Net-Map: Collecting Social Network Data and Facilitating Network Learning through Participatory Influence Network Mapping

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Abstract

The authors describe how to use Net-Map,[1] a low-tech, low-cost, interview-based mapping tool that can be used by researchers, facilitators, and implementers to (1) visualize implicit knowledge and understand the interplay of complex formal and informal networks, power relations, and actors' goals; (2) uncover sources of conflicts as well as potentials for cooperation; (3) facilitate knowledge exchange and learning processes; and (4) develop visions and strategies to achieve common goals. The authors

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show that the tool can produce both qualitative and quantitative data to increase network understanding by going beyond the purely structure-driven approach of social network analysis (SNA) and combine structural measures with measures of attributes of actors, especially concerning their perceived influence and their goals. The authors present experiences from a field study from Ghana to illustrate the procedure and briefly discuss possible applications of the tool.

Keywords

social network analysis, participatory methods, visualization, learning, Ghana

Introduction

As transdisciplinary researchers in the field of policy analysis and development studies, we typically face conflicting demands in terms of the timeliness of results. On one hand, we want to collect high-quality data, analyze it meticulously, and produce cutting-edge global public goods. On the other hand, we interact with local policy makers and practitioners who need to make good decisions under time pressure and often cannot wait for the lengthy review process to be completed. ''Research fatigue'' is one result of time-consuming and mainly extractive research approaches (Westerlund 1994; Stevenson 2003).

The complexity of the questions analyzed increases the more actors are involved in decision making and implementation. Multi-stakeholder organizations have been strongly promoted by governments and international donor agencies for complex governance issues both in developing and in developed countries (Warner 2005). However, the involvement of multiple actors who are linked by formal and informal structures makes it difficult for outsiders to understand the complexity of governance issues especially under time pressure. The understanding of processes and structures is exacerbated when the culture where research is conducted differs from that of the researcher's origin.

However, it is often these structures that determine the success or failure of policies, projects, or management of natural resources. For the sake of improvement, it is essential to understand complex processes (Widmer and Frey 2006) and linkages of individuals (Handwerker 2001), the structures these linkages build, and their dynamics (Davies 2003). Social network analysis (SNA) is increasingly used to shed light on complex patterns of formal and informal interactions between different actors. SNA explains the

achievements of individual actors and also the developments within groups of people or organizations by looking at the structure of linkages between actors. Instead of analyzing the characteristics of an individual or the formal hierarchical structure of an organization, SNA focuses on the networks of actors. Although general concepts of analyzing formal and informal linkages are helpful for understanding complex social realities, standard approaches to social network research pose a number of problems to researchers in the development field.

The most common approach to data collection in SNA is to identify the actors using a name generator (Hogan et al. 2007), followed by a list of questions asking for each possible pair of nodes (actors), whether or not they are linked. This is either done on paper or via computer applications (Wasserman and Faust 1994). Depending on the number of actors, this can be a long and tiring process (Hogan et al. 2007) without learning effects for the interviewee. This challenge, together with the problem of time pressure, has led to a search for innovative approaches, such as quick ethnography, which aim at delivering effective results within efficient research frameworks (Handwerker 2001).

McCarty et al. (2007) tested an approach that considerably reduces the informant burden and still allows the establishment of a general network structure. They showed that for most purposes, a network of 25 alters can sufficiently reproduce the structure of a 45-actor network, cutting the information needed from 990 to 300 pairs. However, by reducing the numbers of actors assessed, there might be a risk that, for example, information for planners who are especially interested in specific positions of concrete actors with whom they interact is lost. So, cutting the number of alters would significantly reduce the utility of the research for planning.

Furthermore, despite the massive reduction of questions, the participants' learning effect is probably quite small. Thus, adapting social network approaches to field conditions in developing countries goes beyond shortening the interview. Ayuku et al. (2003), in their work with scavenging street children in Kenya, encountered further challenges: a low level of trust, short attention span, and a low level of abstract thinking.

More participatory strategies are described by Douthwaite and Davies (2006), who integrated the drawing of multiplex social networks into their impact pathway approach. Other examples of visual network data collection from developed countries are studies of ego-networks during which the names of network members were written down on paper or plastic chips and arranged in concentric circles around the ego/interviewee (Fitzgerald 1978; Antonucci 1986; Hogan et al. 2007) to represent relative

closeness to the interviewee. Although this does not in itself constitute social network data, as the links between nodes are not defined, Hogan et al. (2007) did add links between actors and clusters and could show that using a paper-based method for visually arranging ties yields more dependable results, pleases respondents, looks visually compelling, and can be understood intuitively.

In intercultural research contexts, the probability of misunderstandings is high, even more so, if the questions asked are predefined, closed ended, and do not leave room to explore whether the words and concepts used carry the same meaning for everyone involved. Using a flexible, participatory approach, intercultural differences can be uncovered and discussed throughout the mapping process and positions and linkages can be corrected immediately.

One goal of analyzing structures is the detection of actors who have influence based on their position in the network. This is usually done by calculating indices such as betweenness centrality or closeness centrality. Krebs (2004), for example, argues that those actors with the highest betweenness (who are on the closest link between other actors) and the highest closeness (who can reach everyone in the network on a short path) will have the most power, as they combine control (betweenness) and access (closeness). Borgatti (2005) points out that for different kinds of network flows, different centrality measures should be applied. When approaching culturally diverse empirical research situations, it is important to test whether these measures are culturally appropriate. For the analysis of power, Krackhardt (1990) proposes to ask interviewees directly how much power network actors have. To address the challenges discussed above, we expanded the pen-and-paper–based network mapping approach of Douthwaite and Davies (2006) by adding the goals of actors and Krackhardt's idea of independent measures for the perceived influence (also see Schiffer 2007). The result is the Net-Map method, which we describe step by step in the following section, drawing on experiences from a case study focusing on multi-stakeholder water governance. We briefly describe the participants' learning experience, introduce some findings, and end with a critical reflection on (of) the lessons learned.

Net-Map

The Net-Map method was developed as a low-tech and low-cost tool and applied during a partnership between the Challenge Program for Water and Food and the White Volta Basin Board (WVBB), a local multi-stakeholder

organization, in northern Ghana. The research was conducted between 2006 and 2008. WVBB brings together representatives from different water-related public sector agencies, nongovernmental organizations (NGOs), and traditional authorities to form a consultative group. The aim of the board is to improve the coordination of all stakeholders toward an economic and environmentally sustainable use of water in the White Volta River Basin. However, the board has limited formal enforcement capacity. Understanding the influence and goals of different actors in the network (within and beyond the board membership) helped board members use this knowledge strategically to push recommendations, developed by the board, to increase sustainable water governance. Another aim for us was to test the method's abilities to combine researchers' data collection with participants' learning.

In the following, each step of the interviewing process is first described in general and then illustrated by experiences from the case study.

Using Net-Map Step by Step

Equipment Used

Net-Map is a method whose strength lies in visualizing and making explicit a number of phenomena that structure decision-making arenas. During the interview process, we used

1. large sheets of paper for drawing the influence network maps (one per interview);
2. small, if possible multicolored actor cards to note down the actor names, preferably adhesive paper ("post-its");
3. checker pieces, bicycle bearings, or similar flat round disks that can be stacked to build influence towers (number depends on complexity and influence differences between actors, about 80 for complex setups);
4. figurines (optional) to represent the different actors; and
5. different color felt pens (three–five) to draw different types of links between actors.

Preparation, Pretesting, and Sampling

One important step of the pretesting phase is the choice of appropriate terminology. As the term "power" often has a negative connotation, we are opting for the term "influence." However, in other cases, it might be just the other way around. Influence is a term with a broad meaning, and some thought should be given to the different kinds of influences, which are

similar to the links (e.g., who influences whom by exerting formal power, paying money, giving information, antagonizing, fighting, etc.) drawn in the mapping process. Links can be predefined by the researcher or facilitator based on previous knowledge or developed during the interview.

Based on previous knowledge as well as on the research interest, the researcher or facilitator can also establish a list of network members or leave this step to be answered by the interview partners themselves.

In the case of the basin board, the research question—"Who can influence whether and how the basin board achieves its goals?"—was developed following a preparatory round of interviews during which all 17 board members were asked to define goals for the board. The goals were divided into environmental, economic, and governance groups. Because board members saw the environmental and economic goals as partly antagonistic, it was decided to focus the mapping on these two goals to increase the board's ability to act strategically in forming coalitions to achieve and consolidate these goals. The kinds of links were defined beforehand to include line of command, flow of funds, giving advice, and flow of information.

Explain Basic Ideas to Interview Partners

Most interviewees will not be familiar with the specific approaches used by Net-Map. However, the underlying concepts of SNA and power mapping appeal easily to everyday experiences. Thus, the interviews start by explaining that this tool helps explore those relationships that shape and affect the issue at stake but are not necessarily reflected in formal hierarchies or otherwise easily visible. This idea can be explored further by giving practical examples that relate to the experience of the interviewee.

Assemble All Stakeholders on Map

A large empty sheet of paper is placed in front of the interview partner and she or he is asked to think of all individuals, groups, or organizations that affect the governance body/field/activity under analysis according to the research questions developed earlier. If a list of network members is prepared beforehand, the participants choose from this list.

Names are then written on the actor cards (post-its or small pieces of paper fixed with masking tape) and distributed on the empty map. To allow for a more defined visual structure, different color actor cards can be used for different actor groups (e.g., governmental, NGO, civil society, and private sector).

In our case study, no list of names was developed beforehand and we stressed that actors can be from local as well as regional, national, and international levels and not necessarily formally linked to the process. We kept the question accompanying this step rather open and referred it to the future ("Who will influence the achievement of the basin board's goals?") as the board had just been inaugurated and its members were still in the process of developing strategies.

In our interviews, the initial phase took different shapes with different interview partners. Some had a long list of actors whom they named immediately and filled the map quickly. Others started slowly and added more and more actors throughout the whole process of the interview. Adding actors and links whenever they came to mind was encouraged, to allow people with different approaches to complex questions to express themselves at their own pace. With interviewees who start rather slowly it helped to read out loud the actors noted, as suggested by Brewer (2002), to give them time and space to think about further actors.

Define Different Links and Draw Network

In the next step, the interviewer collects data about how the selected actors are linked. This is done by drawing different colored arrows between the actor cards. The colors represent different kinds of links. To cross-check whether both interviewer and interview partners are clear about the definition of the links, the interview partners can be asked to give examples on how the actual process of influence would look. This qualitative information can also be useful during the interpretation of the results.

The interviewer explains that different colored arrows should connect actors according to their links. The arrows indicate that "something" (such as information, funds, violence, etc.) flows from one actor to the other. If there is a mutual exchange, the arrow has two heads. It may be helpful to start with those kinds of links that are rather rare and only add the very common ones (such as flow of information) toward the end so as not to clutter the picture at the start. If actors are linked by more than one flow, arrowheads in a different color were added to existing arrows. In the case study, the following links were drawn: lines of command, flow of funding, exchange of information, and giving advice.

Especially in complex setups, the interviewers should guide the interviewee through the process by making sure that she or he goes step by step instead of jumping from one color to the next and back. If actors get very few or no links, the interviewer can point that out and ask whether that was

an oversight or a purposeful statement. However, it is important that the interview partner does not feel pushed to add links. Especially when dealing with delicate knowledge, the interview partners should be assured occasionally that the information will be handled confidentially.

Define "Influence/Power" and Put Actors on Influence Towers

For comparable results, it is crucial that power/influence are defined in a clear and understandable manner and that both interviewer and interviewee reach a common understanding. The interview partners are then asked who has how much influence on the issue at stake. According to the answers, influence towers are put next to the actor cards. The rules for building the influence towers were

1. The more influence an actor has, the higher the tower.
2. The towers can be as high as the interviewees want.
3. Two actors can have towers of the same size.
4. If an actor has no influence at all, no tower is added.

The influence value (height of tower) can be used to understand how centrality and influence are related and to identify influential partners or antagonists.

In the case study, the question was "How strongly can these actors influence the achievements of the basin board's goals?" After setting up the influence towers, we verbalized the setup, starting with the highest tower, and encouraged the interviewees to adjust anything if they had second thoughts. This was seen as especially necessary when networks were very complex. Once the interviewee was content with the whole setup, we made note of the height of the influence towers next to the actors' names on the network map. This is important for easy data entry later.

Add Goals of Actors

In this step, informants are asked to provide information about the perceived goals of the members in the network, which are noted on the paper next to the member cards and their influence towers. Together with the height of the influence tower, the information about the perceived goals is especially helpful if the Net-Maps are used for strategic planning because participants want to understand which alliances they could strengthen in the future and of which potential conflicts of interest they should be aware. In a context in

which the goal is mainly to understand complex situations, such as the dynamics of a conflict, it is interesting to compare different networks and to see in which (opposing) directions the parties are pulling and how they try to influence other actors for their goals.

In the analysis of the WVBB, the interviewees were asked whether actors had developmental or environmental goals or both. These orientations were noted next to the names of the actors: P for protection; D for development; PD for both goals; *P*D for both goals but stronger protection focus; and P*D* for both goals but stronger development focus.

Analyzing Net-Maps

Only some basics on data analysis are discussed below, as a full description on how to analyze social networks would go beyond the scope of this article.

If Net-Map is used to facilitate interventions, the process ends with a strategic plan on how goals are reached or conflicts are addressed. This plan is based on the Net-Map that is drawn with a group of network members who negotiated and drew a group network to identify potential cooperation partners or differences in perceptions about networks (thereby identifying sources of potential conflicts).

Further analysis is based on SNA algorithms, analyzing the different centrality measures of actors in the different networks, comparing them between different kinds of links (Are the same actors central in the money and the advice network?) between interview partners, and correlating them to the influence of actors as shown by the influence towers (Does high betweenness in the advice network make actors influential?). The analysis of network parameters such as density, core-periphery, and structural holes can help us gain a better understanding of the general ways how the network works. Analyzing the goals of actors can help us develop a richer understanding of the network dynamics: Are certain goals shared by the influential network members? Do network members use their links (e.g., out-degree centrality in the funding or the advice network) to influence others to follow their own goals? Are the goals of others clear or opaque to the interview partners? This analysis can be made for the individual interviews; however, it often makes sense to develop a common network that combines the views of all interviews. Going beyond the analysis of individual Net-Maps, one can "stack" networks on top of each other to develop a cognitive social structure (see Krackhardt 1987).

Results of the Case Study: A Learning Experience

Using Net-Map with the basin board facilitated learning and knowledge exchange within the group and provided the researchers with data about actors, networks, and actor attributes. We next describe the learning process and then briefly discuss the research results.

The research and collaboration process started with individual qualitative interviews to understand the goals that members would like to achieve with the basin board. Subsequently, 17 individual networks were drawn with all board members. To collate the common network view, two networks were drawn with smaller subgroups and finally one was drawn with the whole group, leading to a common influence network map that was used as a basis for their strategic planning.

After the individual and group exercises, participants commented about the learning effects from visualizing their influence networks. Drawing the maps helped them structure their own thoughts and served as a tool to prioritize their extensive but implicit network knowledge. This, in turn, helped them focus on actors of core importance for strategic planning, either because they have the same goals or a high influence.

Especially during the group interviews, the learning took place while explaining to each other why an actor should be on the map or not, how they are connected, and why certain actors were perceived influential or not. Sharing their experiences helped board members develop a common understanding and the facilitated negotiations in the process of drawing one map together helped to formulate a common vision. When presenting the common map to a bigger audience, this elicited an engaged discussion about the possible involvement of and collaboration with actors on the map and others who were not mentioned. Participants asked, ''What do we need to do, to become more influential in this process?''

The Net-Map drawn by all of the basin board members together serves as an example for the kind of data collected and the kind of understanding derived from it.

The data were analyzed with the Visualyzer software. Figure 1 shows the network of actors that will influence the achievement of the basin board's goals.

Although the 17 individual interviews showed a great variation of perception and understanding among the different board members—the number of actors mentioned ranged from 12 to 47—the common map shows a medium number of actors. The selection shows mainly organizational actors (such as district assemblies, NGOs, etc.) or functional groups

(such as farmers, chiefs, and fishermen) but individuals (regional minister and basin officer) were also mentioned.

Net-Map allows a more in-depth understanding of the interrelationship between the position in the multiplex networks and the influence of actors. Here two questions are of interest:

1. Is there a systematic correlation between network positions and influence?
2. Are there specific actors and actor combinations whose network position and influence are of relevance for the planning process and implementation?

Table 1 shows the influence of actors (as rated through influence towers) in relation to selected centrality values: out-degree in the command network (giving command); betweenness in the advice network (passing on advice); closeness in the advice network (reaching everyone quickly in the network with advice); out-degree in the funding network (giving funds); and betweenness in the funding network (passing on funds). The correlation analysis shows that only the betweenness in the funding network correlates with the influence of actors. This can be explained relating to Krebs's argument that betweenness centrality is a measure of control (actors with high betweenness can control to whom the money is given and whether it arrives at the intended beneficiary) and thus of influence.

The correlation analysis also shows that the influence towers add an important new dimension to the understanding of the governance network that is not entirely covered by the network indicators. Actors who lack high centrality can still be seen as influential. In the discussion, the board members indicated that the most influential actors had this influence because of distinct roles they played in the collaboration to achieve the goals.

Thus, for concrete strategic advice, it is not only important to reach a general understanding of structural determinants of influence it is crucial to understand the roles that different actors play in the game and how the position of specific actors in the network is related to their influence. This kind of understanding is easily attained using the visual representation as given by Net-Maps and the discussion facilitated through the drawing process. One example here is the specific position of the Regional Coordinating Council (RCC) in the command network (Figure 2). The RCC was described as an actor that could give formal command to the majority of actors and also had an extended (reciprocal) advice network but was seen as an actor with no influence at all (concerning the question at stake). In the
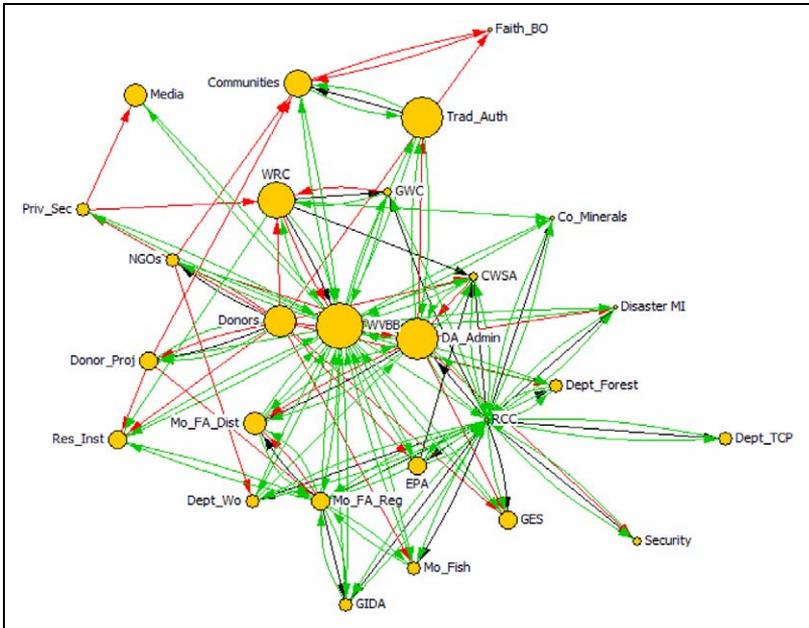
Figure 1. Net-Map from Group Exercise: Size of nodes = height of influence tower; Color of link = kind of flow; black = formal command; red = money; green = advice.

discussion, this was related to a lack of funding and a rather passive attitude toward their coordinating role.

Figure 3 shows the perceived influence. The members of the basin board decided to be the most influential actors when it comes to reaching their own goals. Further traditional authorities, the district assemblies (DA), the Water Resources Commission (WRC), donors for development projects, and the communities of the region are perceived to be influential.

Reflections and Conclusions

The Net-Map tool enabled the participants to make implicit knowledge about networks of influences explicit, detect sources of conflicting goals and potentials for cooperation. The participatory tool provided immediate results, which we and the WVBB could use to support organizational development. The intense group discussions especially fostered organizational

Table 1. Influence and Centrality Measures of the Group Network

Node	Influence	Out-Degree Command	Betweenness Advice	Closeness Advice	Out-Degree Funds	Betweenness Funds
WVBB	9	0	200.5	0.036	0	0
DA_Admin	8	1	5.333	0.022	5	79.667
Trad_Auth	8	1	0.5	0.02	0	0
WRC	7	3	1.333	0.02	1	41
Donors	6	2	0	0.014	12	161.167
Communities	5	0	0	0.02	1	3.667
Media	4	0	0	0.019	0	0
Mo_FA_Dist	4	0	0.333	0.02	0	5.667
Donor_Proj	3	0	24	0.02	3	19.833
EPA	3	1	0	0.02	0	0
GES	3	0	0	0.02	0	0
Mo_FA_Reg	3	2	7	0.023	1	2
Res_Inst	3	0	0.5	0.02	0	0
Dept_Forest	2	0	0	0.021	0	0
Dept_TCP	2	0	0	0.017	0	0
Dept_Wo	2	0	0	0.021	0	0
GIDA	2	0	0	0.021	0	0
Mo_Fish	2	0	0	0.021	0	0
NGOs	2	0	0	0.019	3	29.5
Priv_Sec	2	0	0	0.019	2	21
CWSA	1	0	0	0.021	1	0

(continued)

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Table 1 (continued)

Node	Influence	Out-Degree Command	Betweenness Advice	Closeness Advice	Out-Degree Funds	Betweenness Funds
GWC	—	0	—	0.021	—	0
Security	—	0	0	0.017	0	0
Co_Minerals	0	0	—	0.021	0	0
Disaster MI	0	0	0	0.02	0	0
Faith_BO	0	0	0	—	—	3.5
RCC	0	14	76.5	0.028	0	0
Pearson Correlation		Out-degree command	Betweenness advice	Closeness advice	Out-degree funds	Betweenness funds
Influence		−0.08626	0.360572	0.24340785	0.316448	0.422035*

* Correlation is significant at the .05 level (two-tailed).

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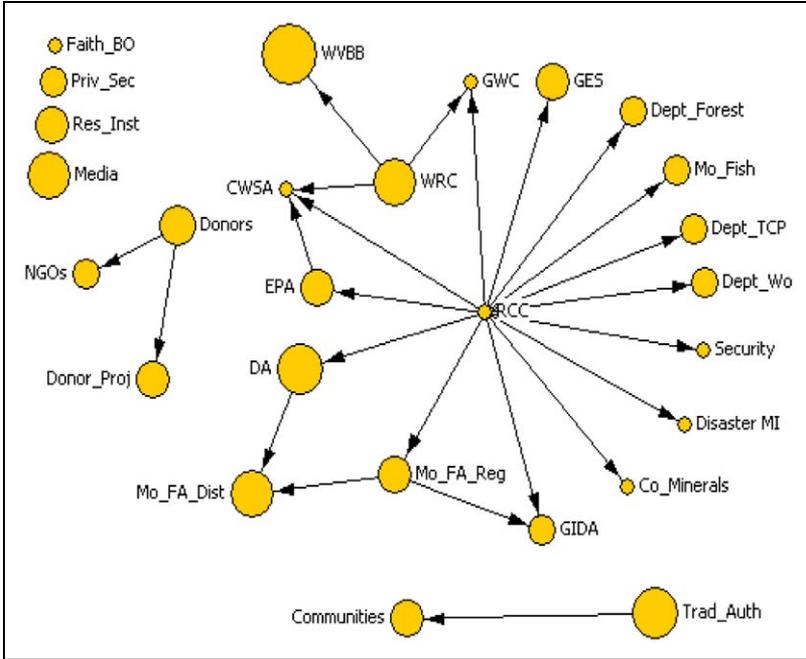
Figure 2. Net-Map from Group Exercise: Size of nodes = height of influence tower.

knowledge exchange and formulation of common goals and strategies. This experience led to the positive reactions to the interviews, despite its time-consuming process, and helped us avoid extractive, exhausting, computerized, and strongly theory-driven approaches. Furthermore, if research partners can make sense of the data collected, they can explain the findings from their own perspective and point of view. This allows intercultural clarification of concepts and priorities, adds new interpretations and ideas, and points out underlying issues that might not be immediately apparent from the raw data.

By drawing multiplex networks that include both formal and informal links, we get a rich picture of complicated governance situations. In addition, the tool allows us to go beyond the purely structure-driven approach of SNA and combine structural measures with measures of attributes of actors, especially concerning their perceived influence and their goals. This is especially valuable in cases such as multi-stakeholder governance in
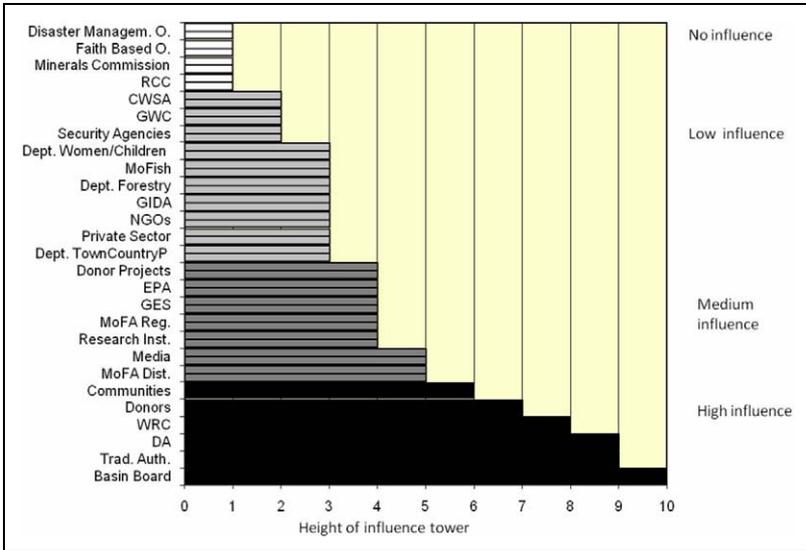
Figure 3. Influence Towers of Actors in Group Network.

developing countries, where the determinants of influence may or may not be captured by understanding the networks of actors.

One limitation of the tool is the potential bias that appears when asking who is influential, as actors perceived as noninfluential are automatically excluded together with the reason why they do not have a voice. Depending on the research interest, this could be avoided by adding a second name generator question that focuses on "Who can be influenced/was influenced by XY?"

The objective of the case study was to develop a common Influence Network Map of the basin board, so all members of the organization were interviewed because the WVBB has a defined number of members. However, when working with bigger or not very well-defined groups, it is difficult to use this approach because the number of interview partners can quickly grow beyond the planned scope of the study.

The study of large networks poses another problem, as the interviewer has to keep track of all possible pairs of links. One idea could be to group actors and draw links only from group to group. Another possibility would be to support the drawing process with software such as EgoNet, which is available for free at sourceforge.com and keeps track of all possible linkages.

Our experiences with Net-Map were very inspiring and although its potentials and limitations are not yet fully understood, it allowed us to use SNA under field conditions in developing countries. We are sure that its usefulness is neither limited to developing countries nor to a development context as it is a flexible tool that can be adjusted to the goals of a wide variety of issues, especially in situations where rapid assessments and quick ethnography are needed.

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Declaration of Conflicting Interests

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Note

1. An updated collection of case studies, user guides, field experiences, and debate of an emerging community of practice can be found at http://netmap.wordpress.com.

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Bios

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