

SIGNIFICANCE OF SOCIAL NETWORKS IN SUSTAINABLE LAND MANAGEMENT IN CENTRAL ETHIOPIA AND EASTERN UGANDA

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ABSTRACT

Social networks (SNs) are social frameworks that form good entry points for business and socio-economic developments. Social networks are important for small-scale, resource-poor farmers in Sub-Saharan Africa, who overly rely on informal sources of information. SNs provide opportunities for establishing effective functional multi-stakeholder Innovation Platforms (IPs) necessary for catalysing wide adoption of SLM innovations. This paper analyses the significance of SNs in sustainable land management (SLM), focusing on stakeholders' characteristics and their association among agricultural rural communities in central Ethiopia and eastern Uganda. The analysis conducted in both countries revealed a positive relationship between the strength of social networks and SLM innovation practices. The closeness of centralisation of networks in Ethiopian and Uganda was 56 and 45%, respectively; implying that only about half of the potential networks among partners actually function. The factors associated with strength of the networks included the age, the physical distance between partners, frequency of interaction, and source of information. Unfortunately, significant weaknesses remain in the existing networks. There exist several networks in both countries without active interactions with key actors in land management. Also, private sector networks particularly important in playing critical roles such as fostering market-led innovations for enhanced adoption, are conspicuously lacking.

Key Words: Eastern Africa, highlands, innovation platforms

RÉSUMÉ

Les réseaux sociaux sont des structures sociales qui forment un bon point de départ pour les développements commerciaux et socio-économiques. Les réseaux sociaux sont importants pour les petits et pauvres fermiers en Afrique Sub-Saharienne qui dépendent seulement des sources informelles d'information. Les SNs offrent des opportunités pour l'établissement des plates formes d'innovation multipartenaires fonctionnelles et efficaces, nécessaires pour catalyser une large adoption des innovations de SLM. Cet article analyse l'implication de SNs dans la gestion durable des terres (SLM), se basant sur les caractéristiques des partenaires et leurs associations parmi les communautés agricoles rurales du centre de l'Ethiopie et de l'Est de l'Ouganda. L'analyse conduite dans les deux pays a révélé une relation positive entre les forces de réseaux sociaux et les pratiques d'innovation de SLM. La ressemblance dans la centralisation des réseaux en Ethiopie et en Ouganda était 56 et 45%, respectivement; impliquant qu'environ la moitié des réseaux potentiels parmi les partenaires fonctionnent actuellement. Les facteurs associés à la force des réseaux comprenaient l'âge, la distance physique parmi les partenaires, la fréquence d'interaction, et la source d'information. Malheureusement, d'importantes faiblesses demeurent dans les réseaux existantes. Dans les deux pays, bon nombre de réseaux manifestent un manque d'interaction active avec les acteurs clés dans la gestion de terres. Aussi, les réseaux du secteur privé particulièrement importants en jouant des rôles critiques tels qu'encourager les innovations orientées vers le marché pour une adoption accrue sont remarquablement manquantes.

Mots Clés: Afrique de l'Est, hautes terres, plate formes d'innovation

INTRODUCTION

Social Networks (SNs) are defined as patterns of relationships and interactions playing fundamental roles as medium for the spread of information, ideas and influence. They comprise of individual or organisations connected by one or more specific type of interdependence such as common interest, beliefs, values and knowledge (Kempe *et al.*, 2003). Social Networks, as component of social capital, facilitate collective action important for small-scale; resource-poor farmers, who tend to rely more on informal than formal sources of information as well as to women farmers, whose information needs are often not addressed by formal extension services (Matuschke, 2001). Several studies have shown that social networks significantly influence the adoption decisions of individual farmers (Matuschke *et al.*, 2008). Thus, SNs are strategically relevant to sustainable land management (SLM), a knowledge based procedure that harnesses integration of land, water, biodiversity and environmental management towards maximising economic and social benefits; while maintaining the ecological functions of land. A deeper understanding of social networks is useful in SLM towards identification and definition of stakeholders relationships, avoiding marginalisation of important partners; identification of conflicts and ensuring stakeholder representation (Borgetti *et al.*, 2009; Reed *et al.*, 2009).

Several studies have shown that such information on SNs is especially, important in natural resources management (NRM) initiatives that seek to influence the behaviour of stakeholders through key influential individuals (Rogers, 1995; Olsson *et al.*, 2004; Posthumus *et al.*, 2008;). As scale dependent, cumulative effects from SLM make the process an issue of scales that requires higher level partnerships for collective action (Berry and Esikuru, 2005). Multi stakeholders Innovation Platforms (IPs) emerge as opportunities of harnessing social networks for wide adoption of SLM innovations. Under Sub Sahara Challenge Programme (SSA-CP), within the contexts of testing the concept of Integrated Agricultural Research for Development (IAR4D), emphasizes engagement

of multiple actors along the commodity value chain. An 'innovation platform' (IP), as described by Adekunle *et al.* (2010), is a physical or virtual forum at the same time an informal partnership. The partners include agricultural research development actors established to facilitate interactions and learning among stakeholder resulting in participatory diagnosis of problems; joint exploration of opportunities and investigation of solutions promoting agricultural innovations.

Actors in an IP may include, among others, research scientists, extension workers, representatives of farmers and farmers' associations, private sector, non-governmental organisations (NGOs), and government policy makers who communicate, cooperate and interact to set priorities. Through partnerships, networks and linkages, IPs provide the niche platform for expanding spaces of engagement within and across sector scales, hence, relevant in scaling process. The most important stage in IPs process are establishment that include a clear understanding of the suitable partners to attract (Reed *et al.*, 2009). The objective of this study was to harness existing social networks at IP establishment in order to strengthen social capital for accelerating adoption of SLM innovations among rural communities in Ethiopia and Uganda.

METHODOLOGY

Study area. This study was conducted during March to June 2010 in study sites located in the highlands of central Ethiopia (900-2900 metres above sea level) and eastern Uganda (700 - 2200 metres above sea level under the auspices of the African Highland Initiative (AHI), a programme of the World Agroforestry Centre (ICRAF). The two sites are situated in two districts in Ethiopia (Dendi and Were Jarso) and three districts in Uganda (Kapchorwa, Kween, and Bukwo). The study sites were purposely selected adjacent to AHI benchmark sites that are representative of highland areas having small size farms varying from 0.5 ha to 3 ha and apparent natural resources degradation; and hosting successful SLM innovations at pilot level. These study sites are characterised by high population density of 250

to 300 people km², fragmented land holdings; on average it is less than 0.5 hectare per household and highly fragile landscapes. These factors make the sites conspicuously prone to land degradation and poverty hot spots in the region (German *et al.*, 2012).

Innovations. Within land management contexts, SLM innovations are land degradation interventions and include all practices, approaches, mechanisms and institutions towards improving and maintaining land productivity and ecosystem functions. In terms of capitalising on social networks towards SLM wide adoption, three main categories of innovations were considered: (i) various Integrated Natural Resources Management (INRM) technologies such as linked technologies, for example improved germplasm, terraces, manure, mulching, tree, fodder, trenches, contour bunds and use of legumes in crop rotation; (ii) use of Information and Communication Technologies (ICTs) such as mobile phones, and internet for improved access to information for sustainable development; and (iii) new approaches of influencing policy and learning such as appropriate policies and institutional arrangements. SLM innovations emerge from several domains including farmers, researchers, private sector and extension.

Analytical framework. In this study, we describe and evaluate a framework for strengthening local capacities towards scaling SLM innovations using Innovation platform. Against a background, that is characteristic of that affect stakeholder's ability to manage natural resources effectively (Bodin *et al.*, 2006), we use social network analysis (SNA) tools to examine relationships between actors in SN in order to understand the structural functionality, and importance of the connections between actors and organisation. Based on SNA, the social environment in SNs is articulated through a set of concepts summarised in structural variables that capture relational elements within a network, defined as follows:

Nodes - represent the different stakeholders also referred to as social units or actors. Nodes with

the same colour belong to the same category but from separate organisations.

Ties - connections between stakeholders. Ties represent the relationship attributes between them including functions, geographical scale, longevity.

Closeness centrality- the pattern of nodes' direct and indirect ties that allow them to access all the stakeholders in the network more quickly compared to other members. The partners that have shortest paths to others are in "favoured position" and have "more opportunities" and "fewer constraints" to resources and information flow in the network. Closeness centrality is inversely related with the ease of accessing a given partner in the network.

Homophily - homophily occurs when a similar pattern of responses, or observations are identified in a group of participants closely located geographically. This homophily is independent of ties between these actors.

This framework of strengthening social networks towards scaling SLM innovations is built in part on a conceptual model on engagement of multi-scale, multi-stakeholder adaptive management process that involves three major components to enhance the scaling up of SLM innovations namely;

- i. strong farmer institutions;
- ii. functional multi-scale, multi stakeholder innovation platforms;
- iii. effective adaptive governance processes that focuses on the evolution of formal; and
- iv. informal institutions for the management and use of shared assets, such as common pool natural resources and environmental assets that provide ecosystem.

We underscore fostering collective action as necessary for scaling SLM innovations and developing farmer level institutional capacity to engage in landscape level decision making. The rationale for strengthening farmer organisations

is embedded in the synergetic benefits of building social capital through harnessing social networks.

Data collection. In order to identify existing social networks in each district of the study areas, provisional lists of relevant institution and stakeholders were developed during baseline establishment using Participatory Diagnosis (PD). As a result of difficulties associated with high mobility in and out of networks, engagement of local contact persons including opinion leaders and community facilitators were maximised in compiling survey participant lists. The identified individuals and institutions were then, invited for a stakeholder meetings held at the lower level local government headquarters. Benefits of IPs, as coalitions of willing stakeholders provided important niches and expanded spaces of engagement for partnerships across scales towards scaling SLM, were articulated during the meeting. Structured questionnaire designed to map and characterise stakeholders was then, administered to a total of 154 individuals, representing 10 categories of stakeholders. Information collected included type of organisation represented, period of establishment, main activities and their geographical coverage, profile of existing partnerships and how they were established, method of interaction, perception of the quality of the partnerships and potential/desired partnerships. In order to understand the nature of relationships and the benefits that arise from the existing interactions (social capital), participants were asked to provide information about the role, type, frequency and perception of strength of the interaction in the last twelve months. The questions focused on interactions for exchange of land management information. By interaction, we meant people speaking to each other either face-to-face, by phone or e-mail during exchange of technical information, personnel, materials and money (work related interactions and not social interactions). This information was used to create a series of data matrices that indicated whether collaborative relationships existed between stakeholders. Coded responses contained in data matrices were imported into social network UCINET (Borgatti *et al.*, 2002)

Data analysis. Data collected were statistically analysed by ordinal logistic regression using the Statistical Package for Social Scientists (SPSS) Version 16 (SPSS, 2007). Social Network diagrams based on categorised stakeholder organisation attributes and sociograms (network maps) were then, generated using UCINET 6 software for Windows (Borgatti *et al.*, 2002). Sociograms are graphical representation of actors, stakeholder categories in our case (represented as nodes), and their relationships (represented as lines connecting nodes). Each connecting line has an intrinsic element of strength associated with it as revealed by the respondents. Nodes were symbolised by colour and size according to individual level characteristics. Similarly, ties were symbolised by characteristics of the relationship such as frequency of communication or strength of the relationship.

The quality of interaction was assessed in terms of the perceived usefulness of benefits accruing from interaction, timeliness and frequency, in terms of number of interaction per month on a Likert scale of 1 to 5.

We compared respondents from Ethiopia and Uganda as well as the districts within the countries to determine whether there is association between country/district and rating of the attributes of quality of the interactions. The association between various attributes of the interaction and the rating of the value of the relationship at country and at district level was also assessed.

RESULTS

SLM stakeholders. Social networks relevant to study sites comprised of stakeholders from ten categories (Table 1). Based on monthly frequency interactions, at country level, local government representatives were the dominant category of stakeholders in Ethiopia; while farmers' association dominated in Uganda. Most of the relevant categories were represented in both countries, except glaring gaps on private-sector and as faith-based representatives in Ethiopia and research organisations in Uganda. More statistical analysis to support data and comparisons is detailed in Table 8.

TABLE 1. Sustainable Land Management stakeholders categories in in highlands of central Ethiopia and eastern Uganda

Type of stakeholder	Prevailing function	Ethiopia		Uganda	
		Frequency	%	Frequency	%
Local government	Policy makers	26	41.9	11	13.9
Farmer associations	Advocacy	2	3.2	31	39.2
Individual farmers	Land owners	10	16.1	6	7.6
Private sector	Entrepreneurs	-	0.0	12	15.2
Extension	Dissemination	9	14.5	1	1.3
Community based organisation	Mobilising	6	9.7	3	3.8
Faith-based organisations	Spiritual values	-	0.0	9	11.4
None governmental organisation	Change agents	3	4.8	5	6.3
Savings and credit cooperative organisations	Local vehicles for saving and credit	3	4.8	1	1.3
Research	Generating and synthesizing knowledge	3	4.8	-	0.0

Partner organisations that had a bearing of social networks in the two countries were captured using an overview of historical trends of operations as illustrated in (Fig. 1). This trend gives a base of the current status of partners and an indication of the future trend dynamics. Most of the organisations in Ethiopia started operating before 1987 as opposed to Uganda where majority started after 2001. Further, establishment of organisations showed a more steadily increasing trend in Uganda than in Ethiopia. Specific examples in Ethiopia include Ethiopian Institute of Agricultural Research (EIAR), Holleta Agricultural Research Centre and Agricultural and Rural Development office. In Uganda, they included Food for the Hungry-Uganda and Kapchorwa District Local Government.

The trend in the number of organisations being established in Ethiopia dropped from 21 before 1987 to 5 between 1987-1991, increasing slightly to 10 in the period from 1992 to 1996. The number started growing again in 2002 and has been growing since then to 15 in 2013. In Uganda, the number of organisations being established has been growing exponentially from 7 to 34 since 1987 to 2002 albeit after 2002 at a reduced rate. Most of the stakeholder categories that existed before 1987 were individual farmers, but more recently (after 1997), farmer organisations have increased tremendously (Table 2). More local government units had also increased significantly in number in the last decade. Specific examples in Uganda, included mainly farmer groups; Munda farmer group, Kietkel widow farmers group, Riwo Investment Ltd., Kongasis Agro Inputs, Kongasis Agro-Stores, Bukwo Agro Forestry Association, National Agricultural Advisory Services (NAADS) among others.

There was a wide range of SLM stakeholders operating at various geographical scales (local, regional and international) (Fig. 2). The scale of operation of the organisations was highest at local and lowest at international levels; illustrating opportunities for harnessing the local initiative with increasing benefits of building linkages with international partners. The number of stakeholders operating in the district decreased as a function of the geographical extent of their mandate. In Ethiopia, no organisation operated

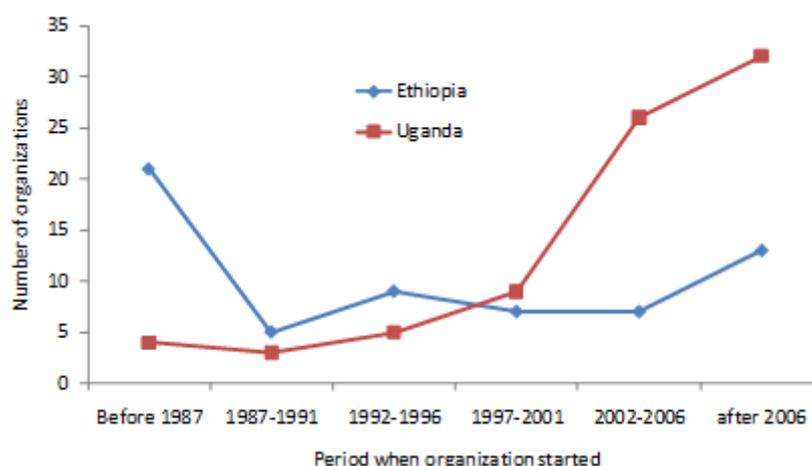


Figure 1. Trends of Sustainable Land Management stakeholder organisations establishment over three decades in highlands of central Ethiopia and eastern Uganda.

TABLE 2. Sustainable Land Management stakeholders' categories and the period within which they were established in highlands of central Ethiopia and eastern Uganda

Type of organization	Before 1987	1987-1991	1992-1996	1997-2001	2002-2006	After 2006
CBO	2	-	1	-	4	2
Extension	7	-	-	-	1	2
Faith-based Organisation	-	1	1	1	6	-
Farmer association	1	1	-	1	6	24
Individual farmer	10	6	5	2	2	1
Local Government	7	1	4	6	7	12
Nongovernmental Organizations	1	1	1	1	3	1
Private Sector	-	-	1	3	5	3
Research	5	-	-	-	-	-
Savings and credit cooperative organisations	1	-	1	2	-	-

at sub-county level, but there were several at district level (Fig. 2). This illustrated discontinuity at sub-county level that has a potential to link with districts in terms of lobbying and information flow. The general trend of minimum networking at international, regional and country level stakeholders, points to glaring gaps to be addressed in terms of opening information flow for scaling SLM. Over all, organisations operating at district level dominated in both Ethiopia and Uganda, illustrating the dominance of district level projects including government driven ones, with districts presenting important nexus for development and decision making, with unique scaling up and out opportunities.

Interactions among SLM stakeholders. The relationships that existed among different SLM stakeholder categories in Ethiopia and Uganda is illustrated in Figure 3. SNA of the existing Social networks among stakeholders in Ethiopia and Uganda showed that the individual stakeholders in Ethiopia had interactions with relatively fewer people but at least each stakeholder had some interaction with SLM actors. In Ethiopia, farmers associations linked more with extension and local government, with very limited links (only 3) among farmer organisations. On the other hand, CBOs had more direct ties with a wider range of partners compared with other categories of stakeholders such as researchers and private sector (input and output

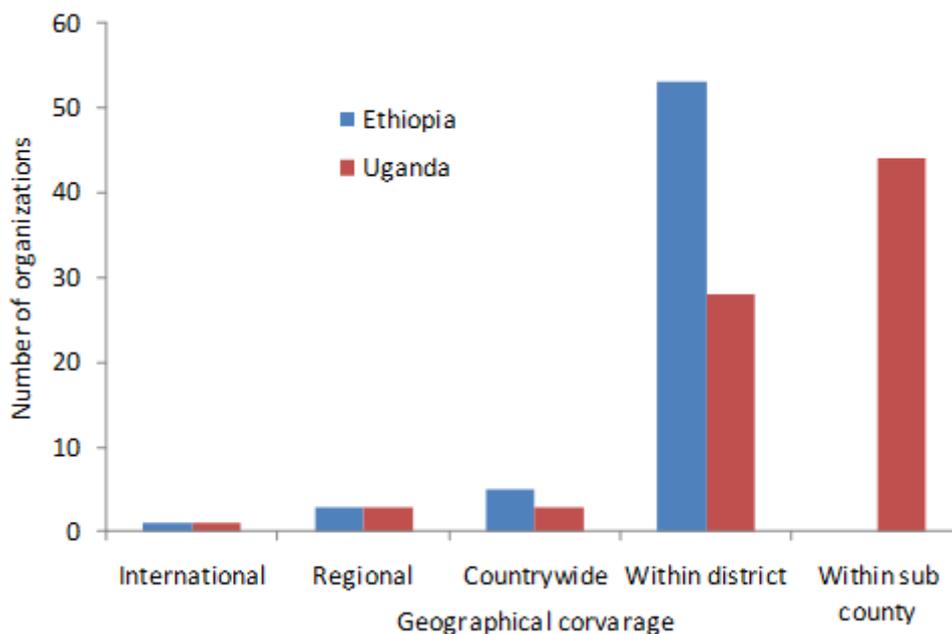


Figure 2. Geographical extent of operation of Sustainable Land Management stakeholder categories in highlands of central Ethiopia and eastern Uganda.

markets, food processing, transport, and rural credit). What was common between the two social networks in the two countries was that, on average each stakeholder category had 1-2 ties with other stakeholders. This means that out of the 10 stakeholder category, each of them interacted with only two of them, mainly extension and CBOs for both countries.

Strength of interaction. In both countries, extension and CBO organisations dominated the number of direct networks. International NGOs, Faith-based and research organisations had the least number of interactions in both countries. The mean closeness (mean of distances to different actors) was shorter (0.64) in Uganda than in Ethiopia (0.77) (Table 3). However, there were fewer stakeholders that interacted with a wider range of partners compared to those in Ethiopia. The overall closeness of centralisation of the Ethiopian and Ugandan networks was 56 and 45%, respectively (Table 3). The network in Ethiopia was less closely centralised than that of Uganda. The implication is that results from Ethiopia, illustrate more favourable flow of information with implications towards tendencies

of a comparative advantage of faster and wider adoption of SLM innovations in Ethiopia compared to Uganda.

Stakeholders in agricultural development participated differently in the various stages of the process (Fig. 4). The distribution of proportions of actors was somewhat balanced across stakeholder categories.

When countries were compared, only timeliness and frequency of interaction was significant at 5% level, with Uganda reporting more timely and frequent interactions compared with Ethiopia in both attributes (Table 4). Within Ethiopia, method of interaction, usefulness and timeliness were independent of the district, but the frequency of interaction was significantly higher in Wore Jaso than in Dendi (Table 4). In Uganda, the rating of all the attributes was significantly associated with the district. All the attributes were rated higher in Kapchorwa than in Bukwo.

When the SLM stakeholder categories were cross-tabulated with the ranking of partnerships, individual farmers ranked highest, followed by farmers groups and savings and credit Co-operatives in that order ($X^2 = 212.631$, $P < 0.000$,

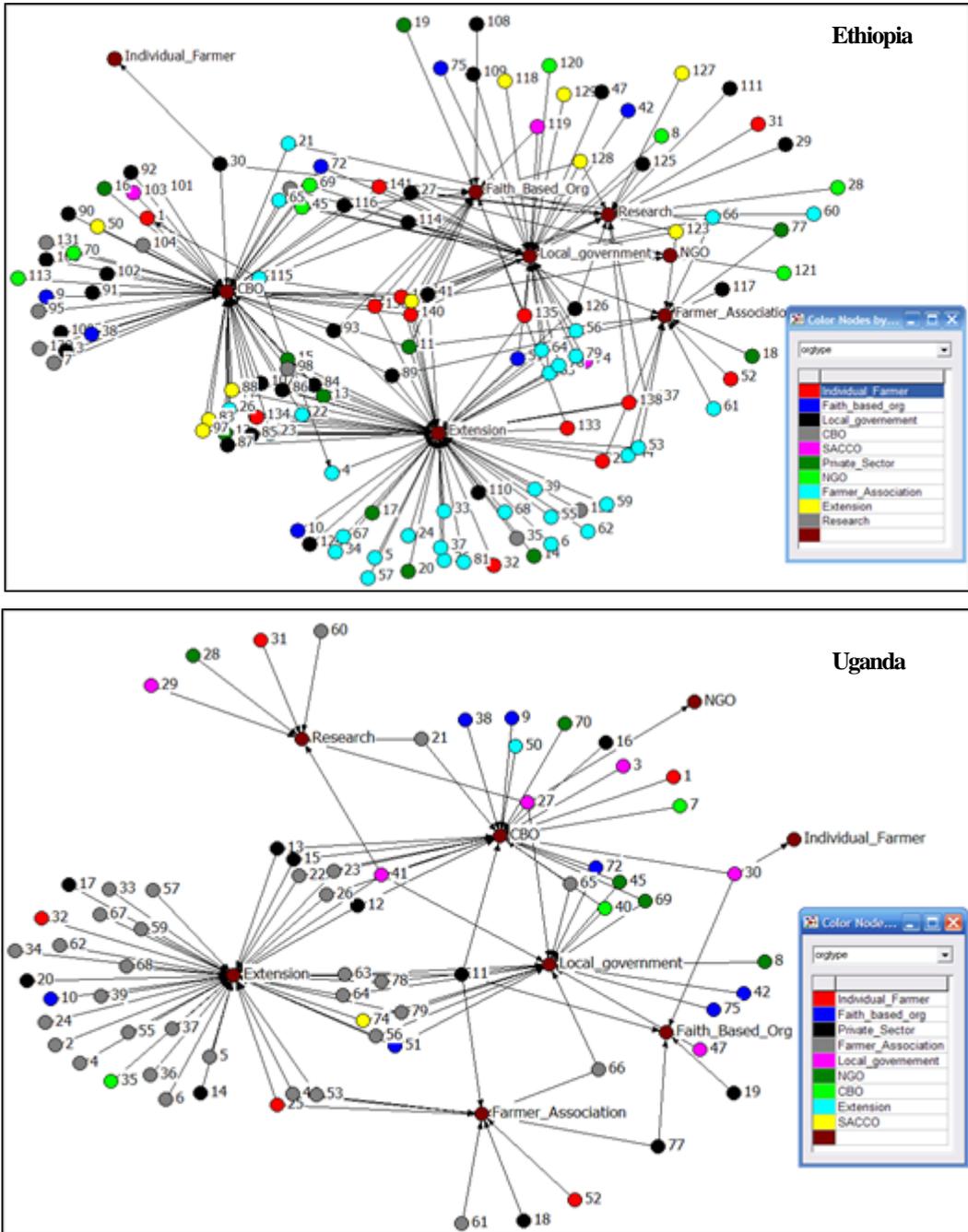


Figure 3. Network maps for SLM stakeholders in the highlands of central Ethiopia and eastern Uganda. Nodes with the same colour belong to the same category but represent different organisations. Repetition of the categories implies interaction of different stakeholders but of the same category.

TABLE 3. Closeness centrality of SLM stakeholder categories in the highlands of central Ethiopia and eastern Uganda

Statistics	Closeness indices	
	Ethiopia	Uganda
Mean	0.77	0.64
Standard deviation	0.08	0.02
Sum	101.94	100.54
Minimum	0.76	0.64
Maximum	1.49	0.87
Centralisation (%)	56	45

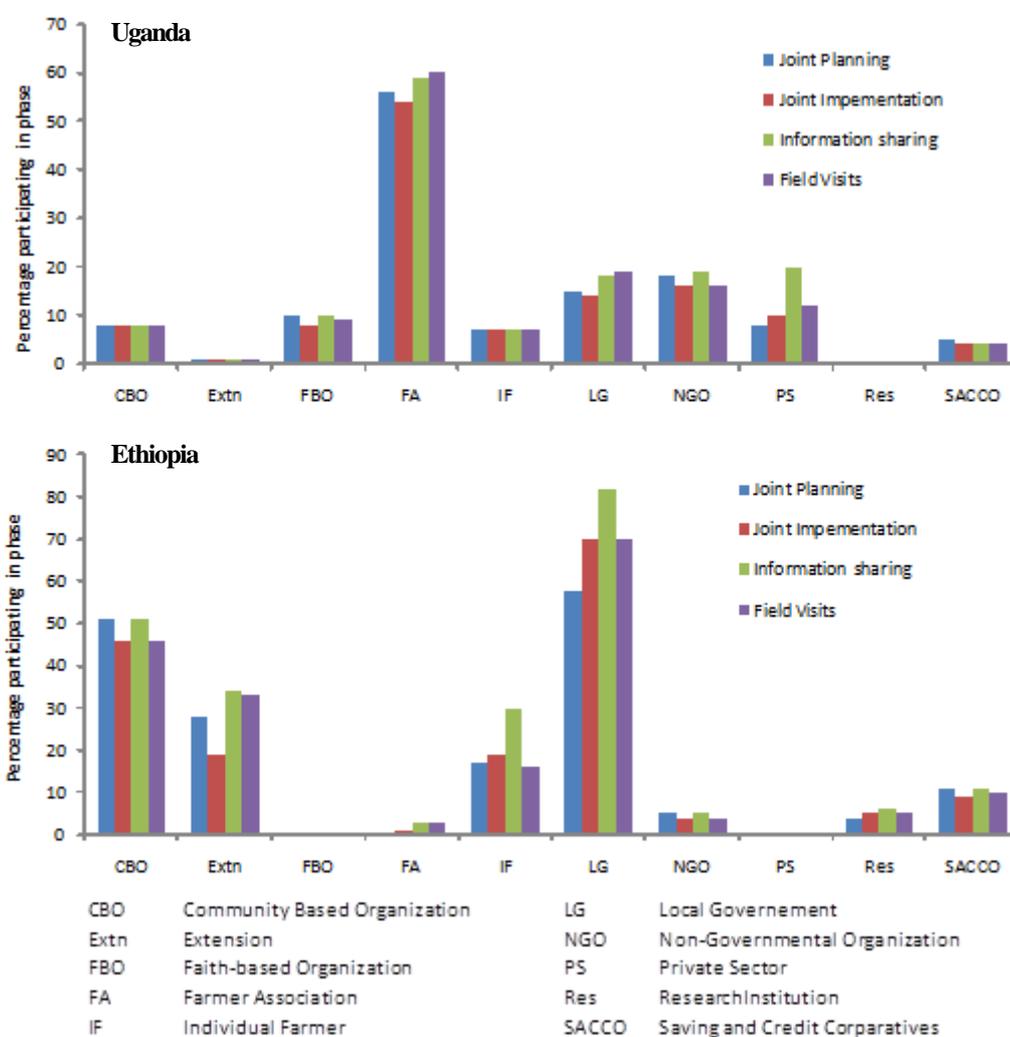


Figure 4. Participation of SLM stakeholder categories in the various stages of the development process in the highlands of central Ethiopia and eastern Uganda.

Table 4). The least ranked stakeholders were extension and Community Based Organisations (CBOs) with a less than 3 out of 5 scale. Extension, CBOs and Non-governmental Organisations (NGO) sometimes did similar or related work but when they were compared, NGOs had stronger ties than the other two categories.

The rating by stakeholders of the strengths of interaction (extent to which two actors reciprocated each other's connections) with their partners, showed that the ties were generally above average (Table 5). However, the ties with CBOs, extension and faith-based organisations were stronger than those with other stakeholders (Table 5).

Similarly, the overall assessment of the partnerships was generally strong with partners aware of the organisations vision, focused and

committed to achieving the goal of the partnership (Table 6).

Determinants of strength of interactions. The characteristics of the SLM stakeholders' categories that were thought to influence the strength of the interaction are presented in Table 7. The average distance between interacting stakeholders was 42 ± 12 kilometres. The number of male stakeholders was approximately twice that of their female counterparts. Approximately two thirds of the stakeholders were below the age of 40 years. Approximately 70% of the interactions were perceived as either moderate or strong.

Determinants of the strength of interactions with individuals in the organisation indicated that the gender of the recipient of information by the individual in the organisation did not influence

TABLE 4. Existing social network interactions among SLM stakeholders categories in the highlands of central Ethiopia and eastern Uganda

Attribute	Country level			District level					
	Ethiopia vs Uganda			Ethiopia			Uganda		
				Dendi vs Wore Jarso			Bukwo vs Kapchorwa		
	N	X2	P	N	X2	P	N	X2	P
Method of interaction	221	4.513	0.105	90	1.463	0.481	131	12.934	0.002
Usefulness of interaction	218	3.81	0.149	88	2.973	0.226	130	17.593	0.000
Timeliness of interaction	227	17.60	0.001	95	6.161	0.104	129	21.91	0.000
Frequency of interaction	220	8.17	0.017	89	18.487	0.000	131	17.768	0.000

TABLE 5. Strength of social network interactions among SLM stakeholders categories in highlands of central Ethiopia and eastern Uganda

Stakeholder category	Strength of the ties (1 = weak, 5 = strong)				
	1	2	3	4	5
Community Based Organisations	8	13	25	79	43
Extension	3	12	21	54	13
Faith based organisation	4	1	7	10	7
Farmer association	1	4	9	5	11
Individual farmer	-	-	1	-	-
Local government	3	11	7	13	28
Private sector	-	-	-	1	-
Non-Governmental Organisation	-	-	4	-	-
Research	1	7	3	7	7

TABLE 6. Quality of social network interactions among SLM stakeholders categories in the highlands of central Ethiopia and eastern Uganda

Issue	Assessment rates of social network st (1 = Poor, 5 = Very good)				
	1	2	3	4	5
Awareness of vision for the partnerships and their roles and responsibilities and fulfill them?	6	11	49	51	18
Equity and transparency of decision making within the partnership	10	15	46	44	19
Extent of trust between you and your partners	15	25	40	39	17
Extent to which there exists enough capacity to achieve the objectives of the partnership (the members of the partnership have the skills and capacity to implement the activities of the partnership)	10	13	44	50	18
How the partnerships handle publicity, IPR issues, etc., (e.g. the partners acknowledge each other's contribution to the achievement of results)	7	15	35	47	30
Information and communication strategies	6	4	43	59	23
Levels of commitment	9	9	52	46	19
Strength of interactions (partners are closely knit and bond even beyond professional activities)	14	14	43	52	13

the perceived strength of the interaction. The factors found to influence strength of the interaction included the age of the person with whom one interacts, the distance to where the person operated from, frequency of interaction, and whether the person gave information or not. Stronger interactions were associated with younger age of the partner ($P=0.01$) as shown by the negative coefficients (Table 8). Further still, stronger networks were found with more distant partners. The more frequent interactions (shorter interaction intervals) were found to be stronger than the less frequent ones ($P<0.000$). The relationships with people that gave information were stronger than those who did not, and the information did not affect the strength of the relationship. If the person being assessed was a recipient of information, the relationship had a negative and significant relationship, but if he/she was a giver, it was not significant.

DISCUSSION

A wide range of SLM stakeholder categories existed in the highlands of central Ethiopia and eastern Uganda as part of existing social network to facilitate supply and brokering relevant knowledge towards scaling SLM innovations (Table 1). Our data showed that the trends of establishment over the last three decades has been increasing exponentially in Uganda, and steadily in Ethiopia (Fig. 1). This illustrates that a critical mass of institutional capacity is available, but *albeit* necessitate strategic organisational alignment, capitalising on functional social networks to improve effectiveness. Although most SLM stakeholders had a long history of existence, farmer associations, private sector and local government authorities had been increased, further, underscoring great opportunities of harnessing social networks for wide adoption (Table 2). Longevity of organisations has a bearing on the sustainability of land management activities that require long term investments (Fig. 2). It also indicates the level of experience in the community and trust developed by community members. In terms of scale of operations (Fig. 2) for the existing social network, there was more diversity in Uganda than in Ethiopia, dominated by district,

TABLE 7. Factors influencing strength interactions among SLM stakeholders in the highlands of central Ethiopia and eastern Uganda

Attribute	N	Categories	Code	Frequency	Percentage
Gender	154	Male	1	100	64.9
		Female	0	54	35.1
Age (years)	154	<30	1	42	27.3
		31-40	2	50	32.5
		41-50	3	27	17.5
		51-60	4	25	16.2
		>60	5	10	6.5
Frequency of interaction	364	Daily	1	34	9.4
		Weekly	2	122	33.6
		Monthly	3	127	35.0
		Every 6 months	4	42	11.6
		Annually or more	5	39	10.7
Perceived overall strength of interaction	364	Very weak	1	16	4.4
		Weak	2	14	3.9
		Moderate	3	94	25.9
		Strong	4	167	46.0
		Very Strong	5	73	20.1
Does the stakeholder give information?	364	No	0	229	63.1
		Yes	1	135	37.2
Does the stakeholder receive information?	364	No	0	299	82.4
		Yes	1	65	17.9

TABLE 8. Determinates of strength of interaction among stakeholders in the highlands of central Ethiopia and eastern Uganda

Factor	Coef.	Std.	z	P> z	95% Conf.	Interval
Gender of partner ^a	0.246	0.293	0.840	0.402	-0.329	0.820
Age of partner	-0.195	0.099	-1.970	0.049	-0.388	-0.001
Distance to operations offices	0.002	0.001	2.580	0.010	0.001	0.004
Frequency of interaction	-0.895	0.109	-8.180	0.000	-1.110	-0.681
Give information ^b	-0.815	0.411	-1.980	0.047	-1.619	-0.010
Receive information ^b	0.148	0.510	0.290	0.772	-0.851	1.148

^aReference variable is 0; 0 = Female, 1 = Male, ^bReference variable is 0; 0 = No, 1 = Yes

national, sub-county, and to a limited extent, regional and international levels, illustrating opportunities for building on the decentralised form of governance to scale SLM.

On the strength of interaction among SLM stakeholder categories, our data illustrated high numbers of inward networks (degree centrality) as well as high strength of networks with

extension and CBOs in both countries (Fig. 3). This suggests the occurrence of "homophily", where similar individuals are attracted to each other and, thus, choose to intensify their interaction (Friedkin, 1998; Ruef *et al.*, 2004; Skvoretz *et al.*, 2004). One problem with homophily, is the limited extent to which different views and opinions are recognised and discussed

(Crona and Bodlin, 2009). In the context of scaling SLM, we observed that the complex nature of interactions warrants involvement of diverse multi-level stakeholders with its associated benefits of increased stakeholders' diversity engaged at innovation platform level. Emerging results point to differences in overall closeness of centralisation in Ethiopia, showing a more favourable pattern for SLM information flow than Uganda (Table 3). On timeliness and frequency of interaction (Table 4), Uganda was at a better advantage compared to Ethiopia. Prevailing opportunities of addressing obstacles in communication included maximising information technology (ICT) such as mobile phones, and radio. An inner assessment of strength of interaction among SLM stakeholder categories showed stronger ties among CBS and faith based organisations that further illustrated benefits of building on trust among LM stakeholders (Table 5). These social networks interactions were generally strong where there was a common vision and commitment to achieve a defined goal (Table 6). Extension, CBOs and farmer groups tended to have stronger ties possibly because they had formal arrangements that foster material and information-sharing and knowledge transfer. Similarly, NGOs had stronger ties compared to CBOs and extension, although they did similar or related activities probably for the same reason above.

On factors influencing strength of interaction among SLM stakeholders, one would expect that networks with distant partners will be weaker but our findings showed otherwise (Table 7). This could be attributed to the fact that the distant partners were connected through ICT innovations as well as exchange visits. Although gender seemed not to be a factor on strength of interaction, age had a bearing and strong interactions were associated with young stakeholders (Table 8). The inverse relationship between age and strength of interaction suggested that older people were slow and had less zeal for the activities of the institution, compared to younger ones. Hence, the perceived strength of younger partners could be due to the energetic and zealous conduct that they expressed in responding to issues raised by other institutions, and consequently, representing an

important target group towards strengthening social networks for scaling SLM innovations

CONCLUSION AND RECOMMENDATION

A clear understanding of social networks structures using SNA offers great prospects of capitalising on social flows and identified bottlenecks for strengthened social capital towards wide adoption of SLM. Specifically, the existing social networks present opportunities of harnessing the interactions, institutional affiliations of stakeholders for improved participation and reaching a wide spectrum of stakeholders through a vibrant outreach programmes towards wide adoption of SLM innovations. However, in view of the fact that half of the potential networks in both Ethiopia and Uganda still need to be exploited, this calls for renewed opportunities of building the social capital through improved capacities for participation and empowerment including: skill enhancement through specialised training targeting various SLM stakeholder categories; wide exposure to harness experiential learning; investment in knowledge management including ICT, capitalising on decentralised form of governance to effect wide impacts.

The networks are dominated by a few prominent institutions such as farmers' groups, extension and local government, with little participation of research and private sector institutions. These trends point to building on grassroots institutions, particularly in Ethiopia at Woreda (district and watershed levels towards strengthened capacity for collective action). Notably, the perceived strength of most networks is considered above average.

In view of their limitations on stakeholder representation and sub optimal linkages, it is essential to mobilise IPs to bring on board all relevant actors, such as the linkages between local government, private sector, extension, research institutions and farmers. This points to mainstreaming multi-stakeholder Innovation Platforms into local government structures, both in Uganda and Ethiopia, for recognition, accessing finances and improved effectiveness towards scaling SLM.

Strengthening existing linkages through enhanced social skills should also be considered a high priority objective in IP functioning in order to ensure more practical and sustainable networks. This will optimise knowledge sharing and learning. Since local government authorities are important SLM stakeholders, they are strategically positioned to host social network platforms targeting improved financing and capacity building schemes for rural communities. More social networks at important action sites for SLM such as sub-county and district level need to be strengthened in both Ethiopia and Uganda to trigger wider participation of SLM stakeholders.

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