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Building farmers' capacities for networking (Part I): Strengthening rural groups in Colombia through network analysis

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Introduction to both case studies

Four major trends, namely climate change, economic globalization, HIV/AIDS, and population growth, are exposing rural communities to greater pressures and risks. The pace of change is so rapid that traditional innovation systems are generally unable to cope. As a result, many small farmers face grave threats to their livelihoods.

Innovation can be defined as the application of knowledge of all types to achieve desired social and economic ends (Hall et al. 2001). It is essentially a social process in which people learn about new ideas and adapt and use them through their interactions with others (Allen et al. 1983; Douthwaite 2002). As a result innovations generally arise out of a network of actors and relationships (Conway and Steward 1998). A growing body of literature is showing that network structure, such as which actors are linked to whom, the number of linkages, the roles that different actors play and the degree of clustering, to mention just a few, determines how effectively networks are at fostering innovation (Krebs and Holley, 2004; Castells, 2004; Cross and Parker, 2002). Companies in developed countries are starting to use network mapping techniques to diagnose their social, innovation and communication networks as a first step to identifying measures to improve them (Cross and Parker, 2002).

This paper (Part I) present a case study of work conducted by the International Centre for Tropical Agriculture (CIAT) to adapt network mapping techniques to a rural and developing country context. It reports on work in Colombia to develop a prototype network diagnosis tool for use by service providers who work to strengthen small rural groups. It is complemented by a further paper in this issue by Louise Clark (Part II) which presents work to develop a network diagnosis tool for stakeholders involved in agricultural supply chains in Bolivia. The prototype methods used in both Parts I and II are based on social network analysis (SNA) methodology. SNA is a rapidly developing methodology that is gaining increasing popularity as an analytical and visualization tool with a wide range of applications across a number of disciplines such as health care, psychology and business organization. The focus of SNA is the nature of the relationships that exist between different actors in order to better understand how an actor's position in a network influences their access to resources such as goods, capital and information.

In both cases, the method development and testing place as part of an action research process in which 'the researcher enters a real-world situation and aims both to

improve it and to acquire knowledge' (Checkland and Holwell 1998, p.9). We tested four hypotheses as part of this research:

1. Drawing network maps will help the actors involved (farmers, their groups and rural service providers) understand and visualize networks of relationships that are important to them;
2. Participatory analysis and discussion of these maps will build the capacity of the actors involved to strengthen their networks;
3. Strengthening networks will benefit the actors within them;
4. It is possible to develop a network analysis method that is simple enough for rural service providers to use with a reasonable amount of training.

Both papers explicitly build on the idea that 'rather than helping to build sustainable institutions and other capacities, technical cooperation tends to displace or inhibit local alternatives' (Fukuda-Parr et al 2002 p.5). Fukuda-Parr et al (2002) go on to say that 'the challenge should be to fully understand the local situation and move forward from there—step by step.' The papers contend that network analysis can help understand the local situation.

Neither case is complete. Both can be seen as an after-action review (Collison and Parcell 2001) carried out on the research to date. Both describe the step-by-step development of the method, what worked well, the capacity building required and what requires further consideration and research. The papers conclude with a final section to identify lessons learnt from both cases and make recommendations for future research. The work is structured as two case study papers because the work was carried out independently and the authors wanted the authorships to reflect this.

Introduction to the case

This case study presents the results of participatory action research carried out with two rural groups in Cauca, Colombia. The research is based on the premise that techniques from Social Network Analysis (SNA) that are used to foster innovation in business in the developed world can usefully be adapted to a rural and developing country context. We adapted Cross and Parker's (2004) approach which involves a consultant first discussing with management of a company what networks they are interested in mapping, and then designing and implementing a questionnaire to map them. Results from the questionnaires are analyzed using SNA software and then are presented to management before being discussed with staff. Consultants make money offering this service in developed countries, in particular in the USA (pers. comm. with Valdis Krebs 2004).

Krebs and Holley (2004) report similar use of social network analysis to map rural business networks in Athens, Ohio, USA. Biggs and Matsaert (2004) give examples of network mapping with government ministries, extension agencies, NGOs and farmers' groups to strengthen poverty reduction programmes in Nepal and

Bangladesh, although these maps were drawn in meetings without the use of questionnaires and SNA software. Gibbon and Pokhrel (1999) used social network mapping with rural women's groups in a similar way in Nepal. This is possibly the first time that the Cross-and-Parker-type approach has been used in the developing world as participatory diagnostic and planning tool, and subsequently reported in a peer-reviewed journal.

Methodology

The research was carried out in Cauca, Colombia with two Farmer Research Committees (CIALs –Spanish acronym): Fortaleza Carpintereña and El Progreso. The CIAL approach was developed by CIAT between 1990 and 1994 (Ashby et al 2000) and consists of a rural service provider, often an NGO, facilitating the formation of a farmer research group (the CIAL) that then carries out adaptive research as a service to their community. Both Fortaleza Carpintereña and El Progreso had carried out research on cost-effective feeding regimes for poultry production.

We selected to work with the two groups because they were different but comparable (see Table 1). The main difference was that one group was relatively old and well established and the other was relatively new and we thought this likely to produce differences in their networks. Both groups were well known to the research team and both were interested in participating in the research.

Our research approach was to first adapt the Cross and Parker method to participatory use in rural Colombian conditions using the existing experience of the research team. This included, for example, first introducing the concept of networks to the group (something that Cross and Parker do not do). The steps of the prototype social network analysis tool are shown in Figure 1. During the implementation of these steps we collected information and analyzed results in a number of ways, including through the use of after action reviews, recording of video, recording participants' comments on flip charts, note taking by the research team and key participant interviews. We collected and analyzed this information to test the four research hypotheses listed above.

To test the fourth hypothesis we invited two NGO staff[i] to accompany the research to help ensure that the network analysis method we were developing was simple enough for them to use.

Results

Group characteristics

There were differences and similarities between the two CIALs (Table 1). Both groups had carried out research on poultry feed, both had poultry projects oriented to generating additional income for member's households, and both were working on other projects. For example, Fortaleza Carpintereña worked on education and care for

Figure 1: Steps in developing the Social Network Analysis tool

1. **Exploring the nature and importance of social networks**
Different coloured wool was used to represent the different communication channels (i.e., a network) through which the workshop invitees received the invitation.

2. **Design and enumeration of a network questionnaire**

Encuesta para Análisis de Redes Sociales en CIAL Carpintero

Introducción

Esta primera búsqueda de información hace parte integral del trabajo de análisis de Redes Sociales *ARS* que el grupo CIAL Fortaleza Carpintereña ha iniciado, con el propósito de que sea una herramienta de trabajo grupal que les ayude a ver y entender de una mejor manera todas las relaciones internas, comunitarias y externas, para mejorarlas y/o fortalecerlas y así aumentar las posibilidades de lograr sus objetivos.

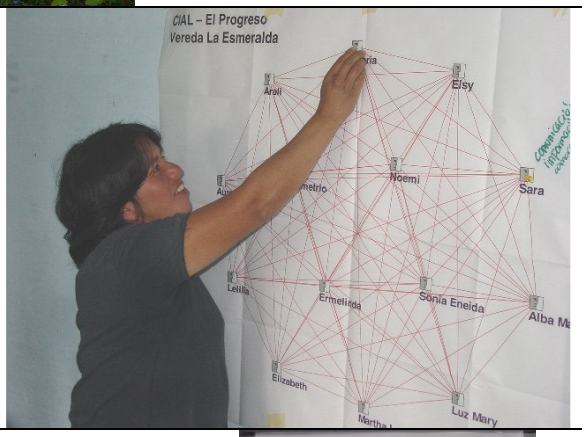
1. Información básica

Nombre Completo				
Vereda / Ubicación:				
Género:	F		M	
¿Desde cuándo vive en la comunidad?				
¿Hace cuánto pertenece al CIAL?				
¿Cuál es su papel/cargo/responsabilidad en el CIAL?				

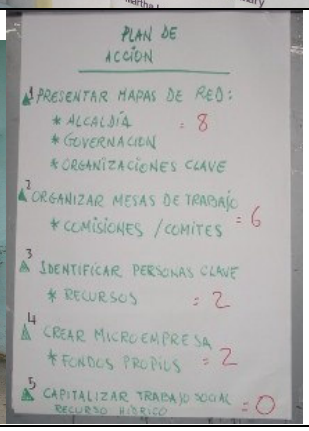
2. Membresía

¿En qué trabajos o proyectos económicos del grupo está trabajando o está involucrado? (Por ejemplo CIALs; producción de pollos; grupos de acción social, etc.)
Grupo 1:
Grupo 2:
Grupo 3:
Grupo 4:
Grupo 5:

3. **Mapping of the networks using SNA software and subsequent verification**



4. **Designing and the start of implementation of a strategic action plan based on this analysis**
Ranking was used to prioritize actions to be taken



5. Follow up of use of results of mapping and the implementation of action plans, including redrawing the maps

the elderly and children of their community. El Progreso members were involved in training in the production and selling of handicrafts. The main differences stem from Fortaleza Carpintereña being a longer established group that has received much more support from outside organizations in terms of financial resources and training.

Steps 1 and 2 of the prototype network analysis tool

The exercise we used to introduce the concept of a network involved group members tracing how the invitation to the workshop had arrived to each one of them using different coloured wool to represent different forms of communication (Figure 1). The subsequent discussions showed that people already had a good understanding of a network. For example, Sara Guetio, a member of the El Progreso CIAL, described social networks as:

> *…those invisible threads that bring people together, threads that you cannot see but can feel … for example, the bonds of affection…you can't see them but they are always with you.*

The questionnaire was designed to identify networks that were of interest to the respective groups and to us, the researchers. Both CIALs were most interested in their resources network –who seeks resources from whom and their strategic contacts – who in the group has contact with people who could potentially help the group. We as researchers were interested in their advice networks – who asks whom for advice about agriculture, and their network memberships - who was linked to whom through group membership. El Progreso were interested in mapping who had contact with whom with respect to commercialization of products produced by the group. We developed and enumerated a questionnaire to map these networks.

Results from the mapping (step 3)

We analyzed the data and drew the network maps using Inflow SNA software. We presented the maps to the group leaders to check for sensitive issues before presenting them to the whole group.

The maps and the mapping data (Figure 2 and Table 2) give insights into the social capital of each group. Woolcock (1998) identified three types of "structural" social capital that can be identified through network mapping. The first is *bonding* social capital that refers to relationships between family and friends, and a very immediate circle of neighbours, acquaintances and co-workers. The second is *bridging* social capital that refers to the connections that go beyond this closer circle with people who are not in frequent contact or who approach each other regularly. These bonds are of special importance when it comes to seeking resources and referrals outside of a person's immediate group. The third, *linking* social capital, is yet another step towards the outside, this time the ties between a person or group with the power structures that are usually represented in formal institutions.

The 'resources' and 'strategic contacts' maps are thus plots of the groups' respective bridging and linking social capital. Both are shown plotted in Figure 2 as green links. The red links are the CIAL members' links to each other through group membership and represent bonding social capital.

Comparison of the network data (Table 2) of both groups shows that Fortaleza Carpintereña reported three times as many internal linkages as El Progreso, suggesting that the longer established group has higher bonding capital. Fortaleza Carpintereña had more internal linkages because its members belonged to eight internal groups while El Progreso members belonged to just two. In contrast, El Progreso members were more likely to belong to external groups, reporting more than twice as many external links compared to Fortaleza Carpintereña. Fortaleza Carpintereña also had higher linking and bridging capital: its members reported twice as many strategic and resource contacts as El Progreso members (Figure 2).

Presenting the maps to the respective groups produced some good discussion and some changes to the maps. Fortaleza Carpintereña members included links to the people who they helped in their community work (see Table 2) including helping incipient groups by providing them with contacts and information. This was important for them as an incentive to do more, as they realized 'we have more to give than money', and since the modified map was later used for fund-raising, this new data helped show the group's impact and wide coverage.

Fortaleza Carpintereña members reported three times as many people asked them for information about agriculture compared to El Progreso (ratio = 3.29). This is not surprising given Fortaleza Carpintereña is longer established and is engaged in more activities. Only one Fortaleza Carpintereña member said she asked another Fortaleza Carpintereña member for information, compared to nine El Progreso members who asked advice from within their group. This confirms that Fortaleza Carpintereña has stronger bonding social capital – the members know each other better than El Progreso, and know more of what each other knows.

Over half of Fortaleza Carpintereña's strategic and resources links were made by just two people, the group leader and the treasurer. In El Progreso strategic and resources links were more evenly distributed, but were characterized by up to six CIAL members approaching the same person, indicating a lack of co-ordination in the group's fund-raising strategy.

Development of action plans (step 4)

The dependence of Fortaleza Carpintereña on their leader and treasurer was something of which the group was already aware. They saw that should either leave the group would be very seriously weakened. As part of their action plan the leader and treasurer agreed to start training others to maintain existing relationships, leaving the two of them free to form new strategic links to the outside. Others agreed to support those who might travel to attend meetings outside the village by doing some of their home and farm work.

Table 1: Characteristics of the participating CIALs

	Fortaleza Carpintereña, Vereda Carpintero, Municipio de Morales, Cauca	El Progreso, Vereda La Esmeralda, Municipio de Piendamó, Cauca
Year formed	2001	2004
Number of members	18	13
Number of internal sub-groups formed by the CIALs	8: chicken rearing; social work with the community elderly; selling aromatic plants; producing personal-hygiene products: bakery; organic coffee growing; home gardens; training in proper garbage disposal for children	2: chicken rearing; handicrafts
Resources received from outside organizations since group inception	- $1,600 from the local municipality (Alcaldía) for poultry rearing - 13,000 special coffee saplings from the Coffee Committee - Funding to install 15 chicken coops in their community from the Rural Development Foundation - A promise of several thousand dollars to buy a plot of land from the Rural Development Foundation	- 300 chickens from the Cabildo for poultry farming, plus some food - 150 chickens from the Piendamó Municipality, plus some food.
Trainings received	- Training in CIALs, Participatory M&E and Network Analysis from CIAT and CORFOCIAL - Training in project proposal development; accounting; chicken rearing; and processing of chicken meat from SENA - Training in managing organic manure; and, clean medicinal plant production from UMATA Morales - Training in bread making; motor mechanics; handicraft production; production of cosmetics from MIRA	- Training in CIALs, Participatory M&E and Network Analysis from CIAT and CORFOCIAL - Training promised by MIRA
Other characteristics	- Only women - Established as an EAT (Spanish Acronym for Associated Work Enterprise)	- Mixed - men and women

In El Progreso, the group decided all would play more of a linking and bridging role to the outside and that all members would share the responsibility for fund raising. They decided to focus on strengthening their relationship with SENA (Spanish acronym for National Learning Service which is the Government's technical education entity) and the local municipality (Alcaldía).

As a result of discussing the maps, both CIALs identified as their first priority the need to hold a meeting to strengthen their ties with their resource and strategic contacts identified in the mapping (see Figure 2). The project (CIAT) helped finance both meetings at which the CIAL members made presentations of their activities and then engaged the invitees in a dialogue about future joint ventures and investment in the CIALs. El Progreso used network maps to explain their internal structure and outside links.

Follow up (step 5)

We conducted follow up interviews in both CIALs six months after their stakeholder meetings. Both CIALs had used their network maps in the intervening period. El Progreso made a presentation in the annual CIALs meeting, which was attended by 12 CIALS. Luz Mary Cobo, who made the presentation, said it was a motivating experience for them because there was much interest and they felt that they had something new and interesting to share with the other CIALs.

Fenix Sarria, the co-leader Fortaleza Carpintereña explained how they used their maps:

> *We took them to the governor's office to show them… the meeting was attended by the Cauca Secretary of Agriculture, the first lady of the Department and people from the Women's office from Bogotá, representatives of groups from all over the department [Cauca], and the maps were useful for us to show our work with other organizations, which is already at a national level, and they liked this a lot. They asked us how we had made the maps and we explained we had done them with your help in workshops with the whole group.*

Fenix Sarria also said that the most significant change for them had come through the meeting with their strategic contacts.

> *The meeting created much interest in the community and now there is more recognition and respect for our group of women. The community now will not be an obstacle to us working with other organizations. Now people (in the community) no longer say that there are many groups and we (Fortaleza Carpintereña) are just one of them. Now we can represent the community.*

This change came about in part as Fenix Sarria again explains:

> *People in the community could see with their own eyes that the group is strong and is supported by a number of organizations big and small and this has generated much credibility and now they respect us much more as a group of women.*

Other members of Fortaleza Carpintereña were not so positive. They reported that some community members felt that the meeting had been too lavish and the group had wasted the money they had donated, and refused to donate again for Fortaleza Carpintereña's work with the elderly and the school children.

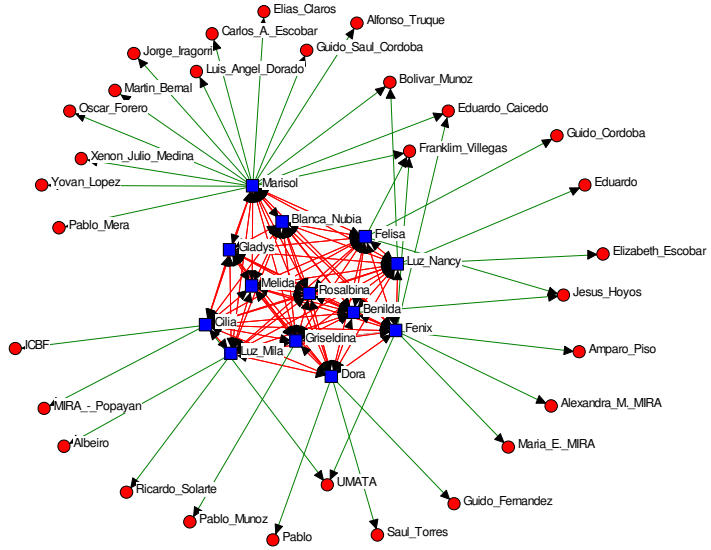
Fortaleza Carpintereña had not met as a group since the meeting, and had ceased some group activities including providing care to the elderly. In the follow-up interviews it emerged the main reason was they were waiting for the donation of plot of land, something that the group had invested a lot of time and effort in. Continual delays had proven demotivating, as had the problems with community fund-raising.

Table 2: Comparison of mapping data for the groups Fortaleza Carpintereña (Carp) and El Progreso (Prog)

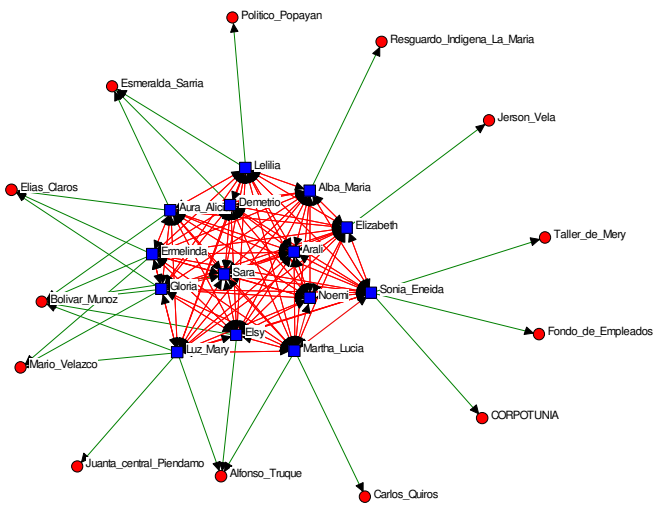
Network Question	No. of internal links between CIAL members			No. of links between CIAL members and outside			Number of external actors		
	Carp	Prog	Ratio	Carp	Prog	Ratio	Carp	Prog	Ratio
What groups are you a member of?	79	25	*3.16*	16	38	*0.42*	15	35	*0.43*
Who are your strategic contacts?	0	0	*n/a*	55	30	*1.83*	34	17	*2.00*
Who do you ask for agricultural info?	3	20	*0.15*	12	18	*0.67*	13	17	*0.76*
Who asks you for agricultural info?	1	9	*0.11*	23	7	*3.29*	21	6	*5.5*

Notes: The number of respondents in Fortaleza Carpintereña (Carp) = 13 and for El Progreso (Prog) = 13.

Figure 2: The Fortaleza Carpintereña and El Progreso Resources Networks. Blue squares are group members linked together by their membership of the their group (red lines), red circles are the people and organizations the group members contact for resources (green lines)



(i) Fortaleza Carpintereña



(ii) El Progreso

The most significant change for El Progreso was that the mapping had helped them see that as a group they had far greater numbers of links and influence than any of them individually. It helped them understand that they were stronger in a group than individuals alone, which was motivating. Also, the analysis of their poultry market links motivated them to seek training to improve these links, and to improve the financial management of the group.

El Progreso reported that it had bought a maize mill. Although this was not as a result of the network mapping *per se*, they understood that its function was to strengthen the group's bonding capital through providing the cash to carry out group activities such as the celebration of each others' birthdays.

Discussion

What was useful for the two groups?

The findings showed that the first two hypotheses held true for the both groups: drawing network maps helped group members visualize and understand networks of relationships that were important to them; and, group analysis and discussion of these maps build their capacity to strengthen their networks. Proof of capacity building was that both CIALs identified networks they wanted mapping which we the researchers had neither predicted, nor suggested, and that they subsequently used the maps on their own to make presentations in meetings. Both groups used their maps to help their strategic contacts understand better how they were working. The maps helped the strategic contacts appreciate that both groups were viable because they were receiving support from several sources. The fact that both groups were developing the capacity to analyze and improve their networks also helped increase the strategic contacts' confidence in them.

The maps also proved useful for Fortaleza Carpintereña in reinforcing what they already knew about their overdependence on their two leaders. It provided them with a new impetus to do something about it. Discussing the maps also helped Fortaleza Carpintereña better understand and articulate the different ways they provide resources to their community, and this better articulation helped raise their profile within their community.

The most significant change resulting from the work was different for each group, reflecting their differing levels of maturity. The most significant change for El Progreso was that the mapping had helped them see that as a group they had far greater numbers of links and influence than any of them individually. For Fortaleza Carpintereña the most significant change resulted from a meeting the project helped organize with their strategic contacts. The consequences were mixed. Some in the group feel that they had gained respect in their own community as a result of the meeting when people 'could see with their own eyes that the group is strong and is supported by a number of organizations, big and small.' Others felt that the meeting had appeared expensive and had damaged their ability to fund-raise in the community.

The follow up interviews showed that the increased capacity of both groups to understand their networks helped strengthen them, thus validating the third hypothesis. Both groups held a meeting to strengthen links with their strategic contacts, which they themselves

suggested. Fortaleza Carpintereña reported better relationships with its strategic contacts after their meeting, and El Progreso was given 300 chickens and chicken feed as a direct result of theirs. El Progreso is using income from a maize mill to build its bonding social capital.

What was useful for the research team?
We learned a great deal in carrying out the research in terms of how to carry out social network analysis in rural settings, and what the method can offer. We learned that comparing the ratio of internal to external links between the two groups was a good way of comparing their levels of social capital and may eventually prove to be a useful tool to characterize groups. A hypothesis for further testing is that mature groups will have higher numbers of internal links with respect to group membership, and higher numbers of external links with respect to being asked for advice, and links to strategic contacts.

Network mapping helped better understand the groups not just as farmer research groups (CIALs), but groups who manage a portfolio of activities of which their CIAL work is a part. The mapping also helped us to understand that both groups were motivated by both self-interest – to help themselves improve their livelihoods – and to help their communities. Both motivations are linked as shown when Fortaleza Carpintereña stopped most of its community work while waiting for a donation of a plot of land.

An interesting finding was also that we, as outsiders, were more interested in their advice networks (who gives and receives information from whom), while both groups' first interest was in identifying their resource and strategic contacts networks. Our interest in their advice network stems from our interest in innovation and the premise that healthy information flows are a sign of a healthy innovation system. The groups' interest, quite rightly, was first in their own sustainability.

What was useful for the NGO (the potential user of the method)?
The NGO (CORFOCIAL) who accompanied us during the testing of the prototype SNA tool is now using it to map the strategic contact networks of the CIALs they work with. As with Fortaleza Carpintereña and El Progreso their main motivation is to use the maps to better understand and communicate how they are working to existing and potential donors.

CORFOCIAL benefited from being part of the research team developing the prototype by: 1) learning that the maps are useful as communication and fund raising tools; 2) helping them understand the types of networks CORFOCIAL wishes to map; and, 3) helping with the design of their questionnaire and its enumeration. CORFOCIAL is now in the process of interviewing 27 CIALs using its own resources. The CIAT research team is providing some technical backstopping with respect to use of the software and interpretation of the maps. CORFOCIAL is driving this work, not CIAT.

What still needs more work?
More work is still needed to test the fourth hypothesis that it is possible to develop a network analysis prototype method that is simple enough for rural service providers to use with a reasonable amount of training. The current prototype is expensive in the number of visits needed, and in the training required if NGO staff are to use the SNA software. Another issue is the cost of the program. We have subsequently switched from InFlow© to

Netdraw©, which is free. The author of the Bolivia case has developed a NetDraw user manual (Clark 2006) for NGO and national program staff in Bolivia which we are field-testing. However, it remains to be seen whether expecting NGO staff to learn and use a relatively sophisticated program is realistic.

Another area for future inquiry and improvement is the follow up of action plans resulting from analysis of the network maps. Network mapping is likely to greater benefit groups if it is implemented as a component in an ongoing relationship between the service provider and the group, and not just as a one-off event.

Conclusions

The first step in building capacity for networking in rural communities is to help rural people and their service providers understand and visualize their existing networks. The results presented in this paper suggest that social network mapping techniques used to foster innovation in business in the developed world can help achieve this first step. Furthermore the research shows that this understanding can lead to the identification of measures that do strengthen these networks, and that this in turn brings benefits, at least to the groups who carry out the network analysis. The benefits included: giving the group a clearer sense of identity and a clearer idea of the benefit of being in a group; clarifying and communicating a group's impact on its community; identifying internal group management issues; and, clarifying a group's strategy towards funding raising and seeking support from outside.

The use of interviews and network mapping software to generate social network maps requires rural service providers to learn new skills. It remains to be seen whether it is possible to develop a network analysis prototype method that is simple enough for rural service providers to use with a reasonable amount of training. Further work is also needed to better link the use of network mapping to monitoring and evaluation so that actions identified are more likely to be implemented. Analyzing networks and intervening based on that analysis can have both positive and negative consequences. More research is needed to identify the types of interventions that strengthen networks.

The data generated from network mapping helped characterize the two groups. For example, the ratios of internal to external links proved to be useful measures of the groups' social capital and development. If such data is collected for a number of groups it may be possible to specify expected values for mature and functional groups and signal how these metrics should change with group development. These metrics could provide monitoring and evaluation milestones.

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Abstract

This paper (Part I) present a case study of work conducted by the International Centre for Tropical Agriculture (CIAT) to adapt network mapping techniques to a rural and developing country context. It reports on work in Colombia to develop a prototype network diagnosis tool for use by service providers who work to strengthen small rural groups. Drawing network maps helped group members to: develop a clearer sense of identity and a clearer idea of the benefit of being in a group; clarify and communicate their contributions to their community; identify internal group management issues; and, clarify their strategy towards funding raising and seeking support from outside. We, the researchers, benefited from a better understanding of group functions and motivations. Comparing ratios of internal to external network links allowed us to assess relative levels of bonding, linking and bridging social capital. Subsequent participatory analysis and discussion of these maps built the capacity of group members to strengthen their networks. Research is ongoing to test whether computer-based SNA is simple and practical enough to be used by rural service providers.

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