EFFECTS OF SOCIAL NETWORK CHARACTERISTICS ON CLIMATE CHANGE ADAPTATION COMMUNICATION IN MAKUENI COUNTY

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Summary

Communication is a central and perhaps the most critical component of agricultural extension. The exchange of information forms the core of communication process. Various methods have been applied studying how the process of communication occurs in social networks. The structural characteristics of social networks affect the communication patterns which have impact on the effectiveness of communication and the subsequent diffusion of innovations. Climate change is already affecting agricultural production and farmers in the developing countries have to adapt through the adoption of appropriate and modern technologies. Agricultural extension agents will certainly play a key role in enhancing the adoption of these technologies and hence adaptation.

This study aimed at studying the effects of social network characteristics and the flow of information through a social system composed of farmers in five villages in Sakai sub-location in Makueni County in Kenya. Social Network Analysis (SNA) methodology combined with probit regression analysis were applied and results show that common demographic traits result in group formation which are instrumental in the flow of agricultural information within groups. The age, marital status and farm sizes were variables that supported group formation and enhanced the flow information on climate change adaptation.

Literature Review

Agricultural production remains the main source of livelihoods for rural communities in Africa, providing employment to more than 60% of the population and contributing about 30% of the GDP (Nhemachena and Hassan 2007 and Quiggin et al. 2010). Globalization, changing consumption patterns, climate change and emerging diseases are shaping the development in agricultural production (ILRI, 2008). Although man has been adapting to other changes in his environment; for example economic development and globalization (Smith and Pilifosa, 2001), climate change presents the greatest challenge to human endeavors, key among them being agricultural production (Global Humanitarian Forum, 2009).

Adaptation is an important approach in coping with the climate change for smallholder farmers to increase their production through adoption of appropriate techniques. Adoption begins with sharing information with potential users (Gailhard, 2012) through interpersonal communication channels. Communication of the agricultural adaptive measures between the scientists, extension agents and farmers play a crucial role in the process of adaptation. Smallholder farmers have been adapting to changing climate since time immemorial (McDowell, 2012). Strengthening of the adaptive capacities is essential for future sustainable and equitable development particularly for livelihoods sensitive to climate change (Osbahrh, 2010).

The role of social networks and their impact on the current demand driven extension approaches that aim at accelerating adoption of innovative techniques by smallholder farmers in developing countries needs to be understood (IFPRI, 2008). In agricultural extension similar links exist among researchers, extensionists and farmers and promote the adoption of new technologies Bandiera and Rasul (2006). Farmers in social networks learn how to cultivate new crops from the choices of other farmers cultivating the same crop (Foster and Rosenzweigh, 1995, Conley and Udry 2003).

Social Network Analysis (SNA) is the study of relationships among agents, groups and entities (Matuschke, 2008) that provide channels for the transfer of information. When combined with computer programmes it can be used to model, visualize and analyze interactions between individuals within groups and organizations (Springer and de Steiguer, 2011).SNA can measure the relation be tween extension, farmers and adoption of better practices, improved decision making by the farmer and performance which are influenced by the kind and sources of information (Anderson and Feder, 2004). A Social networks approach can assist in establishing which network characteristics have the greatest persuasive impact and thus technology uptake and hence improve on the design of extension approaches (Matuschke, 2008). Since the adoption of agricultural technologies is through social learning (Foster and Rosenzweig, 2010), it is importance to understand social networks among smallholder farmers that are adapting to climate change.

Methodology

Binary measures were used to show relationships between two farmers, whether or not two actors are related and the direction of the relation. For example if two farmers A and B in Sakai sub-location have a relation based on the information they share on climate variability and change adaptation agricultural practices; this will be expressed as adjacency matrices as follows:-

$X_{AB}=X_{BA}=1$ if they share information between them. In which case the adjacency matrices are symmetrical in that $X_{AB}= X_{BA}$

On the other hand if only farmer A relates to farmer B and Farmer B doesn't relate to farmer A then this is expressed as:-

$X_{AB}=1$ and $X_{BA}=0$

The data was analyzed using NodeXL version 1.0.1.245, SPSS version 18 and STATA version 10. NodeXL was used to do the social network analysis by analyzing the relational data and to generate sociograms at group and individual levels and socio metric indices. The SPSS was used to do statistical analysis while STATA was used do the regression analysis to determine the statistical significance of the study variables. Emphasis was placed on measures of centrality namely in-degree, out-degree, betweenness and closeness, clustering and reciprocity which describe the actor and network characteristic and how they affect the flow of information among the actors.

Results and Discussion

The farmers in the Sakai sub-location who are adapting to climate change are generally connected by strong bonds within the various subgroups which are formed clustered around similarity in socio-economic and demographic traits. Three; variables age, marital status and farm size according to the regression analysis done positively affected access to information. The subgroups are connected to other subgroups either within their villages, from neighboring villages or from formal information sources. Though not mapped in this sociograms; but analyzed statistically there exist weak formal ties with formal sources of information that the farmers in Sakai sub-location have access to with 44.8% and 23.6% of the respondents saying they only communicated once and twice with formal sources in a whole season.

Figure 1. Sakai sub-location socio-gram showing bonding among the actors at the centre of the network, notice the inter-village linkages

Figure 2. Socio-grams from Muiu village showing linkage (A) and bonding (B).

In general the networks are strongly connected (cohesive) at the subgroups level and this is shown by the proximity of the actors to each other and the average number of links actors in the network have in relation to information exchange. According to the average in-degree and out-degree values which is 1.11, the Sakai sub-location has a structure that supports the flow of information since at least every farmer acts as a source of information to one famer and receives information from one other farmer on average. However this is on overage and individual variations were recorded with the highest out-degree being 11 in Nthongoni village.

The actors in Sakai sub-location network are very close to each other within the subgroups as shown by the degree centrality values and subsequently have stronger bonds among subgroups and weak linking edges to other sub-groups. The cohesive subgroups in Sakai sub-location network apart from facilitating the flow of information can easily diffuse through they can be impervious to information coming from outside from a heterophilic source or the strong intragroup cohesive ties may member to with hold information with other groups. This is supported by positive reciprocated vertex and edge ratios of 0.015 and 0.0303 values recorded across all the villages which according to Leydesdorff (2004) increase salience of opinions. As reciprocity shows that an action from an actor solicits positive feedback. Since it measures the tendency for an actor to choose another, if the second actor chooses the first (Weiligmann, 1999).

There are many central and peripheral actors in Sakai sub-location networks, most peripheral actors are connected to the central actors with a few isolated sub-groups (networks). Bridges are a common feature in the sociograms of the Sakai sub-locations and are a pointer to influence that heterophilic actor has over their followers. The existence of isolated ties may lead to barriers in the flow of information on one hand but may also represent heterophilic actors who connect subgroups or villages. The bridging ties and subgroups show clustering in the network which may be built around specific agricultural information, and supported by the relational ties.

Recommendations

• Social networks are a form of social capital that can be used in agricultural extension to enhance the flow of information and hence communication among farmers adapting to climate change phenomenon.

• SNA is a versatile methodology that should be taught and applied in agricultural extension discipline in developing countries.

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