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**Who has Influence in Multistakeholder  
Governance Systems?**

Using the Net-Map Method to Analyze Social Networking in  
Watershed Management in Northern Ghana

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## ABSTRACT

As multistakeholder governance has emerged as an important feature in development, new governance structures that foster the participation of multiple stakeholders from the public sector, civil society, and the private sector have emerged in various fields, ranging from the management of natural resources to the provision of public services. To make such governance structures work, it is essential to understand how different stakeholders influence decisionmaking and what determines their influence.

This paper uses Net-Map, an innovative participatory method, to analyze how networking influences decisionmaking in multistakeholder governance structures, using the case of the governance board of the White Volta River Basin in northern Ghana as an example. The method visualizes both the relations between all stakeholders in watershed management as perceived by the 17 members on the board and their influence on development outcomes.

The study suggests that significant effects of social networking are at play beyond the formal lines of command and funding as stakeholders in watershed management make decisions. Stakeholders are more influential if they participate more prominently in information exchange and provide more advice to others. This counterbalances the overrepresentation of government actors on the board. Meanwhile some government organizations have a low level of influence, even though they are central in giving funding and command. These findings may be interesting for program leaders and policymakers in watershed management: when designing governance structures they need to take into account the importance of social networking to attain main objectives of watershed development; it is important to provide space that allows the exchange of information and advice among stakeholders. Meanwhile, policymakers and program leaders as well must consider overrepresentation of social network champions in multistakeholder governance structures and the limited capacity of government bodies in social networking. The paper serves to introduce not only the specific findings concerning this case study but also the participatory research method (Net-Map) that was used.

Keywords: social networks, natural resource management, multistakeholder governance, decisionmaking, Ghana

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<sup>1</sup> All authors are former IFPRI staff.

## **ABBREVIATIONS AND ACRONYMS**

NGO	nongovernmental organizations
SARI	Savannah Agricultural Research Institute
DANIDA	Danish International Development Assistance





# 1. INTRODUCTION

Multistakeholder forums have become state of the art to address complex governance issues such as water management. Both policymakers and community-based organizations have come to appreciate multistakeholder forums and boards as solutions to the common problems of participation, particularly of minorities, and pluralistic decisionmaking. Nowadays a wide range of experience exists with local, national, and international multistakeholder governance boards both in developing and developed countries (see Warner 2006 for a comprehensive overview). However, despite an increasing preference for multistakeholder governance boards in natural resources management, there is little understanding of how these boards—often characterized by limited formal decisionmaking and enforcement capacity—can influence governance decisions and the achievement of governance goals. One particular question is, to what extent do representatives on multistakeholder boards use their influence on the boards and their positions in the wider network of stakeholders to influence whether the board achieves its goals?

Sociologists have long argued that power and influence are fundamental properties of social structure; depending on the patterns of relations actors have, their levels of power and influence can vary (Blau 1964; Marsden and Friedkin 1994). According to Granovetter (1985) relations between individuals or organizations—such as those maintained in multistakeholder boards—are embedded in actual social networks and do not exist as separate, abstract, idealized relationships that follow the rules established by their boards. Embeddedness relates to the way an actor is positioned in the wider social network, defined by the direct and indirect relationships the actor maintains with other types of actors in the network. The way an actor is embedded in a relational network can impose constraints on the actor or offer opportunities, and actors with fewer constraints and more opportunities may be able to exercise more influence. Beyond common contract and economic theories, embeddedness in social networks can explain the influence an actor exercises in decisionmaking processes; the occurrence of decisions that cause change can be understood as an outcome of various relationships among the actors or stakeholders. For example, an actor with more links to other actors or with more opportunities to connect different groups to each other may be able to exercise more influence in decisionmaking. However, the actors are linked by numerous kinds of ties (for example, giving money or giving information), and to explain the influence of an actor it might not suffice to ask only, “How many links does this actor have?” One may also have to ask, “What kind of links does this actor have?”

This paper presents empirical results from a study of how the underlying social networks among stakeholders in the management of a large watershed in northern Ghana, the White Volta River Basin, determine the influence these stakeholders have on achieving general development and environmental goals set by a board of stakeholders, such as negotiating water use between environmental and human demands and facilitating the proper registration of water users. The White Volta Basin Board is a multistakeholder governance mechanism for watershed management. In this study the board was subjected to an analysis concerning the perceptions of board members regarding the influence of each of the other members—altogether there are 17 member organizations on the board—and other external stakeholders on achieving the board’s goals. For this study a participatory network-mapping method (Net-Map) was developed that allowed the analysis of the relationships’ effects on, for example, exchanging information, giving advice, providing funding, or being in command as well as the perceived power of actors within these networks. The information was analyzed with tools of social network analysis deriving parameters that describe the embeddedness of each actor in each of these networks. Using correlation and multivariate regression tools, these parameters could then be related to data regarding the perceived influence of board members. The relation between members’ embeddedness in social networks on one hand and their influence on goal-oriented decisionmaking on the other allows for reasoning about over- and underrepresentation of interests in multistakeholder governance and for designing governance mechanisms that take those into account.

The paper is organized as follows: Section 2 presents a brief review of key theoretical and methodological works that have discussed the issue of social networks and influence in multistakeholder

governance boards. Section 3 presents the hypotheses to be tested and describes the study context, the research methods used, and the data-processing and analytical tools applied. Section 4 presents the network graphs and parameters derived from the social network analysis tools and the results from testing the hypotheses. The paper concludes by summarizing the overall findings and deriving some policy implications.

## 2. GOVERNANCE OF NATURAL RESOURCES AND SOCIAL NETWORKS

The articulation of public and community interest such as natural resource management often requires the collaboration of various stakeholder groups. However, the setting up of organizational entities that facilitate the integration of interests of multiple stakeholders in a sort of common governance structure is a recent phenomenon emerging out of the need for a more inclusive and effective method for multistakeholder participation. In the past, a lack of inclusiveness has often led to decisions that caused overuse of natural resources and marginalization of the interests of less powerful groups such as indigenous people, resource-poor farmers, and women. Many natural resources are common goods, and therefore the issues concerning their use and exploitation can often not be addressed appropriately by a single set of governmental decisionmakers or other decisionmakers but require cooperation between many different stakeholders. Unless all parties are involved in one way or another in working out solutions, implementing actions, and monitoring results, such issues are unlikely to be resolved (Rukato and Osborn 2001).

The Earth Summit in Rio de Janeiro in 1992 alerted the world to the pressing problems in every area where humans affect the environment and put natural resource management firmly on the agenda of the international community. The resulting Agenda 21 manifested the important roles various stakeholder groups play in the governance of natural resources including women, indigenous peoples, nongovernmental organizations (NGOs), business and industry, workers, trade unions, the science and technology industry, and farmers and local authorities, among others. Multistakeholder processes aim to bring together all those stakeholders whose interests are at stake in resource management debates in a new form of communication and decisionmaking structure. They involve finding practical ways to recognize the rights of, and the risks faced by, all those involved (Hemmati et al. 2002).

Multistakeholder governance goes beyond traditional concepts of hierarchic organization. It is based on pluralistic principles such as good governance, democracy, participation, equity and justice, unity in diversity, transparency, inclusiveness, legitimacy, and accountability. Arguments that make the case for multistakeholder processes include the following:

- multistakeholder governance promotes better decisions by means of a wider input from different sides and the integration of various viewpoints,
- multistakeholder governance builds trust through honoring each participant's contribution,
- multistakeholder governance generates mutual benefits through the use of complementary resources and the generation of synergies in their joint use, and
- multistakeholder governance creates commitment through participants' identifying with the outcome and thus increasing the likelihood of successful implementation.

A problem in multistakeholder governance is that people often do not take ownership of and responsibility for the decisionmaking process (Agrawal and Gibson 1999). This can lead to pseudo representation and to decisions made by only a few dominant actors. The challenge is to get a fair and unbiased understanding of who the relevant stakeholders are and get all stakeholders involved without jeopardizing the interests of any or overburdening stakeholders with time and other commitments.

There are many ways to design multistakeholder involvement, ranging from governments' consulting stakeholders to their creating multistakeholder platforms, formal partnerships, and joint ventures. One particular way of organizing multiple-stakeholder processes is setting up decisionmaking boards in which the various stakeholders have voting and decisionmaking rights. Watershed boards, for example, are composed of interested governmental and nongovernmental stakeholders that collaborate in the management of water and related natural resources at the scale of a watershed.

There is considerable variability in watershed boards' goals and strategic orientation, their effectiveness, their stakeholder composition, the way stakeholder participation is achieved, the voting systems they use, their leadership, their financing, their decisionmaking procedures, their efficiency, and their temporal scale. International river commissions have been developed for many rivers that touch more than one country (such as the Mekong River Commission, the Volta Basin Authority). Individual

countries install bodies such as water resources commissions (for example, Water Resources Commission of the Republic of Ghana), and even at the subnational level, multistakeholder bodies are instituted to coordinate the governance of river basins or sub-basins (for example, the White Volta Basin Board as a subcommittee of the Water Resources Commission of the Republic of Ghana).

These multi-stakeholder organizations may be legally entitled to make binding decisions. In many cases, however, they play a mainly coordinating and advisory role. The underlying assumption is that coordination will improve the decision-making of individual agencies involved. Increased collaboration might inspire synergy effects and help to mitigate conflicts of interest (for example in the case of water resource management between agricultural, industrial, environmental and household uses of water).

However, coordinating multistakeholder collaboration is not always straightforward. If multistakeholder organizations consist of a combination of government and civil society organizations, different organizational cultures may have to be reconciled. Also, the participatory character of multistakeholder organizations might clash with the more hierarchical organizational structure of some of the organizations involved. Within the multistakeholder organization, different forms of interaction are required that follow consensus building rather than rules of authority. For example, although a representative from a ministry of agriculture represents an organization wherein he or she is bound by clear line hierarchies (and it is important that the representatives on the multistakeholder board have the authority to fully represent the organization), when working for the multistakeholder organization, this same person might need to interact with representatives at different hierarchical levels from other ministries, traditional authorities, and NGOs. None of these has a predefined formal authority over the other because they refer to separate systems of hierarchy. To stick to the idea of multistakeholder governance, actors must interact through negotiating collaboration and exchange of information and advice rather than through following formal lines of command and hierarchical relations. In multistakeholder governance not only formal but also informal aspects of power and influence of the actors become immanent.

However, although multistakeholder bodies are strongly promoted by international actors, the knowledge about how and why they influence policymaking and implementation is still scarce. Widmer and Frey (2006) argue that this is mainly due to a lack of knowledge about appropriate methodologies for analysis. Lately there has been a trend of applying social network research tools to the understanding of the relationships among board members (Brinkerhoff 1996; Olsson 2007), following a general trend shift that began in the second half of the 20th century away from individualist, essentialist, and atomistic explanations and toward more relational, contextual, and systemic understandings (Borgatti and Foster 2003). In social network analysis the power or influence of an actor is often seen as a result of his or her position in the network, for example, the number of links someone has (the actor's degree centrality). In this context, Granovetter's (1985) argument, that the decisionmaking process reflects only the underlying social network structure, puts into question the role of such boards in supporting change processes. The question is, to what extent is the board actually able to guarantee pluralistic decisionmaking and good governance in the presence of power and influence in the underlying social relationships? Thus, the formal and informal networks can, on one hand, help these organizations to be inclusive and nonhierarchical, but there is the risk, on the other hand, that existing networks benefit only a limited number of well-connected, powerful actors and manifest existing structures of clientelism and elite capture.

Still there are few studies that shed light on the dynamics that occur when decisions are made on multistakeholder boards; most of them concern the corporate sector, where multistakeholder approaches are less common. Donaldson and Dunfee (1994), for example, argue that social contracting can best be understood and applied in organizational settings if it is perceived and treated as a network governance process, emphasizing the processes by which trust is built among corporate board members. Carpenter and Westphal (2001) show how external network ties determine a board's ability to contribute to decisions of strategic importance. They find that the strategic content of social network ties, not simply the number of ties, is an important influence on corporate governance. The same authors also deal with the issue of limited board involvement and find that this is determined by the lack of board power.

In a different governance context Boerzel (1997) analyzes European policy networks and finds that these networks constitute arenas for nonstrategic, communicative action, providing solutions for collective action problems and allowing for more efficient and legitimate policy mapping. However, she also warns about the ambiguity of policy networks, which can, depending on their implementation and governance, either enhance or reduce the efficiency and legitimacy of policymaking. Thus, although multistakeholder governance can provide for more inclusive governance processes, the dangers of inefficiency or elite capture should not be underestimated.

In the natural resource management literature Folke et al. (2005) argue that natural resources governance systems often self-organize as social networks with teams and actor groups that draw on various knowledge systems and experiences for the development of a common understanding and common policies. However, key persons often provide leadership, trust, vision, and meaning, and they help transform the governance system into a learning environment. They further argue that the emergence of bridging organizations lowers the costs of collaboration and conflict resolution. In other words, they argue that the functionality of boards, such as those in watershed management, depends on the leadership of certain key actors. The above studies, however, all focus on analyzing just one kind of link (or simply asking, Is there a link between a and b?), whereas the interactions that constitute multistakeholder governance consist of a number of different kinds of formal and informal links, which in combination affect the governance outcome and the power of different actors in the process.

In conclusion, there is ample evidence in the literature for the existence of multiple effects of the underlying social networks on the way decisions are made on watershed management boards and in other multistakeholder governance organizations. The main question now is how this actually happens. What are the mechanisms and reasons that make social networks influence and even determine the impact of multistakeholder organizations? How do formal and informal links affect this process? Drawing from social network analysis, there are a number of network phenomena that can help one understand the relation between influence and networking among stakeholders in natural resource management.

*Information exchange.* One may expect that actors that are well connected are better informed, and this puts them into positions from which they can make better decisions than those that are less well informed. Other actors in the network will realize this and follow the better informed in their decisionmaking; hence the better informed gain influence. Also, in esteem-based relations, well-informed actors may find it easier to make others follow their decisions because the less informed may take the better informed as references or models (Erickson 1988; Sparrowe and Liden 1997, 2005). Further, due to their capacity to inform others, some of the better-informed actors can become opinion leaders. A testable information-exchange hypothesis is the following:

*Hypothesis 1. Influence in decisionmaking depending on one's role in information exchange: The influence of actors in a governance network depends on the way they are embedded in the exchange of information among network actors.*

*Funding relationships.* In a resource-poor environment the ability to both give and get funding can affect the influence of actors in decisionmaking (Provan, Beyer, and Kruytbosch 1980). The ability to give funding is closely linked to the ability to set the agenda, even if the funder is located at a distant place (such as in a donor country): by determining what the funds have to be used for, funders can structure the content and degree of activity on the ground, even if they are marginal to the local social network. The ability to get funding improves the economic capacity of an actor and hence the possibility of exercising influence and achieving goals. Furthermore, an actor's ability to link (or refuse to link) other actors to these funds increases his or her control over other actors in the network, his or her activities, and his or her capacity to persuade those actors to follow his or her decisions. In network theory the incapacity to provide access to funding to others can be operationalized as constraint. An actor experiences a constraint when this actor's relational investments directly or indirectly involve only one other actor (alter). If those that receive funding from one particular actor all have other potential funding sources, this actor/funder is highly constrained. If they do not have alternative funding sources in the neighborhood, they cannot constrain the actor's behavior. The more constrained the actor, the fewer

opportunities he or she has to exercise influence. From the foregoing, the following hypothesis was developed:

*Hypothesis 2. Influence in decisionmaking depending on access to funding: The influence of actors in a governance network depends on the constraints they face to providing funding; if others do not need an actor to acquire funding, the actor is less influential.*

*Lines of command.* Command relates to activities with which an actor seeks to influence other actors to behave in a specific way, and in the case of noncompliance, the actor can revert to formal mechanisms of sanctioning. The hierarchical organization of social networks may imply command structures wherein certain entities, often central government organizations or traditional village authorities, set laws and rules and seek other entities, such as local governments, private NGOs, and community based organizations, to comply with those. Who is in command can influence decisionmaking processes at different levels. In a truly participatory multistakeholder system, the formal lines of command would not be the main determinants of influence of actors on the governance outcome. However, often a central government organization still considers itself the leading decisionmaker regardless of whether a multistakeholder governance system with democratic decisionmaking processes is installed. Other actors in the governance system recognize the influence or, depending on their positions, reject it.

*Hypothesis 3. Influence in decisionmaking depending on command authority: The influence of actors in a governance network depends on the extent to which they can command the actors in the network.*

*Embeddedness in the advice network.* Advice relates to activities with which an actor seeks to influence other actors to behave in a certain way, but the actor has no means of enforcing this behavior. In the context of water resource management, actors give advice to promote environmentally beneficial behavior. Whether the advice is actually accepted and the desired activities are undertaken is strongly linked to the advisor's embeddedness in the social networks and the trust in the advisor's capacity by those who receive and use the advice (Rousseau et al. 1998; Kilpatrick and Bell 1998). Those actors that are more prominently embedded in the advice network—that provide advice to others—are likely to exercise more influence and power in decisions that help to achieve preset goals; the credibility they experience in the advice network reflects the influence they can exercise on other watershed management-related decisions. The foregoing leads to the formulation of the following hypothesis.

*Hypothesis 4. Influence in decisionmaking depending on giving advice: The influence of actors in a governance network depends on the way they are embedded in giving advice.*

*Brokerage regarding advice.* Weak ties are fundamental in influencing behavior as they provide local bridges to otherwise disconnected parts of the whole network as well as links to external sources of information (Granovetter 1983; Hansen 1999; Levin and Cross 2004). Burt (1992) revised Granovetter's (1983) hypothesis about the "strength of weak ties" and suggested that rather than the weakness of the tie, it is the bridging function that makes the difference. Those actors that can span the "structural holes" of the network, brokering the access to advice of distinct subgroups, become influential players in decisionmaking in the network, at times even being able to filter and block information. By measuring the extent of structural holes in an advice network, for example, it may be possible to gauge the actor's influence on enabling this advice and on decisions that positively contribute to resource-management-relevant goals.

*Hypothesis 5. Influence in decisionmaking depending on brokering advice: The influence of actors in a governance network depends on their ability to link different network groups and broker the communication of advice.*

### 3. METHODOLOGY

This study applies social network analysis to research on governance and decisionmaking processes in a multistakeholder board instituted to improve watershed governance in a river basin in northern Ghana.

The role of the White Volta Basin Board is to coordinate the activities of those organizations that can actually regulate, enforce, and provide advice about issues of fishing, building, pollution, irrigation, and so forth in the field; most of these organizations are members on the board. This includes, for example, the ministry of food and agriculture, the water and sanitation authority and the district assemblies. Although some of the member organizations have enforcement capacity, the board itself does not. This is why the role of giving advice and the underlying social networks are becoming so important in the management of the watershed. The 17-member board includes representatives of many regional governmental agencies involved in water resource management, the eight district assemblies in the basin, one NGO representative, the research sector, and the regional House of Chiefs (representing the traditional authorities).

The research question investigated in this study is how patterns of social interaction among the members of the board and other stakeholders affect how they influence whether the board achieves its environmental and economic goals. Influence in this study is understood as the probability that one actor can affect the achievement of environmental and development goals according to his or her own will, even despite resistance of other actors in the governance system.

The underlying definition of influence was adapted from Max Weber's definition of power: "Power is the probability that one actor within a social relationship will be in a position to carry out his own will even despite resistance, regardless of the basis on which this probability rests" (Weber 1922, 53). Early conceptual formulations and empirical studies focused on interpersonal power relations. During the past decades, however, many works dealt with the power of organizations, comparing levels of power between organizations at different hierarchical levels and with different attributes (Cook, Emerson, and Gillmore 1983; Yamagishi, Gillmore, and Cook 1988; Rowley 1997). One prominent approach, the resource dependence approach, suggests that organizations are powerful relative to others to the extent that they control resources needed by others and that they can reduce their dependencies on others for resources (Pfeffer and Salancik 2003).

Other sociological approaches suggest that power depends on the emergent properties in interpersonal relations and social interaction. Blau (1964), for example, argues that rewards and acts of gratitude are important determinants of social interaction. An individual for whom another individual has done a service is expected to express gratitude and return a service when the occasion arises. The same may hold true for organizations and their representatives. Failure to express appreciation and to reciprocate tends to stamp the organization as ungrateful; it does not deserve to be helped any more. If the organization properly reciprocates, the social rewards serve as inducements to extend further assistance and trigger the creation of a mutual exchange of services and a social bond leading to inter-organizational dependencies. The most powerful organizations are those that are able to develop the strongest social bonds, allowing them to demand reciprocal services.

In conclusion, regardless of whether the source of power is dependence or social bonds, power can be seen as the capacity of actors within a social relationship to carry out activities according their interests even despite the resistance of others.

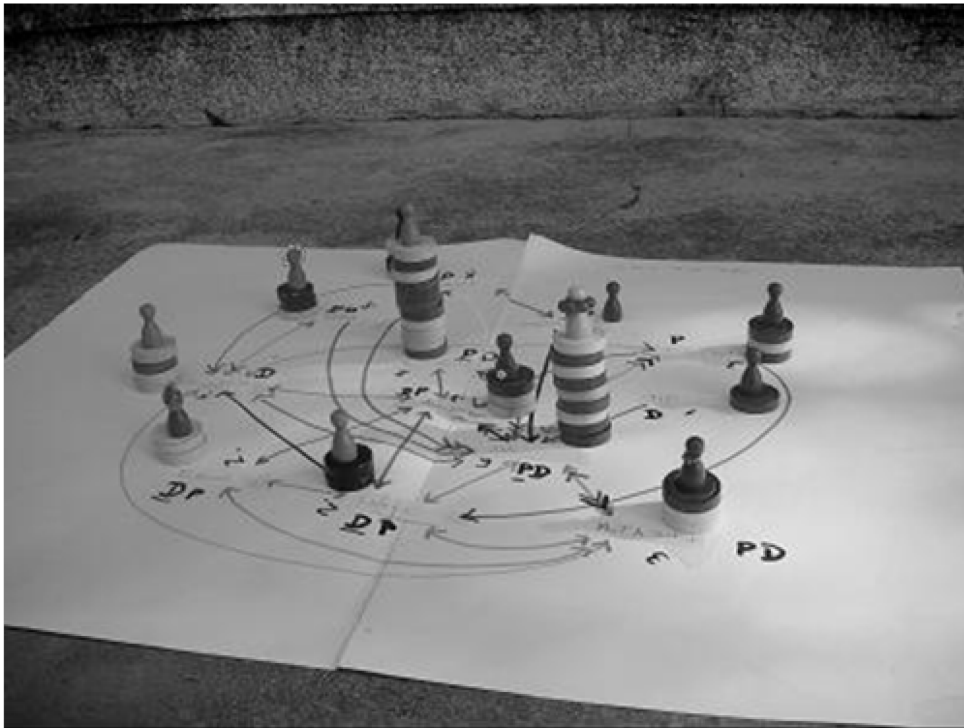
Preliminary tests in the study region in northern Ghana showed that the term power had a negative connotation or that it was used only to describe formal hierarchical authority. To avoid misunderstandings, the term influence was used in the interviews describing a mix of hierarchical command structure, power, influence, pressure, persuasion, and social bonding. During the interviews, representatives were asked to rate how influential the actors in the network were concerning the achievement of the Basin Board's environmental and development goals.

The research methodology (Net-Map) developed for this study focuses on the participatory visualization of network actors, multiplex links, and influence of actors in the interview process. This took the following steps:

1. Who is involved in this multistakeholder process? Actor names are written on actor cards and distributed on a blank sheet of paper.
2. How are they linked? Arrows of different colors are drawn between those actors that interact in terms of information, advice, funding, and command relationships.
3. How influential are they on this multistakeholder process? “Influence towers” consisting of checkers pieces are put next to each actor name to indicate the influence of actors.
4. Participants have a qualitative discussion about how and why (this method expands the approach of Douthwaite et al. 2006; for a detailed description of the Net-Map methodology, see Schiffer and Waale 2008).

This process is portrayed in Figure 1 an example of a Net-Map drawn by one of the board members.

**Figure 1. Net-Map drawn by one of the board members**



Source: Eva Schiffer 2008

The methodology led to three types of data: (1) data about influence, in our case the dependent variable; (2) data depicting the connection between the actors in the governance network; and (3) qualitative protocols of the discussion and explanation that occurred while the networks were drawn. It is important to note that these data were not drawn by an outside analyst but by the members of the board themselves. The data were collected in individual interviews, and then the network and influence data were aggregated (stacked). The qualitative data were used to guide the interpretation of the quantitative data.



The indicator for influence (dependent variable) was introduced to the analysis as a discrete variable whose value was established by the interviewees (corresponding to the number of checkers pieces interviewees put on towers to indicate the influence of an actor). The values were normalized by setting the highest value per interview equal to 1 and the lowest equal to 0. The influence indicators for each of the stakeholders were averaged across the interviews to derive an overall influence indicator for each of the stakeholders. The independent variables used in the study described the embeddedness of actors in the wider social network of stakeholders. The Basin Board consists of 17 individual members who represent different organizations of government, NGOs, and traditional authorities. To derive a balanced picture, all 17 board members were interviewed. However, the networks they drew included not just other board members but also external actors that could influence the activities, decisions, and achievements of the board (Table 2 shows this mix of board members and external actors. In individual interviews, each of the board members was asked to describe the relationships in terms of (1) exchange of information, (2) giving and receiving advice, (3) providing and receiving funds, and (4) giving and receiving command, and a map was drawn accordingly (see Figure 1). Through this interview process a list of 149 actors was developed. Reciprocity of the relationships was assumed; that is, if one board member indicated the existence of collaboration, the collaborator is assumed to indicate collaboration with that same organization in return. The ego-networks derived from the interviews were put together (stacked) to build overall cognitive networks (Krackhardt 1987a). Cognitive networks combine the perspectives of a number of the actors involved so that the multiple perspectives even out the biases and blind spots of the individual actors. The result of this process was four networks, each combining the view of 17 interview partners on

- information flow (network 1),
- giving advice (network 2),
- flow of funds (network 3), and
- giving command (network 4), respectively.

These cognitive networks were then subjected to various social network analysis operations using UCINET software (Borgatti, Everett, and Freeman 2002), deriving specific network indicators for each of the 149 actors.

Further, descriptive variables were used to specify the 149 actors with regard to the type of organization (public-central, public-local, private, nongovernmental, community, other) and the physical distance between them. Table 1 summarizes the variables used in the study.

**Table 1. Variables used**

Variable	Type
Contextual	
Type of actor	Categorical (government, private-sector organization, nongovernmental organization, civil-society organization, traditional authority, donor, faith-based organization)
Level of actor	Categorical (local, district, regional, national, international)
Dependent (influence in decisionmaking)	
Influence (average)	Continuous (index)
Influence (sum across 17)	Continuous (index)
Influence (count across 17)	Continuous (index)
Influence (average across 17)	Continuous (index)

**Table 1. Continued**

Variable	Type
Contextual	
Independent (indicators of embeddedness in various networks)	
Degree centrality in information network	Continuous (index)
Out-degree centrality in command network	Continuous (index)
Constraint in funding network	Continuous (index)
Out-degree centrality in command network	Continuous (index)
Out-degree centrality in advice network	Continuous (index)
Betweenness centrality in advice network	Continuous (index)
Coordinator function between types of actors in advice network	Continuous (index)
Consultant function between types of actors in advice network	Continuous (index)
Gatekeeper function between types of actors in advice network	Continuous (index)
Representative function between types of actors in advice network	Continuous (index)
Liaison function between types of actors in advice network	Continuous (index)
Coordinator function between levels of actors in advice network	Continuous (index)
Consultant function between levels of actors in advice network	Continuous (index)
Gatekeeper function between levels of actors in advice network	Continuous (index)
Representative function between levels of actors in advice network	Continuous (index)
Liaison function between levels of actors in advice network	Continuous (index)

Source: Author's creation, describing variables for data analysis.

In the analysis, we first developed measures of network embeddedness and then drew network maps that depicted the position of actors in the four networks, the information exchange network, the funding network, the command network, and the advice network. The bivariate relationships between the dependent and independent variables were then analyzed with simple measures of correlation, again using UCINET software. In the following, we provide brief descriptions of the network analysis methods used to derive the independent variables:

1. Degree centrality corresponds to the count of ties each board member has with stakeholders in the wider information-exchange, advice, funding, and command networks, normalized by the maximum number of stakeholders to which each member could be affiliated.
2. Out-degree centrality is a type of degree centrality that takes into consideration only the outgoing ties of an actor. The measure relates closely to the influence an actor is able to impose on other actors, for example, giving commands or giving advice.
3. Betweenness centrality indicates how often an actor sits on the shortest (geodesic) path between other pairs of actors in the network. Hence the measure depicts to what extent an actor can become a powerful broker in the network because other actors have no alternative efficient ways of connection apart from this broker. A high betweenness centrality allows an actor to control the interactions of others.
4. Constraint is a measure that indexes how far an actor is linked to alters that would need to link up with this actor to get access to the network. It describes the extent to which the relationship between a network actor and each of the alters in the actor's neighborhood limits the actor to exercise power over alters; if the alters have alternative ways to connect to the rest of the network, the actor is more constrained.

5. Brokerage (coordinator, consultant, gatekeeper, representative, liaison function) assesses the extent to which a network actor enables the relationship between two alters. Depending on the affiliation of the broker and the two stakeholders to different predefined subgroups,<sup>2</sup> the broker can act as a coordinator, consultant, gatekeeper, representative, or liaison. A coordinator is a network member who brokers the relationships between actors of the same group to which the broker belongs, a consultant brokers the relation of two actors of the same group without being a member of that group, a gatekeeper operates at the boundary of a group and brokers access of outsiders to the group, a representative brokers the relationship of an actor in his or her own group with an actor in another group, and a liaison brokers a relation between members of two different groups without being a part of either. For each actor in the network expected values under random assignment to each of the five broker categories can be calculated and be compared with their actual scores.

The next step entailed combining the relational variables found as key determinants of power in the governance system in regression analysis using standard ordinary least squares procedures. The results from the ordinary least squares estimation as well as the bivariate correlation analysis (Pearson's and Kendall's Tau B coefficients) were then tested with UCINET software, which is instrumental for running diverse statistical testing procedures by simulation (randomization) and running permutation-based significance tests (Baker and Hubert 1981; Krackhardt 1987b, 1988; Snijders and Borgatti 1999; Hanneman and Riddle 2005).

The rationale for the application of permutation testing procedures is as follows (see Monge, Hartwich, and Halgin 2008): as relational data are, by definition, nonindependent, their statistical analyses should not be undertaken using standard statistical procedures. The standard formulas for computing standard errors and inferential tests on attributes in correlations and regressions generally assume independent observations. Applying them when the observations are not independent can be misleading. In general, the standard inferential formulas for computing sampling variability (meaning, standard errors) give unrealistically small values for network data. Using standard inferential formula results is the worst kind of inferential error—the false positive, which means rejecting the null when one should not. To avoid these problems, permutation approaches can be used, which calculate sampling distributions of statistics directly from the observed networks by using random assignment across hundreds or thousands of trials under the assumption that the null hypothesis is true.

Finally, a set of regression analyses using a Tobit model was applied to facilitate understanding of multivariate effects at the individual level of power in the governance system that each actor exercises. Various models were run including or excluding certain explanatory variables, testing their combined effect and the robustness of the results.

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<sup>2</sup> In this study we used categories related to the hierarchical level, that is, international, national, regional, district, or local level, and to the type of organization/actor, that is, government, nongovernmental organization, private organization, community, research, donor, or faith-based organization.

## 4. RESULTS

In the following section, we first conduct a descriptive analysis of actors participating in the information exchange, funding, command, and advice networks and present specific features of those networks to depict the structural patterns of interactions the board members maintain with a range of stakeholders. In the next section we analyze bivariate relationships between measures of influence in governance systems and measures of network embeddedness before, in the last section; we test for multivariate effects on influence.

### Types of Actors

The network of stakeholders was generated from information gathered during interviews with key actors (representatives on the Basin Board) who were asked which actors they deemed important in the governance of the White Volta Basin. The resulting cognitive network of 149 organizations and actors reflects the perceptions of these key actors; as such it is the approximation of the true stakeholder network. The latter is an image of the relationships of all stakeholders in water governance in the White Volta Basin watershed as it is perceived by the totality of the 17 stakeholders represented on the Basin Board.

According to the properties of a scale-free network (Barabási 2003), the number of additional stakeholders that would need to be included to picture the true population (network) is negligible; the chance that a key actor would identify another central stakeholder in watershed governance in the White Volta Basin in addition to the ones that are already named is marginal as important actors tend to be well known. We can therefore assume that our full network provides a rather complete picture of the connections between interest groups in the White Volta Basin, a picture that has not been drawn to date.

Table 1 shows the types of network actors that can be found among the stakeholders in the governance of the White Volta Basin and the hierarchical levels at which they operate. The majority of organizations belong to the government, putting in question to what extent the governance system is actually stakeholder based and not government dominated.

**Table 2. Types of actors**

		Full network of 149 stakeholders		Members of the White Volta Basin Board	
		Frequency	Percentage	Frequency	Percentage
Type of actor	Government	84	56.4	14	68.8
	Nongovernmental organization/project	21	14.3	1	6.3
	Traditional authority	5	3.4	1	12.5
	Civil-society organization	21	14.1	0	0.0
	Private-sector organization	4	2.7	0	0.0
	Research organization	7	4.7	1	6.3
	Donor	4	2.7	0	6.3
	Faith-based organization	3	2.0	0	0.0
Hierarchical level	Local	25	16.8	0	0.0
	District	20	13.4	7	41.2
	Regional	39	26.2	9	52.9
	National	44	29.5	1	5.9
	International	21	14.1	0	0.0
	Total	149	100.0	17	100.0

Source: Authors creation, from data analysis.

The representation of stakeholders on the governing board somehow reflects their involvement in the wider network. However, community-based organizations as well as civil-society, private-sector, and faith-based organizations are not represented at all on the board, and NGOs/projects are less represented whereas government organizations are more prominently represented.

### Network Properties of Social Interaction among Stakeholders in the Watershed

Figures 2 through 5 depict the cognitive networks as perceived by the board members; that mean each of the individual perceptions of the relationships in the stakeholder network (the ego-networks) were stacked together, avoiding double count, to produce a network that includes the perceptions of all 17 individuals.<sup>3</sup> The positions of the nodes in the network were established on the basis of an algorithm that allows for the visualization of the relative distances and positions of actors and events in the network.<sup>4</sup> The size of the nodes in the graphs corresponds to the number of collaborations the organization maintains (degree centrality). Table 3 presents centrality measures for the actors on the Basin Board in all four networks.

**Table 3. Well-connected stakeholders in the governance of the White Volta Basin**

Actor Name	Degree centrality in the information network	Degree centrality in the funding network	Out-degree centrality in the command network	Out-degree centrality in the advice network
Members of the Basin Board				
District Assembly Administration (DA admin)	41	34	62	74
Regional Coordinating Council (RCC)	19	5	39	39
Environmental Protection Agency (EPA)	13	3	13	41
Ministry of Food and Agriculture, regional (MoFA-Reg)	18	7	6	31
Regional Community Water & Sanitation Agency (CWSA_Reg)	12	5	1	21
District Assembly members (DA_Mem)	6	2	2	13
Individual District Assembly Staff members (DA_Staff)	5	1	1	13
District Water and Sanitation teams (DWST)	7	1	1	6
Basin officer (BO)	2	2	0	2
Savannah Agricultural Research Institute (SARI)	1	3	0	4
Department of Women's Affairs (Dept_Wo)	3	1	0	0
Regional House of Chiefs (Chiefs_Reg)	2	3	2	8
White Volta Basin Board (WVBB)	3	22	5	37

<sup>3</sup> Imagine a process similar to stacking 17 transparent slides with networks drawn on them on top of each other.

<sup>4</sup> NetDraw, the software used for plotting the graphs in the figures, locates nodes in a two-dimensional space according to the so called spring-embedding algorithm on the basis of the following criteria: (1) observability (avoiding overlap), (2) the number of ties each agent has (agents with higher degree centrality, that is, more ingoing and outgoing ties, are closer to the center of the network), and (3) maintenance of the same length for all ties. The size of the nodes in the graphs corresponds to the number of ties each actor maintains in the network (degree centrality). NetDraw is part of the UCINET for Windows software (Borgatti, Everett, and Freeman 2002), which was used to analyze the data.

**Table 3. Continued**

Actor Name	Degree centrality in the information network	Degree centrality in the funding network	Out-degree centrality in the command network	Out-degree centrality in the advice network
Members of the Basin Board				
Other stakeholders				
Chiefs	12	12	3	32
Government of Ghana (GoG)	15	9	14	14
Ministry of Local Government and Regional Development (MoLGRD)	11	6	2	11
Regional minister (Reg_Min)	9	4	1	3
Tindanas/traditional earth priests	2	3	1	13
Water Resources Commission (WRC)	9	11	5	10
Ministry of Water Resources Works and Housing (Mo_WRWH)	8	7	5	6
President of Ghana (President)	7	7	1	6
Donors	6	10	6	6
Ministry of Women & Children's Affairs (MoWomen)	3	5	3	6
Water Aid (Water_Aid)	3	4	4	2
Area Council, local government (Area_C)	2	3	3	6
National House of Chiefs (Chiefs_Nat)	2	1	2	3
Forestry Commission (CoForest)	2	7	3	13
Council for Scientific & Industrial Research (CSIR)	2	4	1	0
District chief executive (DCE)	2	3	0	4
Ministry of Food and Agriculture, national (MoFA_Nat)	2	3	1	6
Ministry of Mines (Mo_Mines)	2	0	1	0
Regional Planning Unit (RPU)	2	6	1	6
Courts, regional level (Courts_Reg)	1	2	1	2
Department of Feeder Roads (Courts_Nat)	1	1	1	3
Department of Town and Country Planning (Dept_TCP)	1	3	1	5
Ghana Education Service, regional level (GES_Reg)	1	3	3	4
Environmental Health and Sanitation Unit (EHSU)	1	3	1	10
Ghana Health Service (Health_S)	1	1	1	4

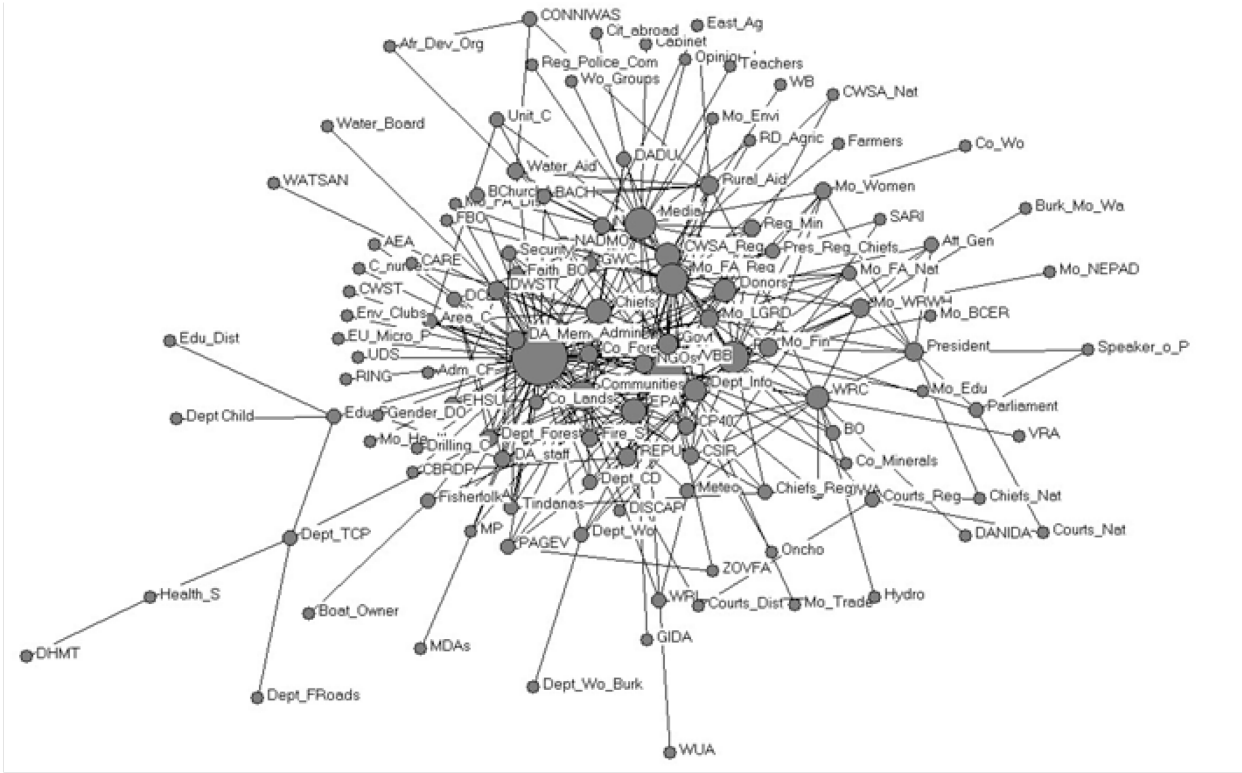
Source: Authors (from data analysis).

### *Information Exchange*

Figure 2 shows that most organizations represented on the White Volta Basin Board, such as the District Assembly Administration, Regional Coordinating Council, and Environmental Protection Agency are located in the center of the graph, maintaining a substantial amount of information exchange relationships. The two best-connected institutions in terms of information exchange, the District

Assembly Administration and the Regional Coordinating Council, both act as coordinating units of the decentralized regional and district government, pointing toward the dominance of the government in the network. This is surprising given that governments, besides sending out extension agents and exchanging information about planned and accomplished activities, are often less prominent in the exchange of informally transferred information. However, among government organizations, it is not those concerned with specific content (such as agriculture, environmental protection, and so on), but the co-coordinating administrative units at both the regional level and the district level that are considered information hubs by the Basin Board members. Apparently the coordinating units maintain connections to actors from different domains such as the NGO sector and civil society. This might be due to the fact that the content agencies link only to specific audiences, whereas the coordinating units link to a wide variety of audiences.

**Figure 2. Information network**



Source: Authors' creation (from data analysis)

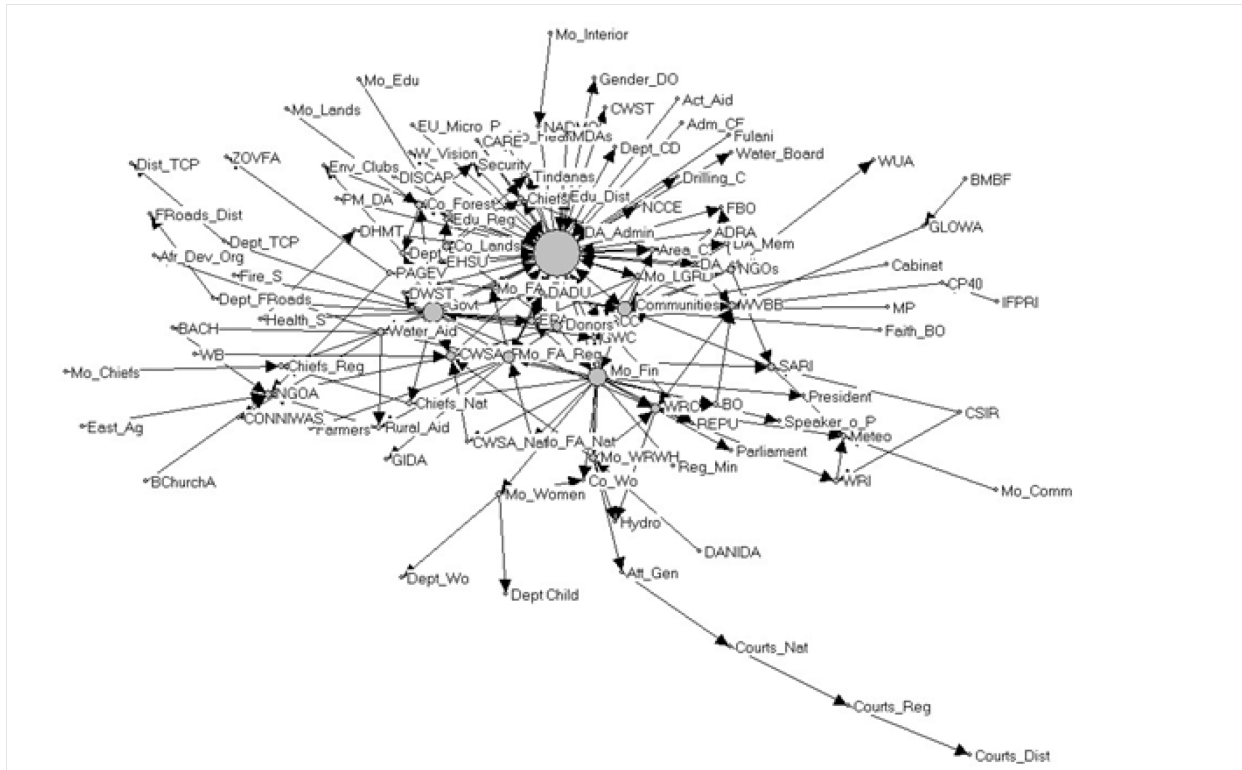
Meanwhile, there are a good number of stakeholders in the full network that exchange information with only one or two actors, pointing to many actors' dependency on just a few others for access to information. Among those are a few members of the Basin Board, such as the Savannah Agricultural Research Institute (SARI), an agency that is physically located outside the boundaries of the area that the Basin Board is responsible for, and the Department of Women's Affairs (Dept\_Wo), an agency that is only marginally concerned with water-related issues. Also, there are a good number of community-based actors such as the Water Board (community-based water boards for the management of small-town water systems), WATSAN (community-based Water and Sanitation Committees for the management of individual boreholes), boat owners, and teachers with only one link into the network, suggesting that they act only as recipients of information. In the interviews, board members emphasized that these local actors are among the core audience for their work. Thus, the lack of connectivity of local actors might pose a problem in achieving the board's goals. Other less-connected actors are organizations

at the national and international levels. There is also an intermediary group of actors that maintains more than two information exchange relationships.

### Funding Relations

Figure 3 illustrates the network graph of funding relationships; the lines depict who provides funding to whom, reflecting the interview partners’ perceptions. It is a picture of who is funding work in the area of the Volta Basin as perceived by the members of the Basin Board. Funding in this context means both the provision of government funds and the contributions of external donors. Interviewees saw funding as a rather linear activity, mostly following formal hierarchies, with a high number of actors being directly connected to the same hub.

**Figure 3. Funding network**



Source: Authors’ creation (from data analysis).

DA admin (District Administration) is represented as the best-connected actor in the funding network. This can be explained by the way that the decentralized government in Ghana is structured: most of the implementation of government activities (for example, building of infrastructure, agricultural extension work, and so on) is organized and implemented at the district level, whereas the regional administration has a rather weak and coordinating role. Thus, other actors, such as the national administration and donors, will channel the money for projects on the ground through the district administration. As observations on the ground confirm, however, the high number of links does not necessarily indicate a big size of funding flows. Similarly, the MoFi (Ministry of Finance and the Govt. (national government) are represented as well-connected actors in the finance network. This is mainly due to their role in the administrative system as funding distribution coordinators and decisionmakers. It is surprising that donors do not have a more central role in funding. This may be due to the increasing tendency of donors to provide general budgetary support to governments and not to be involved in the



day-to-day activities at a regional level. In fact, one of the main donors to the White Volta Basin project, the Danish International Development Assistance (DANIDA), has been actively involved in carving the organizational setup of this multistakeholder mechanism, the Basin Board, in its initial phases. Although a DANIDA representative still is actively involved in advising the Basin Board and its national parent body the Water Resources Commission, board members did not perceive the donor agency to be setting the agenda; rather, the perception was that the agenda was set through the multistakeholder process in place and implemented largely by the government's channeling money from donors to local actors. In the perception of board members, it was the national Water Resources Commission (a national-level multistakeholder board, the parent body of the Basin Board) that was seen as the most influential external actor in agenda setting. From the point of view of a subnational initiative such as the Basin Board, the government organizations act rather as gatekeepers and brokers for funding. Most activities related to the management of the White Volta Basin are budgeted and implemented at the lower government district level, whereas the regional administration (Regional Coordinating Council) mainly has a coordinating function, without access to funding to support activities.

Closely related to the above argument about gate-keeping is that about constraint: as mentioned before, an actor is constrained if it provides funding to others that could also receive funding from other sources. Those that constitute the only funding source to others do not have a constraint in exercising power over those others. Table 4 presents the constraint index for the funding network as computed by UCINET (an actor with a high constraint index funds agencies that have a lot of alternative funding sources, and an actor with a low constraint index funds agencies that basically rely on this actor for funding).

**Table 4. Constraint index (CI) measures for actors in funding network**

Range	Actors in category	<i>n</i>
$CI \leq 0.2$	District Chief Executive, RD_Agric, Reg_Police_Com, AEA, Basket_WA, Boat_Owner, Ministry of Water Resources in Burkina Faso, C_nurses, CBNFSP, CBRDP, CHRAJ, Cit_abroad, Co_Culture, CSO, Dept_Info, Department of Women's Affairs in Burkina Faso, Fisherfolk, IBIS, Judiciary, Media, Mo_BCER, Mo_Envi, Mo_Fish, Mo_NEPAD, Mo_Tourism, Mo_Trade, NSBCP, Oncho, Opinion_L, Pres_Reg_Chiefs, Priv_Sec, RING, Small_users, Teachers, UDS, UNDP, Unit_C, VRA, WATSAN, Wo_Groups, Ministry of Water Resources Works and Housing, Mo_FA_Reg, NGOA, national government, Mo_Fin, District Assembly Administration	46
$0.2 \leq CI < 0.4$	GWC, Regional Coordinating Council, Edu_Reg, Rural_Aid, Co_Forest, Communities, Water Resources Commission, Mo_Women, Meteo, Donors, Regional Community Water & Sanitation Agency, Savannah Agricultural Research Institute, Water Aid	13
$0.4 \leq CI < 0.6$	Security, REPU, Council for Scientific & Industrial Research, Department of Feeder Roads, Courts Regional Level, CWSA_Nat, Dept_FRoads, Department of Town and Country Planning, Ghana Health Service, Att_Gen, BACH, CP40, DHMT, GLOWA, NADMO, Dept_Forest, NGOs, Co_Lands, National House of Chiefs, Regional House of Chiefs, PAGEV, Environmental Protection Agency, WRI, White Volta Basin Board, DADU	25
$0.6 \leq CI < 0.8$	District Water and Sanitation Teams, FBO, CONNIWAS, Chiefs, Area Council, local government, Hydro, District Assembly Members, Environmental Health and Sanitation Unit, Co_Wo, Individual District Assembly Staff members, Edu_Dist, Env_Clubs, Basin Officer, Mo_LGRD, Tindanas, Mo_FA_Nat, Mo_FA_Dist	17
$0.8 \leq CI$	CARE, Regional Minister, President of Ghana, Ministry of Mines, Cabinet, Mo_Comm, Mo_Edu, Mo_Health, Mo_Interior, Mo_Lands, MP, PM_DA, Speaker_o_P, Act_Aid, Adm_CF, Afr_Dev_Org, BChurchA, BMBF, Co_Minerals, Courts_Dist, CWST, DANIDA, Dept_Child, Dept_CD, Department of Women's Affairs, DISCAP, Dist_TCP, Drilling_C, East_Ag, EU_Micro_P, Faith_BO, Farmers, Fire_S, FRoads_Dist, Fulani, Gender_DO, GIDA, IFPRI, MDAs, Mo_Chiefs, NCCE, Parliament, W_Vision, Water_Board, WB, WUA, ZOVFA, ADRA	48

Source: Author's compilation from data analysis.

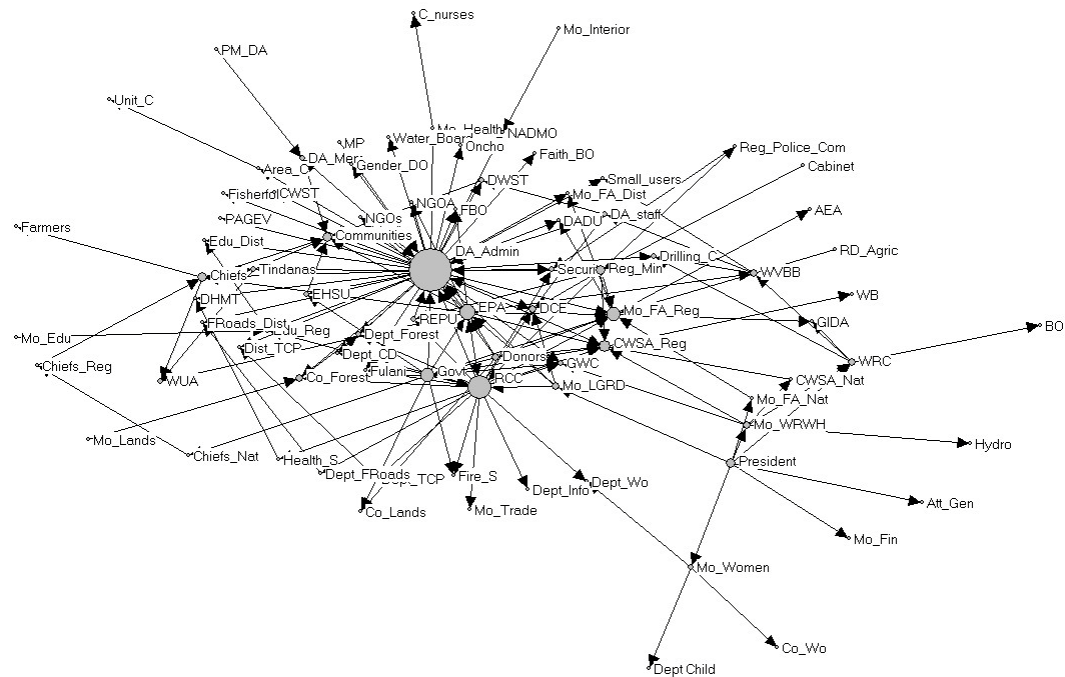
One finds in Table 4 that there is a large number (48) of highly constrained actors. Interestingly it is in this category that most of the traditional funding agencies can be found. This seems to confirm the argument made above that donors do not really set the agenda not only because they channel their funds through government organizations but also because they are too constrained: beneficiaries can choose between too many alternative funding sources to allow donors to impose their agendas and influence decisionmaking. This links into the debate about the need for increased donor coordination. However, the main donor to the White Volta Basin Board, DANIDA, is found in the category of low-constraint actors. So although donors in general cannot be seen as having the power to set the agenda through exclusive funding relationships, the specific role of the major donor is different. This is reflected in the role that representatives of DANIDA take up in the field, having a staff member seconded to the Water Resources Commission (White Volta Basin Board's national equivalent) who takes an active role in the day-to-day and strategic activities of the Water Resources Commission and visits the Basin Board as part of the Water Resources Commission team. However, in discussion with the board members, this active involvement was seen as advice rather than agenda setting. The board members' understanding was that DANIDA's funding was crucial in putting the Basin Board into existence but not in setting and achieving its goals.

### *Lines of Command*

Figure 4 shows the command network, depicting structures of formal hierarchy. In a command link an actor can force his or her will on another actor and apply sanctioning in case of noncompliance. The link was not only limited to the formal government hierarchies but could also extend to traditional chiefs who at times enforced compliance on local community members. Figure 4 shows directional ties; the arrows depict who gives command to whom.

It appears that the same organizations are central as are central in the information exchange network but that the entire network is less dense (density = 0.0114, standard deviation = 0.1701) compared to the information exchange network (density = 0.0372, standard deviation = 0.2887). It is not a surprise that in the pluralistic multistakeholder governance system that the 17 interviewees described through their network maps, giving and receiving command is a less frequent activity than exchanging information. Although all governmental actors, traditional authorities, and community-based actors are included in this network, faith-based organizations and some NGOs are not parts of it. Basically, the command network has two central hubs that give command to two distinct sets of actors: the District Assembly Administration is central in giving command to all governmental agencies at the district level, and the Regional Coordinating Council is central in giving command to all governmental actors at the regional level. A number of national-level actors are depicted as giving command to their lower-level counterparts, but no national-level hub was described. Community-based actors are mainly seen as receiving formal command from traditional authorities (chiefs) and not from government actors. This might indicate the reason for involving a representative of the regional house of chiefs on the Basin Board. It was a generally shared understanding among interview partners that due to traditional authorities' local presence and authority, they were the most important partners at the local level, especially when it came to being able to enforce compliance. However, it is important to note that in the culture of northern Ghana, the chiefs do not form a hierarchical system among themselves, and thus the head of the regional house of chiefs cannot give command but rather only advise his fellow chiefs at the village level.

**Figure 4. Command network**

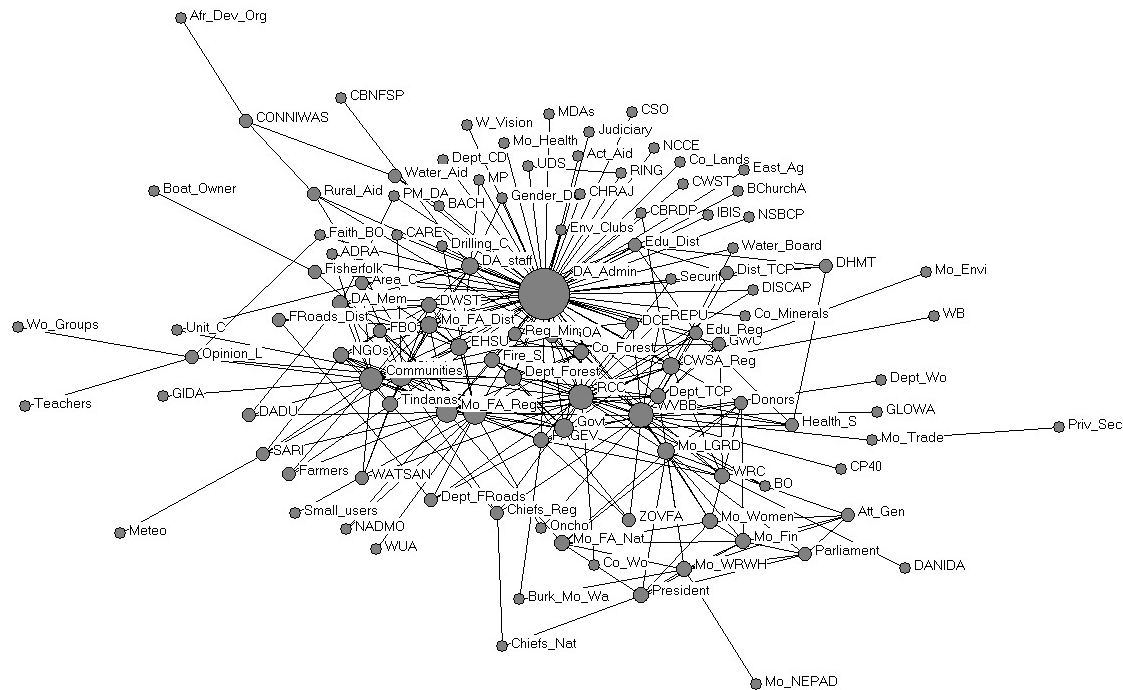


Source: Authors' creation from data analysis.

### *Giving and Receiving Advice*

Figure 5 shows the advice network, depicting the relationships in which actors try to change other actors' behavior by giving advice without being able to enforce a change of behavior. Again, the District Assembly Administration is very central, but there are also a large number of intermediary organizations that are involved in giving and receiving advice; the advice network seems to be less hierarchical than the funding and command networks. Apparently, advice and information are the flows that link different actors irrespective of the kind of organization, domain, level of actor, and formal hierarchies. They involve the biggest number of the actors and integrate those that are isolates in the formal command and funding networks. The information and advice networks include informal links and are as such crucial for making this vision of intersectoral coordination within a multistakeholder governance system a reality in the presence of formal (hierarchical) networks. This is especially crucial for integrating the nongovernmental actors (civil-society organizations, NGOs, faith-based organizations, private-sector organizations) and their partners across the border in Burkina Faso (the Ministry of Water Resources and the Department of Women's Affairs).

**Figure 5. Advice network**



Source: Authors' creation from data analysis.  
 Note: See Table 3 for full titles of abbreviations.

**Advice Brokerage**

Table 5 shows the number of brokerage functions each actor plays in the advice network linking different types of organizations (governments, NGOs, private-sector organizations, community-based organizations, faith-based organizations, and others) and different hierarchical levels (local, district, regional, national, international), calculated from UCINET.

Only seven organizations fulfilled any brokerage functions in the advice network; obviously it was those that had most central positions in the advice network. The White Volta Basin Board is by far the actor with the most brokerage functions, which might be due to its central role in the management of the White Volta Basin but also related to the fact that the research question revolved around the goal achievement of this organization. Furthermore, although the Basin Board has a strong representation of government actors, besides the Water Resources Commission, the Basin Board is the only actor in the survey that integrates representatives from different types of organizations. The White Volta Basin Board mainly brokers relationships between the different types of organizations, fulfilling a representational role that is being part of the same type of organizations and linking up other organizations. However, often it also brokers advice relationships, taking on the role of gatekeeper, liaison, or coordinator. In only a few cases, it acts as a consultant, brokering actors from two different types of organizations while not being part of any of those organizational types.

**Table 5. Brokerage roles in the advice network (linking types of organizations and organizations on different hierarchy levels)**

Actor	Coordinator		Gatekeeper		Representative		Consultant		Liaison		Total		Normalized betweenness centrality
	Linking types of organizations	Linking hierarchies	Linking types of organizations	Linking hierarchies	Linking types of organizations	Linking hierarchies	Linking types of organizations	Linking hierarchies	Linking types of organizations	Linking hierarchies	Linking types of organizations	Linking hierarchies	
White Volta Basin Board	35	12	19	16	9	19	0	5	4	15	<b>67</b>	<b>67</b>	0.733
Water Resources Commission	3	1	5	4	3	3	0	1	2	4	<b>13</b>	<b>13</b>	0.251
PAGEV (local NGO)	0	0	<b>0</b>	1	3	0	0	0	0	2	<b>3</b>	<b>3</b>	0.246
ZOVFA (local NGO)	0	0	2	0	0	0	0	0	0	2	<b>2</b>	<b>2</b>	0.303
Ministry of Water Resources Works and Housing	2	0	0	0	0	2	0	0	0	0	<b>2</b>	<b>2</b>	0.009
District Assembly Administration	0	0	1	0	0	0	0	0	0	1	<b>1</b>	<b>1</b>	0.011
Burk_MoWa (Ministry of Water Affairs in Burkina Faso)	0	0	1	0	0	1	0	0	0	0	<b>1</b>	<b>1</b>	0.087

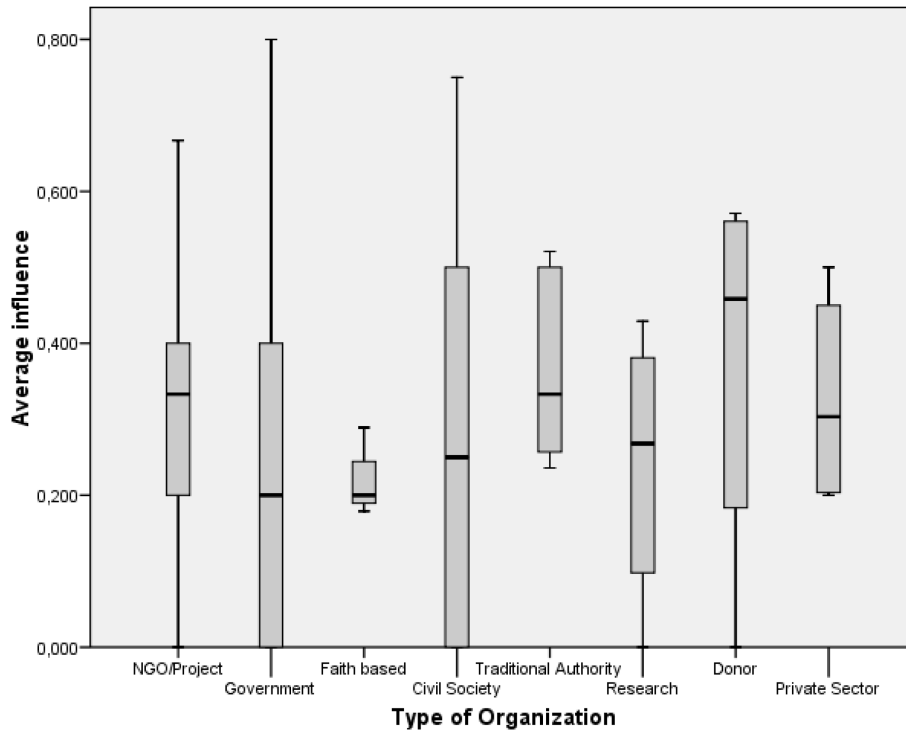
Source: Authors' compilation from data analysis.

## **Relations between Networking Properties and Stakeholder Influence**

We turn now to testing the degree of association between diverse relational characteristics of actors in the network and their particular influence in the decisionmaking process: how is an actor's position in the network related to its influence? First we compare means of influence between the different groups of organizations. The first two measures average influence scores: when organizations have been repeatedly mentioned by different interviewees, the sum of all influence scores was divided by the number of times the organization was named (average influence) or by 17, that is, the number of interviewees that could have mentioned the organization (weighted influence). The two other measures, sum of influence and count of influence, represent organizations that have been named repeatedly by different interviewees more prominently, simply by summing them up or by counting the number of times they have been mentioned. The logic behind this is that more-influential actors would be mentioned more often. The distribution of the influence scores across categories is shown in Figures 6 and 7 in the form of box-whisker charts depicting the mean (black line in the middle), the second and third quartile as the box, and the first and fourth quartiles as the whiskers. In Figure 6 some outliers are marked with os. A standard analysis of variance revealed that indeed the different groups have means that are significantly different.

Donors and traditional authorities have the highest mean influence. Although both groups are represented by only a small number of actors, those actors were mentioned by nearly all interviewees and generally rated as very influential. This is remarkable because, as was shown above, the network consists of a majority of government actors that, when lumped together as a group, are not rated as equally influential. Next in average influence are NGOs/projects and, surprisingly, an actor group that is not even represented on the watershed management board—the private sector. The latter, however, was named by few interviewees; apparently the private sector is influential only in the view of some. This might either reflect the limited influence of the private sector or point to a blind spot in the perception of the board members, most of whom focused in their networks on actors similar to themselves.

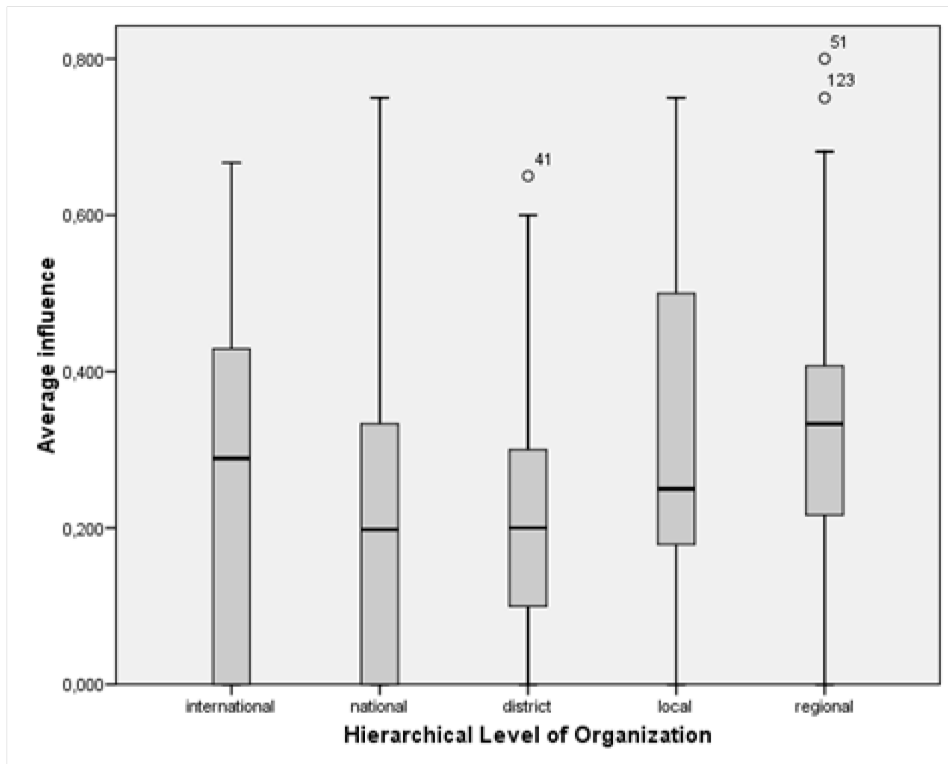
**Figure 6. Distribution of average influence (quartiles) across types of organizations**



Source: Authors' creation from data analysis.  
 Note: NGO = nongovernmental organization.

The government, despite its prominent representation in the network and on the board, has only a mean influence score per unit that lies slightly below the average. Certainly, in this group, very influential government organizations have been lumped together with less influential ones. Influence is distributed across hierarchical levels pretty equally, the only exception being regional organizations, which lie slightly above the average. Differences in mean influence scores, however, have to be considered with caution. We tested whether the type of group the actors are affiliated with can explain variations in the influence score, and the tests revealed no significance for any of the four types of influence scores. According to our data from northern Ghana, knowing the group an actor is affiliated with does not explain whether the actor is influential.

**Figure 7. Distribution of weighted influence (quartiles) across hierarchical level**



Source: Authors' creation from data analysis.

Table 6 presents the averages and standard deviations for all network variables considered in this section and shows the degree of association among them. Correlation tests were conducted following two approaches: Pearson correlation coefficients were used because both variables were of a continuous or interval nature. Permutation-based significance tests were conducted, and their results are indicated.



**Table 6. Correlations between variables of social interactions and influence**

	Mean	Standard deviation	Correlation parameter	X1	X2	X3	X4	Y1	Y2	Y3	Y4
X1. Average influence according to individual interviews	0.26448	0.22383	Pearson correlation	—							
			Significance (two-tailed test)								
X2. Sum of influence according to individual interviews	0.91309	1.77548	Pearson correlation	.533***	—						
			Significance (two-tailed test)	.000							
X3. Count of influence according to individual interviews	2.51	3.015	Pearson correlation	.372***	.938***	—					
			Significance (two-tailed test)	.000	.000						
X4. Weighted influence according to individual interviews	0.05377	0.10439	Pearson correlation	.533***	1.000***	.938***	—				
			Significance (two-tailed test)	.000	.000	.000					
Y1. Out-degree centrality in command network	1.68	6.389	Pearson correlation	.304***	.701***	.623***	.701***	—			
			Significance (two-tailed test)	.000	.000	.000	.000				
Y2. Degree centrality in information network	3.07	5.069	Pearson correlation	.448***	.877***	.842***	.877***	.755***	—		
			Significance (two-tailed test)	.000	.000	.000	.000	.000			
Y3. Out-degree centrality in advice network	4.24	9.143	Pearson correlation	.354***	.900***	.905***	.900***	.818***	.870***	—	
			Significance (two-tailed test)	.000	.000	.000	.000	.000	.000		
Y4. Constraint in advice network	0.47342	0.36678	Pearson correlation	-.085	-.217***	-.228***	-.217***	-.187**	-.255***	-.219***	—
			Significance (two-tailed test)	.303	.008	.005	.008	.022	.002	.007	
Y5. Betweenness centrality in advice network	0.60943	2.97394	Pearson correlation	.261***	.722***	.649***	.723***	.840***	.781***	.822***	-.162**
			Significance (two-tailed test)	.001	.000	.000	.000	.000	.000	.000	.048

Source: Authors' compilation from data analysis.

Note: \*\*Correlation is significant at the .05 level, two-tailed. \*\*\*Correlation is significant at the .01 level, two-tailed.

With one exception (relation between X1, average influence according to individual interviews, and Y4, constraint in advice network) all variables included in the calculations to reflect network interaction (independent variables Y1 to Y4) yielded significant correlations with influence indicators (dependent variables X1 to X4). However, the correlation was also high among variables within the two groups, indicating high levels of intercorrelation.

The bivariate analysis suggests that stakeholders in the governance of the White Volta Basin have more influence in making decisions that lead to achieving environmental and development goals set by the Basin Board if

- there are more actors that the stakeholders command (higher centrality in out-degree command relations),
- stakeholders participate more prominently in information exchange (higher centrality in the information exchange network),
- they provide more advice to others (higher centrality in out-degree advice relations),
- they provide funding to actors that do not have alternative sources (less constraint in the funding network), and
- they connect other actors that do not have alternative efficient ways to connect themselves to others (betweenness centrality in the advice network).

We have seen that each of the variables we identified in Section 3 on its own seems to affect the level of influence actors have in making water resource management decisions. However, the question remains: what happens if these variables influence the dependent variable influence simultaneously? Behind this lies the idea that power and influence depend on the embeddedness of actors in a range of social networks of which the information exchange, command, funding, and advice relationships are only one part. For example, more centrality in one network may compensate for the actor's more marginal positions in other networks. Without going further into detail about a particular social model, we tested for the simultaneous effects of our dependent variables on influence, applying a multivariate Tobit regression model. A robust model was applied to control for heteroscedasticity effects, meaning the bias from the variance of the residuals. Various models were run including or excluding certain explanatory variables and testing their combined effect and the robustness of the results. Tobits are censored normal regression models that fit the type of dependent variable used in this study (an index ranging from 0 to 1). We included all relational (network) variables. From the list of dependent variables, we selected only the two most relevant ones. The first model included sum of influence as its dependent variable, and the second model included weighted influence. Regression results are shown in Table 7.

**Table 7. Tobit regression coefficients for the diverse models of influence**

Variable	Model 1	Model 2
Sigma (intercept)	.180 (.031)***	-.003 (.006)
Out-degree centrality in command network	.003 (.005)	-.002 (.001)
Degree centrality in information network	.028 (.007)***	.009 (.001)***
Out-degree centrality in advice network	-.001 (.004)	.008 (.001)***
Constraint in funding network	.020 (.042)	.002 (.008)
Betweenness centrality in advice network	-.020 (.012)*	-.003 (.002)
Fit measures		
Log likelihood function		
ANOVA-based fit	.225	.856
DECOMP-based fit	.198	.851

Source: Authors' creation from data analysis.

Notes: N = 149

Standard errors are in parenthesis.

ANOVA = analysis of variance; DECOMP = Decomposition (common procedure to estimate fit of Tobit models)

\*p < .10. \*\*\*p < .01.

The results in Table 7 show that our network variables can better explain the variance in weighted influence than in average influence. In fact, model 2 seems to be a more comfortable model to explain how influence is determined. Both variables, degree centrality in the information network and out-degree centrality in the advice network, positively contribute to weighted influence. Effects of out-degree centrality in the command network, constraint in funding, and betweenness centrality in the advice network are not significant.

The multivariate analysis suggests that stakeholders in water resource management have more influence in making decisions that lead to achieving environmental and development goals if

- they participate more prominently in information exchange (higher centrality in the information exchange network) and
- they provide more advice to others (higher centrality in out-degree advice relations).

## **Resume of Results and Discussion**

Based on the data analysis we feel comfortable adopting

- *Hypothesis 1: The influence of actors in a governance network depends on the way they are embedded in the exchange of information among network actors, and*
- *Hypothesis 4: The influence of actors in a governance network depends on the way they are embedded in giving advice.*

However, despite the fact that the bivariate analysis supports all these statements, due to the results of the multivariate analysis, we still are doubtful about

- *Hypothesis 2: The influence of actors in a governance network depends on the constraints they face to providing funding; if others do not need an actor to acquire funding, the actor is less influential;*
- *Hypothesis 3: The influence of actors in a governance network depends on the extent to which they can command the actors in the network; and*
- *Hypothesis 5: The influence of actors in a governance network depends on their ability to link different network groups and broker the communication of advice*

## 5. CONCLUSIONS AND POLICY IMPLICATIONS

We analyzed the case of a multistakeholder governance board for water resource management in northern Ghana. For this purpose we constructed networks of all stakeholders in water resource management based on the collective understanding of social relationships among stakeholders of the representatives of 17 organizations on the governance board of the watershed. The networks represent partial aspects such as information exchange, advice giving, receipt of funding, and command relationships of the multistakeholder governance system. In particular, we investigated to what extent position in these governance networks affects the influence of actors in achieving governance goals.

When compared to the definition of multistakeholder governance provided by a document such as Agenda 21, the Basin Board falls short in terms of inclusiveness. Both the board itself and the governance network in which it acts are strongly biased toward governmental agencies and decisionmakers and do not give a strong voice to nongovernmental actors, civil society, and the private sector. However, going from who is represented on the board to who is actually influencing the decisionmaking process, the picture changes. In fact, the study finds strong correlations between the perceived influence of actors and their positions in the information and advice networks, whereas there was no significant correlation between their influence and their positions in the command or funding networks. This points to the central role that knowledge brokers play in decisionmaking in the watershed; their influence is based on the informal networks they maintain with a large number of actors. Effective communication regarding the exchange of information and advice is a prerequisite for this influence to happen. Additionally we found that donor influence did not significantly distort the decisionmaking process in the multistakeholder governance system.

There are four issues that result from these findings:

**The power of those that are central in the information network.** The study shows that actors such as the District Assembly Administration, Regional Coordinating Council, and Environmental Protection Agency are central in the information network and are seen as very influential in multistakeholder governance. This is especially crucial in a setting such as rural northern Ghana, where the acquisition and distribution of information is hampered by high logistical cost and deficient infrastructure. However, in recognizing the importance of an actor's position in the information network, there are also some risks and challenges that need to be considered. If access to information increases the influence of actors, there is an incentive for influential actors to abuse their positions by sharing only with selected partners in the network. Thus, accountability, best practice procedures, and monitoring of information flow are crucial to making sure that the system is fair and inclusive. Observations on the ground showed that the information exchange at board meetings led to a lot of cross-sectoral learning of individual board members. The challenge remains, however, to ensure that board members carry this new knowledge into their organizations and that actors that are not represented on the board also benefit from this information exchange. This points especially to the low representation of nongovernmental actors (NGOs, private-sector organizations, and community-based organizations) on the board.

**The influence of those giving advice.** In this multistakeholder network with organizations of different kinds and organizational structures, giving advice was seen as one of the most powerful ways of influencing natural resources governance. Actors that give advice support a certain course of action but have no means of enforcing compliance. To be able to give good advice, actors need to have access to valid information, make a reasonable decision about the actions needed, and have viable advice relationships with other actors that trust their judgment. Thus, for affecting multistakeholder governance it is recommendable to invest (time, money, human capital, social capital) in this process of developing advisory capacities. This is relevant both for actors in the field and for external actors such as donors when they decide on their priorities. Both information networks and advice networks can be formal and informal; thus, the concerns about elite capture, exclusiveness, and transparency of networks mentioned above are also valid for the advice network. As overlapping hierarchies and lack of enforcement capacity reduce the effectiveness of formal command, giving advice becomes a more important tool for

collaborative governance. For many actors in the field this requires a radical change in approach, from worrying about, “How can we enforce this?” to considering, “Why would a farmer want to do this? What is their added benefit?”

**No significant influence effects of being central in the command network.** At first glance it might seem as if those actors that can dictate and enforce action should be most influential in any governance field. Thus, it might be surprising that there were no significant correlations between high out-degree centrality (giving command) in the command network and the influence of actors. The governance system integrates many organizations from different sectors and levels, some of which are linked by command relationships (such as national and regional offices of a ministry) and others that may collaborate as partners with no explicit hierarchy (for example, two regional offices of different ministries or a governmental organization and an NGO). Furthermore, in the Ghanaian system there is an overlap of different hierarchy systems, involving modern and traditional authorities. For those involved in multistakeholder governance, it is important to realize the limited reach of top-down authoritarian approaches and to adapt strategies accordingly. Experience in the field shows that a lot of the governmental actors are still in a learning process toward this change of approach and that further capacity building and strategic support would be needed to develop their full potential.

**No significant influence effects of being central in the funding network.** In the general analysis we could not prove the hypothesis that being well connected in the funding network increases the influence of actors in multistakeholder decisionmaking processes. This is surprising, especially in a resource-poor environment such as northern Ghana. This result might have something to do with the diversity of funding sources (both governmental and donor agencies) for the activities on the ground, so that few actors reached the status of having limited constraint and being able to dictate the terms. However, the specific role of the major donor (DANIDA) of the Basin Board might not be sufficiently reflected in the general analysis. In future analyses of funding networks it might make sense to include weighted links to better understand the amount of funding flowing between two actors instead of just indicating that a funding relationship exists.

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