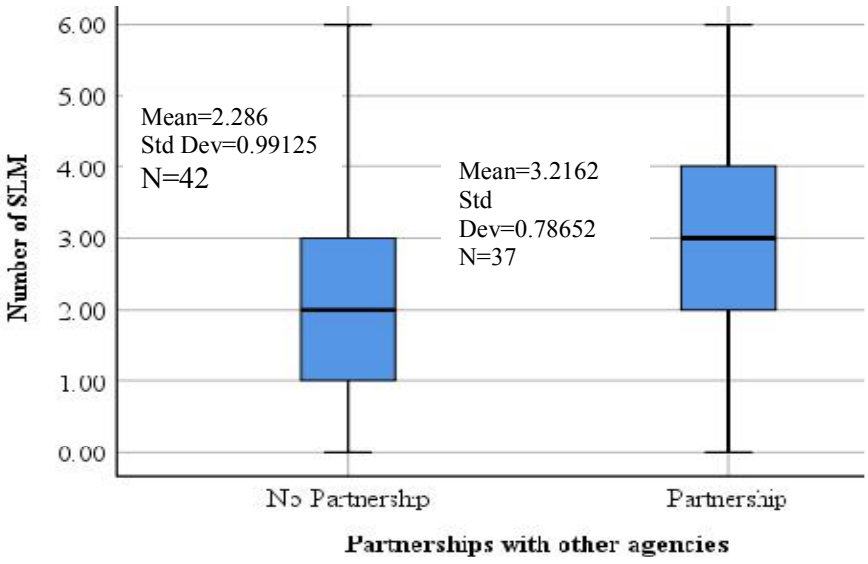

Fig. 5. Influence of Partnerships on number of SLM practices adopted by households

Our study suggests that the capacity of a group to carry out its functions may depend on the group's relationships with state and other external agencies. This is supported by [52], who found that partnering with developmental agencies increased benefits accessible to farmers in groups and also promoted collaborative learning leading to higher adoption and utilization of soil and water conservation technologies in Kenya. In Ghana, participants in farmer based organisations received training on agricultural production from NGOs and state extension that was not available to the non-group participating farmers [53]. Similarly, women farmer groups partnerships with external agencies was found to be important in training and motivating members to participate in group activities [54]. Consequently, farmers group's ability to build productive partnerships and collaborations with rural development agencies, has the potential to improve their success in availing more and higher levels of benefits to members.

4. CONCLUSION

The study concluded that adoption of SLM practices was significantly and positively influenced by participation of farmers in farmer groups and that members whose groups partnered with development agencies like extension and NGOs had higher adoption levels of SLM practices than those without partnerships. The farmer groups were found to be effective in bringing together actors to enhance stakeholder networking and collaboration for joint innovation and investment towards achievement of adoption of SLM practices. This is evidence that farmer groups are appropriate vehicles for technology development, dissemination and adoption thorough pooling of resources, facilitating knowledge and credit access, labour sharing or any other activity that enables group members to tap into economies of scale. Partinerships with development agencies allowed for tapping of resources and expertise held by various partners to address land degradation

A few policy implications emerge from our findings. Firstly, the worth of farmer groups on combating land degradation suggests the need to develop their organizational and resource capacity to profit even more households especially the very poor in the community. This could potentially help in dealing with challenges in sustainable land management hence and by extension increase farm production and growth in farm income. Secondly, groups should be supported to form linkages and collaborations with private and government agencies, which could promote groups access to a wider range of services and increase their effectiveness in provision of resources and services such as farm inputs, information, accessing markets and financial services which a are all tied to adoption of SLM. Thirdly, since SLM technologies are location specific and dryland farmers are continuously experimenting to improve their productivity and adapt both traditional and modern technologies to their location and their prevailing contexts, they should be seen as natural partners of academia and research who need to develop sustainable approaches to livelihood strategies in drylands. Lastly, financial implications central to active participation in groups, may keep away the poor members of the community. Agricultural policies at the county and national government level should address this exclusion to ensure that the poor benefit from group participation that often requires meeting upfront costs before realizing benefits.

CONSENT

As per international standard or university standard, Participants' written consent has been collected and preserved by the authors.

ACKNOWLEDGEMENTS

We thank, Francis Parkolwa, the extension officer with Rehabilitation of Arid Environments (RAE), Trust, Mr Duyu and Daniel Toroitich of Kenya Agricultural and Livestock Research Organisation (KALRO) based at the Apiculture Research Institute Marigat for their help in the field during data collection. Further, we are very grateful to Baringo South Sub-County Agricultural Extension Office for providing us with the farmer groups information and data needed for effective sampling and interviewing of the group members for this study

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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