The "Invincible" Hand: Exploring the Role of Government as a Conduit for Interorganizational Collaboration in Competitive Systems.

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Abstract

Recent research has shown that different types of social capital can form within interorganizational collaborative networks as a response to perceptions of risk: bonding social capital forms when actors perceive high risk; bridging social capital emerges when risk is perceived as low (Berardo and Scholz 2010). However, there is yet no empirical evidence assessing how governmental agencies affect the generation of network capital in collaboration networks that form when multiple actors participate in joint efforts to provide public goods at the local and regional level. Do central agencies help create bridging social capital that is conducive to innovative ways of solving problems, or do they promote the formation of bonding structures that provide assurances against defection to members of the network at the price of reduced levels of potential innovation?

This paper answers these two questions by analyzing the participation of multiple governmental and non-governmental organizations in the Cooperative Funding Initiative, a collaborative program in Florida sponsored by the South West Florida Water Management

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District (SWFWMD). This program attracts organizations that design projects and apply for funding to the District, and in so-doing seek assistance from other organizations to strengthen their applications. The information of how organizations participate in projects was captured in two-mode matrices and analyzed with BPNet, a software that implements ERGMs (*p**) in these types of matrices. Results show that structures that facilitate bridging capital predominate over the structure that facilitates bonding, and that this is caused by the dominant presence of the District in the networks. Implications are important: even when actors don't explicitly cooperate with each other, a central governmental actor in a self-organized system (where actors freely choose their contacts), can help set the conditions that lead the system to perform *as if* the actors cooperate explicitly with each other.

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Introduction

How do governmental agencies affect the generation of network capital in collaboration networks that form when multiple actors participate in joint efforts to provide public goods? Do they create bridging social capital that is conducive to innovative ways of solving problems, or do they promote the formation of bonding structures that provide assurances against defection for the participants in the network at the price of reduced levels of potential innovation?

With the growing awareness that policy processes are increasingly complex and jointly steered by a large number of actors with divergent –and often opposing- interests, many have warned that the capacity of governments to act as the driving force of policy making processes is somewhat weakened. Due to the increasing difficulty to mobilize all necessary resources to reach their goals, governments depend on the cooperation and resource mobilization of policy actors outside their direct control to produce needed goods and services (Kenis and Schneider 1991; Kettl 1996, 2000; Salamon 2002), which clearly results in a loss of the capacity to act autonomously. This is even more noticeable in the typically fragmented subnational policy arenas of federal systems, where multiple agencies hold regulatory overlapping power, and institutional collective action dilemmas are common in the provision of public goods and services (Feiock et al. 2009; Feiock and Scholz 2009).

Yet, despite this problem, governmental actors may often be able to facilitate the emergence of the conditions needed to deliver goods and services effectively. This is particularly true when government can both "frame" and "synthesize" the activities that take place in collaborative networks where multiple actors make contacts with each other (Agranoff and McGuire 2001). Consider for example the common case of collaborative programs of a local or regional scale, where multiple actors in dire need of financial resources try to access public funds distributed by governmental agencies. Government-led programs like these are extremely common nowadays, and have even been branded as the preeminent mechanisms to foster cooperation in the fragmented sub-national policy arenas of the U.S. (O'Toole and Meier 2004, Agranoff 2006). In shared-costs programs neither a single public agency nor the private sector can provide the entire needed amount of a given public good or service on its own (Mandell 2001, Rethemeyer and Hatmaker 2008), and so collaboration is a necessary ingredient in the elaboration of solutions to common problems.

By simply presenting a shared-costs type of program, governmental agencies can usually reduce conflict and initiate a cycle of sustained collaboration (Berardo 2010); yet *one important problem in public management and policy studies is that details are scarce about how the structure of interactions among participants of those programs is shaped by the leading governmental organization*. This is an important issue to know more about because the structure of interactions may indicate the potential of a given program to achieve innovative responses to the problems participants are facing. Networks of collaboration where organizational actors interact with a reduced number of peers, or where there are abundant connections that facilitate the transmission of overlapping information in smallish groups may foster cooperation, but only in a localized sense and at the expense of innovation. On the other hand, networks that are weakly connected (Grannoveter 1973) with one or a few central actors providing a coordinating role may be more conducive to innovation if the central actors facilitate the flow of resources such as technical and regulatory expertise through the network.

In this paper I study how the participation of a leading governmental organization in a program designed to foster collaboration can modify the underlying structure of the network of collaboration that develops among participants of the program. Specifically, I assess whether participation by a leading governmental organization brings the system closer to a state where innovation is more likely or not.

To accomplish this goal I examine the pattern of collaboration that forms among organizations that apply for funds to a program sponsored by the Southwest Florida Water Management District (from this point forward, "the District"[2]). This program, called the Cooperative Funding Initiative (CFI), was created by the District to financially support projects that are designed by applicant organizations –primarily local governments- to provide goods and/or services in the territory under the District's jurisdiction and that are related to one or more of the District's main areas of responsibility: 1) protection of natural resources, 2) prevention of flooding, 3) provision of water for human uses, and 4) improvement of water quality.[3]

Applicants design their projects but they don't do it alone. In most cases, they secure the aid of other organizational actors (including the District), from whom they obtain needed resources to improve the quality of their applications (assistance on technical issues, political support, knowledge about regulatory issues, etc.). Thus two-mode affiliation networks of collaboration develop, where organizations are linked to projects based on the resources they contribute to them.

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[2] There are five water management districts in Florida. The website of the Southwest Florida Water Management District can be viewed at http://www.swfwmd.state.fl.us/

[3] Projects are obviously of a varied nature, and may include public works to treat storm runoff in urban centers, educational programs to promote conservation practices among the general population, restoration efforts in estuarine natural systems, protection of biodiversity in wetlands, etc. Approved projects are eligible to get up to 50% of its budget financed by the District.

It is in this collaborative setting that the District may facilitate the creation of bonding or bridging capital simply through its participation in projects as a provider of needed resources that are required by the applicants. Studies of network capital that utilize Social Network Analysis (SNA) techniques tend to focus on the structures that develop in one-mode networks, where only one type of node is allowed (for instance organizations), but structures that facilitate the creation of network capital also exist in two-mode affiliation networks.

The study of two-mode networks has been common in the social sciences since the publication of Davis et al's (1941) *Deep South*, which included the classic study of the pattern of attendance to social meetings among a small group of women during a nine-month period. From that point forward, a wide variety of social phenomena have been studied through the analysis of two-mode networks, including membership in voluntary organizations (McPherson 1982), and clubs (Bonacich 1978), the configurations of interlocking boards of directors (Levine 1972, Mizruchi 1982, Windolf 2002, Robins and Alexander 2004, Koskinen and Edling 2010, among others), the structure of relationships in the film industry (Watts 1999), the pattern of attendance of Soviet politicians to social and official events in the 1970s (Faust et al. 2002), etc.[4] However, in public management and policy sciences scholarship, the study of two-mode networks has not received the attention it deserves. This paper makes a contribution to reversing this tendency.

I test for the existence of network of bonding and bridging social capital in two-mode collaboration networks by applying Exponential Random Graph Models (ERGMs) to the

[4] Basic methodological treatments of two-mode networks may be found in the classic textbook in Social Network Analysis (Wasserman and Faust 1994) and in a variety of articles including Breiger (1974), Faust (1997) Snijders and Stokman (1987), Iacobucci and Wasserman (1990), Borgatti and Everett (1997), Skvoretz and Faust (1999), Wang et al. (2009), among others.

observed patterns of collaboration among actors participating in the Cooperative Funding Program and assess the role of the District as a driving force in the formation of network capital. Simply stated, ERGMs enable the comparison between observed structural configurations in a given network with the configurations that result from simulating a random link-creation process in networks of the same size (and with the same number of connections) than the observed network. When certain configurations are found in the observed network that are not significantly present in the simulations, the researcher can conclude that there are specific configurations in the network that cannot be attributed merely to the existence of a random process of network formation.

The main goal here is to provide a detailed assessment of the type of network capital that is likely to be created in the CFI program (bridging or bonding) and the role of the District in the emergence of those structures. I hope this work will contribute to enhance our understanding of the role that central governmental entities may play in the horizontal, self-organized collaborative processes that have come to characterize decision-making processes at the lower levels of the American federal system (Feiock and Scholz 2010).

Bonding and Bridging Social Capital in Networks of Collaboration.

In studies of management of common pool resources where this research is empirically anchored, the predominant view over the last two decades regarding collaborative processes has been that they reduce the transaction costs of cooperation by –among other things- creating social capital among stakeholders (Ostrom 1990, 2005; Lubell et al. 2002). Higher levels of social capital lubricate social and political relations in the form of increased trust and trustworthiness (Sabatier et al. 2005, Bromiley and Cummings 1995, Scholz and Lubell 1998), favor the transmission of scarce resources among the components of a group (Agranoff and McGuire

2003), and in general help to produce the conditions that facilitate sustained cooperation in policy networks (Scholz, Berardo, and Kile 2008; Berardo and Scholz 2010).

In this paper, I explore the presence of bonding and bridging social capital in the networks of collaboration that develop through the participation of organizations in projects that take part in the Cooperative Funding Initiative. These two basic forms of network capital have been studied in one-mode networks extensively, but there is a vacuum of empirical evidence asserting how they manifest themselves in two-mode networks.

Bonding Capital

Defenders of the benefits of bonding social capital in groups claim that it is easier to reach cooperation when the members of a group are linked to each other through dense, overlapping relationships (Coleman1988; Putnam 2000, 1993). The denser –or more closed- a group is, the higher its bonding value, which makes it easier it to detect and punish defective behavior by non-cooperating members. Of course, when the penalty for defection is rapid detection and punishment, then –*ceteris paribus*- the likelihood of defection decreases sharply. In other words, bonding social capital creates an advantage for the members of a group in the sense that it decreases the risk associated with unmonitored behavior (Berardo and Scholz 2010, Burt 2005). This, in turn, helps build trusting relationships (Provan and Sebastian 1998; Schneider et al. 2003; Scholz, Berardo, and Kile 2008), hence facilitating the probability of observing sustained cooperation in time. In one-mode networks, where there is only one type of nodal entity (organizations, individuals, etc.), bonding social capital is usually indicated by a number of basic configurations.

The simplest form of bonding is dyadic in nature, and exists when there is a high level of reciprocity between the components of the dyad. Reciprocity in collaborative behavior engenders trust and sends positive signals about the members of the dyad to other actors that may be considering creating links to them.

A higher-order representation of bonding –and the most commonly studied- is the triangle: three actors (or vertices) joined by lines indicating a relationship. The larger the percentage of possible triangles in a network that is actually observed (the higher the clustering in the network), the larger the amount of bonding capital.[5] As more connections are created among its members, a network becomes both denser and more clustered, making the presence of bonding social capital become more evident.

In two-mode collaborative networks, where actors are connected to each other only through their common participation in a given event (projects in our case), the presence of bonding capital is represented by different types of structures. In this paper I present three such structures that capture the basic nuances of the configurations previously described for one-mode networks.

[Figure 1 about here]

In each of the illustrations in Figure 1, a square represents a project, whereas a circle represents an organization. As is the case with two-mode networks, nodes cannot be linked directly to other nodes in the same mode. Hence, squares are not directly linked to other squares and circles are not linked to other circles. Instead, members of the same mode are indirectly linked to each other only through their connection to a common node of the other mode.

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[5] This way of conceiving bonding capital is rooted in Heider's (1958) early work on balance theory. Heider claimed that the likelihood of two nodes being connected to each other grows when they are linked to a third party.

Figure 1A contains the two-mode representation of a strong reciprocal relationship, where two organizations are linked to each other through their participation in a number of projects. These organizations can only "reach each other" through multiple paths in the network. The overlapping participation in different projects sets a precedent to sustain cooperation in the long run because actors involved in many projects with the same counterparts perceive defection as a costly strategy when the system is relatively stable and the partners are not likely to get deactivated after the initial interactions (Berardo 2010).

Figure 1B demonstrates the equivalent of a strong triangle in a one-mode network. Here, three organizations are linked to each other through their participation in two projects. In situations like this, the results of the interactions in one activity most likely affect the behavior of the organizations in other events. It would be to the detriment of an organization not to live up to its commitments in one of the projects if it is involved in other projects with the same organizations, since the latter can "punish" suboptimal performance. For example, "punishment" can take the form of discontinued collaboration in future rounds of the CFI, where the underperforming organizations may need assistance in other projects.

However, bonding does not necessarily need to be strong. For example, Figure 1C represents a looser type of structure that also captures bonding social capital –what I call "extended bonding capital". In this case, a larger number of organizations participate in the same activity, therefore bonding despite the fact that repeated interaction is not present. Bonding in this case occurs because the activity brings together a larger group of participants, each of whom now have more information about what other actors do and how they behave.

All three of these structures are indicative of bonding because the complex exchanges that take place in a network of collaboration impose uncertainty that can only be reduced in the presence of more information about the way partners act. This information can be provided by a formal unified governance structure (Williamson 1981), but in many cases (including the projects I study) relationships in collaboration networks are informal and self-organized, and so the decisions of organizations to participate in certain projects and not others is the best indication of what kind of capital is created in the process.

Since the goal is to assess whether the District shapes the networks of collaboration in ways that favor the appearance of bonding or bridging social capital, I compare the presence of the bonding structures in Figure 1 with and without the District in the two-mode networks of participation of organizations in projects.

Bridging Social Capital.

While bonding social capital provides assurances against defection, it also decreases the capacity for innovation facilitated by multiple non-overlapping, weakly-connected relationships coexisting in a network. Networks of collaboration may be fragmented, with multiple clusters of actors disconnected from each other. When this happens, it is possible that over time members of a group develop shared knowledge that is not accessible to other members of the network with whom they are not connected (directly or indirectly). In other words, when multiple disconnected subcomponents exist in a network, the potential to reach innovative responses to problems decays because members of the subcomponents may access information that they are familiar with already.

It is in situations like this that some actors may contribute to the potential generation of innovative responses to localized problems by building connections that connect otherwise disjointed parts of the networks. Two beneficial outcomes can result from these types of connections. First, the actor who builds the bridging connections may obtain the individual benefits that result from reaching new, non-overlapping sources of information or whatever resource flows in the network of collaboration. These benefits usually amount to a comparative advantage over peers in the same network (Granovetter 1973). For example, in studies of careers in research and development industries, Burt (2000, 2005) has shown that network brokers who bridge *structural holes* perform better than those who don't –in terms of salary compensation and promotion. Public policy research has confirmed this overall finding. For example a study of cooperation among organizations that form the policy networks of more than 20 estuaries in the U.S. found that a different measure indicative of bridging capital ("betweenness" centrality) significantly increased an organization's participation in beneficial collaborative activities. These activities included the signing of Memorandums Of Understanding, the sharing of personnel, and collaboration on joint grant/funding proposals (Scholz, Berardo, and Kile 2008). Another study on the same dataset found that the same measure actually increased the level of generalized trust exhibited by the organizations' representatives (Berardo 2009b).

A second type of benefit that results from the establishment of bridging social capital involves previously disconnected groups (or nodes) being able to take advantage of the existence of the newly established connections. For instance, a recent study on self-organizing policy networks points to the relevance of bridging social capital for the integration into a network of otherwise disconnected nodes that may be searching for cooperative settlements to common problems in low-risk situations (Scholz et al. 2008, Berardo and Scholz 2010). When exchanges in networks are not very risky and transaction costs are not high, the strong tie relationships in closed structures that bond actors to each other impose unnecessary costs and constraints. In these cases, bridging capital and "weak ties" that link disconnected groups can enhance the outreach necessary to locate desired exchange partners (Granovetter 1973) and can provide brokerage opportunities to explore new ideas and innovate through exposure to information and resources not available within the group.[6]

While bridging social capital has been extensively examined, empirical treatments of the idea are limited to one-mode networks, where only one set of nodes exists. What happens in two-mode networks where organizations are linked through their common participation in specific events? In Figure 2, I present a simple configuration that can be utilized to indicate the presence of bridging capital in affiliation networks.[7] Like the previous figures, here a square represents the event (a project) and a circle represents an organizational actor.

[Figure 2 about here]

The structure in Figure 2 is similar in its layout to Figure 1C in that both are star-like configurations. However, they are radically different since they represent the generation of very different types of social capital. Whereas Figure 1C captures the generation of bonding social capital, Figure 2 represents the bridging social capital an organization can generate by participating in many activities at the same time. Applied to the Cooperative Initiative Funding

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[6] The bridging argument I lay out here finds a strong correlate in organizational studies in March's ideas (1991) on the existing tension in organizational settings between the needs to "explore" new opportunities in the surrounding environment (engaging in searches that reach beyond the most immediate neighbors) to "exploit" existing resources that are available in more local settings.

[7] The reader should keep in mind that the illustration in figure 2 does not represent bridging in the clear-cut sense used in Social Network Analysis (see Wasserman and Faust 1997: 114-116 for a precise definition of "bridge"). The use of the term in this paper is more contextual and flexible, as will become clear in a later discussion.

setting, this “Organization star” is the representation of an actor that participates in multiple projects and may be able to provide know-how in some of them based on the information and expertise it “learns” from its participation in other projects.

The main goal of this work is to assess the effect that the District has on the architecture of the networks of collaboration that are created when different organizations participate in different projects. Therefore, the Exponential Random Graph Models I estimate will test whether the District generates bonding capital through its participation (affecting positively the formation of the structures contained in Figure 1), or whether it is at the center of many of these “organization star” structures, which would indicate the creation of conditions favorable to the generation of bridging social capital.

More structures indicating “bonding social capital” in the two-mode networks of collaboration that I study would represent a system where a) the District is involved as a participant in just a few projects, and b) the same organizations tend to participate in the same projects, without linkages to other projects through certain participants. Networks of collaboration structured in this way would be more likely to produce projects where all partners tend to know each other well, but where the style of “doing business” is rarely challenged. Projects are more likely to be designed based on incremental views of the world.

On the other hand, more “organization stars” centered around the District would indicate that the overall system of projects involved in the Cooperative Funding Initiative are connected through the participation of a central node. In the design stage of the project where this research concentrates, this would provide at least the potential for projects to take advantage of the know-how that develops in other projects provided that the District “moves resources around”. In situations like this, incremental responses to problems may still be the rule. However, more innovative projects are far more likely here than in a setting where only bonding social capital exists.

The following sections describe the Cooperative Funding Initiative and the data collection process in more detail. In addition, a descriptive analysis of the data is provided before the details of the Exponential Random Graph Models for the two-mode data are presented.

The Cooperative Funding Initiative

Southwest Florida contains approximately one quarter of the state's rapidly growing population, and unfortunately the magnitude of urban growth poses great environmental threats to the stability of ecosystems in the area (Marella 2004). The Southwest Florida Water Management District –one of five that exist in Florida- is the main regional authority that can regulate water use, and has developed a menu of programs designed to prevent the negative impacts of human activities in the area.

One of these programs is the Cooperative Funding Initiative (CFI), which funds projects that tackle problems linked to the main areas of District responsibility, as explained in the introductory section of this paper. The main goal of the organizations that design projects is to obtain financial resources from the District to pursue these projects. The District, on the other hand, also obtains clear benefits by taking advantage of local water management expertise to solve water-related problems in the area under its jurisdiction.

The process of applying for funds every year is straightforward. The deadline for the presentation of applications is the first Friday of December. Each filled application contains detailed information including the goal/s of the project, the name of the leading organization presenting the application and its "contact person" (the project leader who serves as liaison with the District), as well as milestones, budgetary requirements, etc. In the months following the submittal of the applications, the District's staff reviews applications and elaborates a ranking of the projects (from high to low priority). Finally, the District's eight basin boards make funding decisions in July of the following year and award the contracts for those projects that obtain funding.

Designing CFI projects requires informal collaboration among multiple actors because rarely do applicant organizations possess all the knowledge, expertise and/or political clout to design and implement projects in an isolated manner. Projects are usually of a complex nature; they include infrastructure building initiatives, proposals to protect water quality or natural habitats, educational campaigns, etc. This complexity requires reaching out to actors who may contribute specific resources to improve the quality of applications. In this sense, the CFI projects are good examples of collaborative public management since organizational actors join forces in projects to remedy problems that can hardly be solved individually (McGuire 2006, 33). Projects are also examples of informal collaboration, since the linkages that may develop between organizations through their participation in projects are by no means mandated or forced upon the actors. In other words, the structure of relationships emerges from the choices of collaborative partners rather than from any statutory design.

Data Collection

In 2006 an expert advisory panel of active policymakers in southwest Florida was formed to identify the types of resources that are *needed to ensure the successful design and implementation of projects*.[8] The experts identified the following resources: funding availability,

[8] The panel was formed by this author and John Scholz at Florida State University. It was composed by the Executive Director of the Tampa Bay Estuary Program, a Senior Scientist at the Florida Fish & Wildlife Commission, the Director of the Pinellas County Department of

technical information, public buy-in and/or political support for the project, and finally, the ability to meet regulatory requirements that make the project legally viable. [9]

With this information I led a team of graduate students at Florida State University in the summer of 2007 who were tasked with identifying the contact persons for projects that applied for funding to the District in December of 2006.[10] Those individuals were then approached over the phone and asked to answer a semi-structured questionnaire that contained questions about the project and the process of developing the application. Out of a total number of 138 contact persons, 95 answered the survey for a rate of response of ~69%.

Each respondent was asked to first identify other organizations that participated in the project and then asked to clarify the nature of that participation by acknowledging whether each of those organizations had assisted the leading organization in four main areas in the project: 1) obtaining technical information, 2) securing adequate funding, 3) obtaining public and/or political support, and 4) solving the project's permitting/regulatory issues. A total of 198 organizations were identified as providing assistance in at least one of these areas in the 95 projects in question. This organizational set included federal (4% of total), state (7%), regional (7%), and local

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Environmental Management, a former member of the District's Governing Board, and the District's Director of the Resource Management Department (see Berardo 2010 for more details).

[9] Notice the close resemblance of these resources to what Rethemeyer and Hatmaker's (2008) label as ''material-institutional resources'' (MIRs), which organizations can deploy in networks to achieve their goals and include technical knowledge, political constituencies, and sources of funding, among others.

[10] Applications are available on the District's website at http://www.swfwmd.state.fl.us/

government agencies (40%), as well as research organizations (12%) environmental organizations (11%), business organizations (11%), and neighborhood associations (8%).

With this information I built four two-mode matrices of collaboration in projects (collaboration networks). Each one of these matrices has 198 rows (organizations) and 95 columns (projects), and in each of them an entry $x_{ip} = 1$ when organization *i* participates in project *p* in the given area, and 0 otherwise. The graphic representation of these matrices of collaboration is contained in the Figure 3, where squares represent projects and circles represent the organizations participating in them.

[**Figure 3 about here]**

The network of assistance to obtain technical information for the projects (3D) is the most active (311 links), followed by assistance to secure funding (3A—243 links), assistance to secure public buy-in (3C—239 links), and the assistance to solve regulatory and permitting issues (3B—225 links).

All four illustrations in Figure 3 show a main component that is connected primarily through one highly central organization (the District), and a few projects on the periphery that attract the assistance of one to three actors but are not linked to the large main component. There are, however, a few differences worth noticing. First, the District is more central –in absolute terms- in the network of assistance to secure funding (participating in more than 60 projects) and the network to obtain technical information (participation in 40 projects). In the remaining two networks that absolute centrality is somewhat diluted. In the particular case of the network of assistance for regulatory and permitting issues (Figure 3B) other governmental authorities at both the federal (US Army Corps of Engineers) and state level (the Florida Department of Environmental Protection) adopt a more preeminent role, and so the District participates in a smaller number of projects (34). Finally, the network of assistance to obtain public and/or political support for the project shows more of a "spread" pattern, with more projects disconnected from the main component (the district participates in 29 projects).

Figure 4 directly displays the degree distributions of each of the organizations that participate in the projects. All panels in the figure show the typical distributions that exist in networks where preferential attachment processes take place, with a very large number of nodes having small numbers of ties, and a very small number of nodes concentrating a large proportion of the edges in the networks.[11]

[figure 4 about here]

Despite the overall pattern of preferential attachment-like processes, there are a few differences worth noticing, which complement the visual layout exposed in Figure 3. First, the network of assistance in regulatory issues is the network of collaboration where there are more organizations that are poorly connected. Many organizations in this network are linked to only one project, and in fact the average degree is just 1.14, the lowest of the four networks. The histogram in the network of organizations providing assistance to secure adequate funding for projects shows basically the same pattern with most projects linked to only two organizations (usually the applicant and one of the highly central governmental nodes that can be seen in figure 3A). In the remaining two networks this pattern is modified, with the distribution skewing (although slightly) to the right. This indicates more activity among peripheral nodes in both the network of assistance to secure public buy-in and the network of assistance to obtain technical information.

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[11] Preferential attachment occurs when some ego in a network tends to concentrate the connections created by many other alters.

Clearly, the presence of the District greatly alters the overall structure of the observed patterns of collaboration. In all cases the District is clearly the most central actor, which is even more evident in the networks of assistance to secure adequate funding and the network of assistance to obtain technical information. The organization –as discussed above- shares some of the centrality with other governmental organizations in the network of assistance on regulatory issues, which simply reflects the fact that many of the projects need to clear regulatory hurdles not only with the District but with other agencies as well. Finally, the District is less central in the network of assistance to secure public buy-in, which is expected given that this type of resources needs to be supplied by actors other than the main funding source in the program.

The next table shows how the density and average distance values in the networks change when the District is removed from the matrices.

[table 1 about here]

The importance of the District as an integrative force in all four networks of collaboration is indicated by the changes in the density values in all matrices. In all cases, the density decreases significantly when the District is removed. The range of this drop goes from about 15.4% of the total density in the network of assistance to obtain public buy-in to 23.1% in the network of assistance to secure adequate funding.

Since the networks are basically composed of large main components, inside which all nodes can reach each other (as seen in Figure 3), the high numbers of links that the District has also reduces considerably the average distance in the networks. Provided that information flows from node to node, the lower average distance that the District produces with its presence is more likely to facilitate access for a host of organizations to relevant information that is produced in other projects where the District is also participating. This is the case in all four networks, although the change in average distance in the network of regulatory assistance is lower given the presence of other actors that complement the District as the main integrative forces in the system (see earlier discussion).

This simple description illustrates the critical role the District has in shaping the overall structure of all the networks of collaboration that are formed when organizations participate in projects, but does not provide a strong test to assess whether bonding or bridging social capital are preeminent . Furthermore, there is both more density associated with bonding, and lower distance associated with the presence of bridging when the District is present. To provide such a test, I turn to a statistical cross-sectional analysis of the networks to find out which of the structures of bonding and bridging social capital I presented in Figures 1 and 2 are prevalent.

An ERGM Analysis of Collaboration Networks

The network structures shown in Figures 1 and 2 are configurations that may –or may not- occur more frequently in the four observed collaboration networks than in networks with the same number of nodes and connections where the latter are generated randomly. To find out if this the case I fit a series of Exponential Random Graph Models (ERGMs) to the four networks of collaboration – both removing and keeping the District in for comparison. ERGMS are statistical tools that account for the interdependent nature of network relationships by viewing an observed network structure as a possible realization of stochastic network processes (Robins *et al.* 2007a; Robins *et al.* 2007b; Robins and Morris 2007, Lubell et al. 2010). The network configurations that individual actors create as they participate in projects and the parameters for these configurations yield a probability distribution of networks from which my observed networks (which may be thought of as dependent variables) are drawn.

I analyze the existence of the structures representing bonding and bridging social capital in the four collaboration networks with BPNet, an open source software package that estimates Exponential Random Graph Models on two-mode matrices.[12] BPNet improves on previous techniques because it implements a maximum likelihood estimator to uncover how the local choices of actors affect the global structure of a network (for more information, see Wang et al 2009). The ML estimator produces a vector of estimates that generates a graph distribution with expected values of the statistics equal to the observed graph statistics (in this case, the structures for bonding and bridging social capital that I include in the model). When the estimation is concluded, many simulations are performed (1000 in this case), and the resulting estimates are used to determine whether they can generate the graph distribution centered at the observed network. A t-ratio is produced for each coefficient that captures how much convergence exists in this process. Values of $t < 0.1$ are interpreted as a sign of good convergence –the observed values lie in the center of the graph distribution of model-predicted network characteristics.[13]

Control Variables

In addition to the configurations in Figures 1 and 2 that indicate the presence of different types of network capital, I include as controls in the models other parameters that represent the existence of different structural configurations that respond to particular characteristics of the organizations or projects included in the collaborative two-mode networks.

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[12] The software is developed by scholars at the University of Melbourne (Australia), and can be obtained for free at: http://www.sna.unimelb.edu.au/pnet/pnet.html.

[13] See Wang et al (2009) for more detail on BPNet and a discussion on how ML overcomes some of the limitations of the pseudolikelihood (PL) estimation method for the analysis of interdependent dyads.

Organization Type Homophily

Homophily refers simply to the tendency of nodes of the same type to connect to each other (Weick 1979). Evidence of homophily in networks is extremely abundant (see McPherson et al. 2001 for a good review) and there is no exception in the study of policy networks where it has been shown repeatedly that policy actors may prefer to interact with those who are alike in various respects (Knoke 1990, Termeer and Koppenjan 1997, among others).

In the networks of collaboration I examine in this work I test for Organization Type Homophily, or the tendency of organizations to work in projects where other organizations of the same type are involved. Certain organizational types are more likely to provide specific types of resources, and so it may be possible that organizations tend to cluster with others of the same type in the specific provision of certain resources to projects. For instance, environmental NGOs should be more likely to be contacted when the project designer is in need of assistance to achieve public buy-in, universities and research centers should be contacted when technical information is needed, etc. In the models I estimate, homophily is indicated by the presence of 2-path structures where the organizations working in a common project are of the same type, as indicated in the following figure by the dark grey color in the two circles (organizations).

[Figure 5 about here]

The organizations that participate in the two-mode networks of collaboration can be of 8 different types, as described in an earlier section: federal government (8 organizations), state government (12), regional government (14), local government (79), business (22), environmental NGOs (22), research institution (24), and neighborhood associations (17 organizations). THERE ARE FOUR OTHERS THAT I DID NOT DESCRIBE IN THE JPART SUBMISSION!

Activity Level of Funded Projects

A second variable I include in the models measures whether projects have obtained a favorable funding decision by the District or not. Out of a total of 95 projects, about three fourths of them (73 projects) obtained funding, and so it is relevant to know whether the level of activity in these projects has something to do with the capacity of projects to obtain funds. I include a two-star parameter in the model that captures whether configurations like those in Figure 6 exist in a higher frequency than would be expected in a random network. Notice that the square in the figure (project) is represented in solid grey –in opposition to plain white- to symbolize the project is funded.

[Figure 6 about here]

The information to codify this variable was obtained from budgetary documents available in the District's website.[14]

Project Budget

A third control variable that I include in the models is the size of the project's budget, under the expectation that larger projects tend to be more active than smaller projects, in terms of the organizations that participate in them. More activity by larger projects would be represented by the existence of more configurations like the one contained in Figure 7, where the size of the project (the square) is larger indicating the variable is not dichotomous but continuous.

[Figure 7 about here]

There is an important variance in the proposed budget of the 95 projects studied here; the minimum budget for a project is $ 1,000, and the maximum is $61,366,000. The mean value equals U$3,969,968, with a standard deviation of U$ 9,561,022.

Project Evaluation

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[14] See Berardo (2009) for more information on how these data were obtained.

There is another continuous variable I introduce in the models which captures whether respondents evaluate their projects positively or not. Respondents were asked to state their level of agreement with the following three statements: 1.)"The project will fully satisfy my organization's expectations", 2.)"The project will fully satisfy the expectations of those who initiated the project", and 3.) "The project will deliver the full public value that the community expects for this type of project." The respondent placed responses in scales that range from 1 (strongly disagree) to 7 (strongly agree) for each of the statements, and the mean value was then calculated given the high correspondence among the three questions (Cronbach Alpha =.83).

As with the project budget, the expectation is that projects where the manager provides a better evaluation could be engaged in more 2-stars, representing the tendency of better-evaluated projects to gather the assistance of more organizations in comparison to projects that are not so positively evaluated. The minimum score for this variable in a project is 2.33, with a maximum value of 7. The mean score is 6.04 with a standard deviation of 0.94.[15]

Density Parameter

[15] Given the heavy tipping in the distribution of this last variable, models were also calculated with the transformed version of the variable:

Where *e* is just the base of the natural logarithm (approximately 2.718), project evaluation is the value of the original variable, and equals the maximum value possible of (1095.837). This transformation makes the variable project evaluation more uniformly-distributed with values ranging from 0 to 1. The results in the estimation of the model did not differ when this modified version of the variable was used. Results of these alternative models are available from the author upon request.

Finally, I include a simple density parameter in the models to account for the overall level of activity in the networks, given other configurations that are present. In the estimation of ERGMs parameters are correlated, so a density parameter will typically become more negative as effects with positive values are added. In other words, as positive effects are added, there is less need to explain the occurrence of a tie as an isolated event, and then the density parameter becomes negative. What the parameter tries to capture, then, is just the simple establishment of links between organizations and projects, without further expectation of the nature of that relationship, as represented in Figure 8.

[figure 8 about here]

Results.

Table 1 presents the results of the estimation of the model run in the four two-mode matrices that represent the participation of organizations in projects. All models converged properly with *t* values < 0.1 for all the coefficients, but only after removing the parameter indicating the existence of strong triangles, which impeded good convergence. The density parameter, included in the last row of the table, is negative and significant in all the models. This simply indicates that there are less links in these networks than expected in random graphs of the same size when taking into account the other structural configurations included in the models.

[Table 2 about here]

The results do not show that structures indicating two-mode bonding social capital are prevalent in any of the networks. The parameter indicating the presence of strong reciprocity (multiple connections through common projects) is negative in all cases, although the parameters are significant only in the networks of assistance to secure funding and the network of assistance to solve regulatory & permitting issues in projects, which is a result of the preeminence of the central actors in those networks. The two networks are dominated by the presence of the District , as well as the U.S. Corps of Engineers, and the Florida Department of Environmental Protection (in the network of assistance to solve regulatory issues). Therefore, the structures formed are not particularly conducive to the formation of bonding structures among other actors.

The coefficients capturing the presence of extended bonding in the form of projects that attract multiple participants are all positive but insignificant, which means that there are not more of these configurations in these four networks of collaboration than would be expected in a distribution generated by a random process. [16] Overall then, there is no evidence that the networks of collaboration observed in the Cooperative Funding Initiative program are more prone to

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[16] For two-mode networks of *n* rows and *m* columns, one can model stars up to size *n* and *m*. At the moment of estimating a model in BPNet, one can choose the value of a weight parameter λ (lambda), which dampens the effect of large changes in the statistics of large stars when set to a value equal or larger than 1 (see Wang et al. for a detailed description of the weight parameter). For instance, when λ equals 2, the model treats nodes with degree higher than five almost equivalently and as it grows beyond that value the model estimates the existence of stars of lower degree. As λ approaches infinity, the star parameter is almost equivalent to a 2-star. In the case of the "extended bonding" (project star) coefficient, I set the value of lambda to 3 in all the networks except the network of assistance to solve regulatory and permitting issues, where I set the value of the parameter to 2. This accounts for the fact that there are more large project stars ("extended bonding") in this last network, since there are more organizations that participate in multiple projects. The modification of the weight parameter improves convergence, but it does not affect significance levels.

generate bonding social capital than random networks with the same number of connections and nodes in them.

On the other hand, the structure representing bridging social capital is significant and positive in all four collaborate networks. The coefficient for the organization star reflects the dispersion of organizational degrees, and simply indicates that a few organizations have links to many projects, which at least potentially allows for the transference of localized knowledge generated in particular projects to the larger community of projects that participate in the CFI program. Obviously, the main driver of this finding is the presence of the District in the networks. The widespread centralized structure of the four matrices is highly influenced by the fact that the District adopts the central role in all matrices because it is contacted to provide assistance in a large number of projects –in all types of resources. Note that the network of assistance to secure adequate funding and the network of assistance to solve permitting and regulatory issues have a larger effect, which complements the negative coefficient for the strong reciprocity effect we discussed above in the same networks.

In the case of the network of assistance to obtain public and political support for the project and the network of collaboration to provide technical information, the smaller size of the bridging social capital coefficients indicate the presence of less centralized networks (despite the District's continued predominant role). The structures in these networks are still conducive to the creation of bridging social capital in two-mode networks, but this result does not show up in the dramatic way it does in the other networks. This is not an unexpected result, given that the types of assistance that applicants seek in these cases are more likely to be secured if organizations other than the District are contacted. For instance, consider one of the projects I study, which was designed by the Extension Service of Pinellas County to obtain funds to implement the so-called

“Pinellas County Florida Yards and Neighborhood program”. This is an educational program whose main goal is to promote the adoption of landscaping best management practices among homeowners, business owners, landscape professionals and others to reduce the environmental damage that may result from faulty landscape design and maintenance. The activities of the program include workshops, elaboration of educational material, school visits, etc., with the goal of reaching thousands of potential targets.[17] When asked about the partners that participated in the project providing technical assistance during the design stage, the respondent to our survey (a representative of the Extension Service of Pinellas County) named the following actors: three environmental organizations (Florida Native Plant Society, Adopt-A-Pond Pasco, and the Florida Exotic Pest Plant Council), one local-level governmental organization (the city of St. Petersburg), two regional-level governmental organizations (Tampa Bay National Estuary Program and Tampa Bay Water), and two research organizations (Pinellas Technical Education Center and the University of Florida’s Institute of Food and Agricultural Sciences). The District, however, was not named. This project adds a lot of edges to the collaboration network to assist projects in technical issues, but none of them connects to the District. Projects like this deflate the coefficient for the organizational star that indicates bridging –although this clearly does not mean that bridging is not present.

This pattern is also prevalent in the network of assistance to provide public buy-in and support. The District retains the capacity of creating bridges between otherwise disconnected projects, but its effect is somewhat smaller than in the networks of collaboration in regulatory and

[17] According to the application presented to the District in December of 2006, 21,500 people had received education through the program in 2006.

funding issues, mostly because there is a larger number of projects that are not linked to the District but yet are assisted by other partners.

At this point it is important to note that the only one of the controls included in the model that comes up as being significant is the organization type homophily, and that this only happens in the same two networks where the District's shaping of bridging structures is less pronounced.[18] Both the assistance to projects to achieve public support and obtain needed technical information are usually secured by the efforts of project managers to attract the participation of actors with specialized technical knowledge and the needed capital to improve public acceptance of projects, which is more likely to result in the attraction of more homogeneous groups of actors. Take the example of the "Brooker Creek Watershed Community Outreach" project designed by the Pinellas County's Department of Environmental Management. The main goal of this project is to increase residents' awareness and knowledge of actions that can reduce the negative impacts of human water use on watersheds in three neighborhoods in Pinellas and Hillsborough counties. The application presented to the District stated that the applicant organization would collaborate with neighborhood associations in the implementation of the project because they "…lend themselves well to educational outreach programs, (and) residents often look toward their neighbors to observe model behaviors and obtain information" (South West Florida Water Management District 2007). Thus one would expect to see neighborhood associations assisting the applicant in obtaining public buy-in and political support during the design stage of the project, which is exactly what happened. The project manager who answered our survey observed

[18] None of the other controls included in the models were positive or negative in significant ways. Level of activity did not vary for project with bigger budgets, projects that obtained funding, or projects that were positively evaluated by the respondents.

that the public buy-in for the project was secured by the assistance of the three neighborhood associations active in the area.[19] Overall then, the pattern of participation of organizations in projects differs according to the type of resource that is provided. When projects receive assistance to secure adequate funding or regulatory information, the organizations providing such assistance are of different types. Furthermore, when they receive other types of assistance, there are more cases of projects where participants share at least the same organizational type.

A point worth bearing in mind is that when the District is dropped from the matrices, the coefficients for the parameters for bridging social capital drop significantly in their size, though they maintain a positive and significant value. This drop is due to the fact that the absence of the District diminishes the dispersion in the degree distribution in the networks. In other words, the presence of the District increases the presence of configurations that facilitate the creation of bridging social capital, but not bonding. The results of the models without the District are not presented in Table 2 because they did not converge properly in any case after the District was removed (*t* values of multiple coefficients > .1 –see Wang et al. 2008). [20]

The overall results show that in collaborative networks, the leading organization in the program (the District) can greatly shape the way collaboration takes place and the channeling of relevant information from project to project in ways that make innovation more likely in the design of proposals to provide needed public goods and services. This only confirms the assertion that the role of actors that occupy brokerage positions in collaborative networks is important

[19] They are the Brooker's Landing Neighborhood Association, the Spirit of Life Unitarian Faith-based Organization, and the Woodfield Neighborhood Association, all active in the area of the project’s potential implementation.

[20] The results of these models are available from the author upon request.

mostly because communication between nodes can be difficult or outright impossible in some cases (Fernandez and Gould 1994), and also because they provide opportunities for those that are located in otherwise disconnected clusters (Burt 2005, 18). In two-mode networks, this brokerage role can be fulfilled by contributing to the creation of structures that make information flow easier from project to project, and the simplest of these structures is a star where an organization occupies the central hub, linking it to many projects where other organizations also participate. Of course, one needs to assume that the brokering organization is willing to share what it “learns” in one project with the partners of another project that require its assistance. This is a pretty realistic assumption in the case of the Cooperative Funding Initiative program, given that one of the main goals of the District is to gather relevant knowledge from its interactions with the partners and make sure that knowledge gets incorporated into the program to be reused in the future (Baldwin 2007).

This is a feature of critical importance in the system given that the Cooperative Funding Program is competitive in nature, with many actors preparing projects and competing for limited financial resources. It is in this competitive setting that the District’s intervention in projects may be thought of as a conduit for a kind of “hidden” collaboration among applicants, who do not necessarily know that the expertise they obtain from their links to the District may be generated in the design of other projects that they are supposed to compete with. By participating in many projects at the same time as a provider of different types of resources, the District vests the network with a capacity to generate more innovative projects that would otherwise be lacking.

Conclusion

Among the most relevant issues in public management and policy studies is the extent to which resource interdependencies shape and structure collaborative networks, and how this affects performance both at the nodal (Berardo 2009a) and the whole-network levels (Provan on whole networks). Less explored is the capacity of key actors to affect these configurations when the networks of collaboration are self-organized, with the nodes freely choosing who to interact with or which activities to participate in.

In this work, I have made a contribution to correct this problem by exploring how the participation of a key central governmental agency affects the type of network capital that can be created in networks of collaboration where multiple actors participate in projects that generate public goods and services. The main result exposing the effect of the central organization in the creation of bridging social capital is interesting because it helps us understand how governmental actors can connect otherwise disjointed efforts to provide solutions to problems that affect multiple actors in a regional scale. Recent scholarship on self-organizing collaboration in fragmented federal systems contends that governmental authorities do not necessarily assume a steering role to mitigate institutional collective action dilemmas in networked environments (Feiock and Scholz 2010). The results I have exposed here complement this view. Perhaps governmental authorities do not steer collaborative network processes willingly, but their participation may create bridging social capital that increase the likelihood of implementing better-designed responses to problems.

Of particular importance is that this happens in a competitive system, where participants fight for always-scarce financial resources. Perhaps one of the most important implications to this study is that the bridging social capital which facilitates innovative responses to common problems does not need to develop only in the low-risk policy arenas where defection is less likely, as previous studies have emphasized (Berardo and Scholz 2010). Even in competitive systems, bridging structures can form when competitors are connected to a common collaborator through their participation in joint activities. Whether competitors know it or not, the simple existence of these links may lead to the elaboration of responses to problems that look *as if* they had been explicitly coordinated between them when the District moves know-how around in the network. The “invincible hand” of the central authority may have the potential to turn these collaborative two-mode networks into true action networks where participants are more likely to end up producing the optimal amount of needed goods or services (Ospina and Saz 2010; Keast, Mandell, Brown, and Woolcock, 2004; Milward & Provan, 2006).

Certainly, this initial approach to the study of two-mode collaborative networks is not without its shortcomings. First, these results do not provide information to assess how the structural configurations in the networks affect the behavior of organizations and the performance of projects. Second, it is not possible to know exactly how the District uses the advantages provided by its central role in the networks. By providing a higher amount of connectivity to the system and brokering connections the District becomes the predominant *Tertius Gaudens* in the system (Simmel 1950), obtaining benefits that may be unique to its position. Some of these benefits are clear and have been discussed, but more empirical data will be needed to assess them more clearly.

Future research also needs to explore in more detail the connections that exist at the intraorganizational level in central nodes as complex as the District. The organization participates in different projects, but it is represented in them by a group of individuals who may –or may not- communicate fluidly with each other. To realize the potential for innovation facilitated by the structure of the networks of collaboration described in this article, one needs to assume that communication among those agents is of a high enough quality to allow for the transference of meaningful information that can positively affect the performance of the District. Future research studying interorganizational collaboration through participation in joint activities needs to account for this complex feature of collaborative networks.

Finally, one should keep in mind that the collaborative networks studied in this work are all formed in the process of designing projects that will seek public funds. The process of designing and presenting ideas is clearly very different than the process of implementing them, and so further research should examine whether the patterns uncovered here hold once monies are allocated and actors are left to their own devices on how to fulfill their projects' goals. Perhaps implementation is the realm of bonding social capital and not bridging, but this will remain a supposition until more data is made available.

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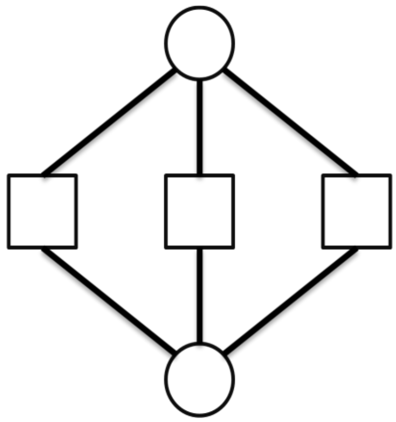
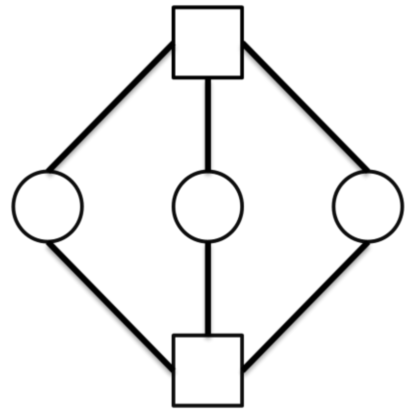
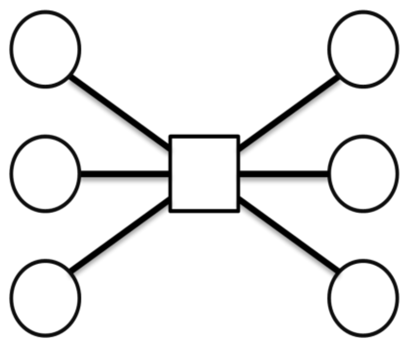


1A. Strong Reciprocity



1B. Strong Triangle



1C. Extended Bonding (Project Star)

Figure 1. Bonding Social Capital

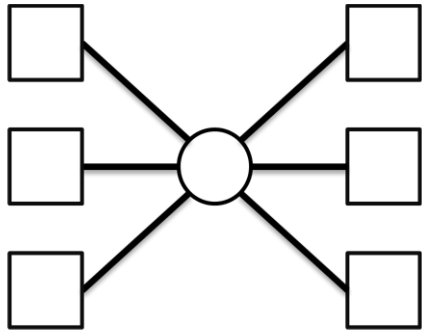
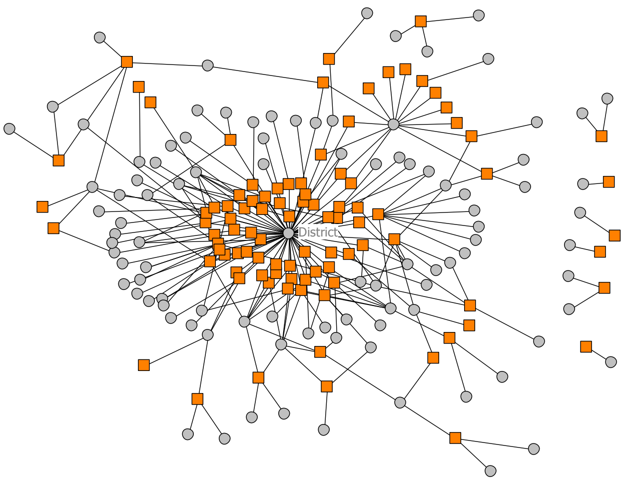
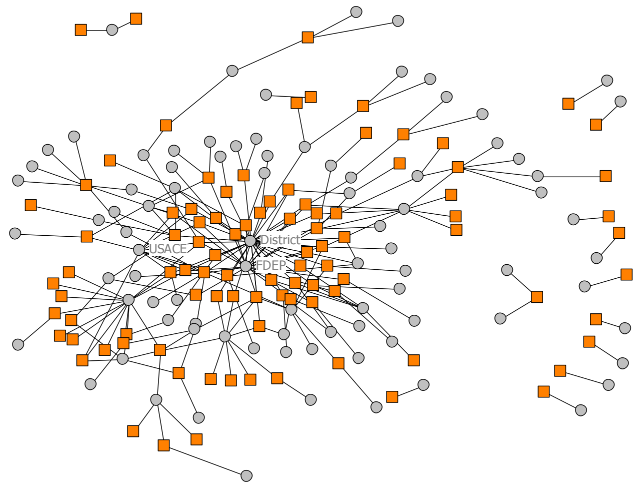


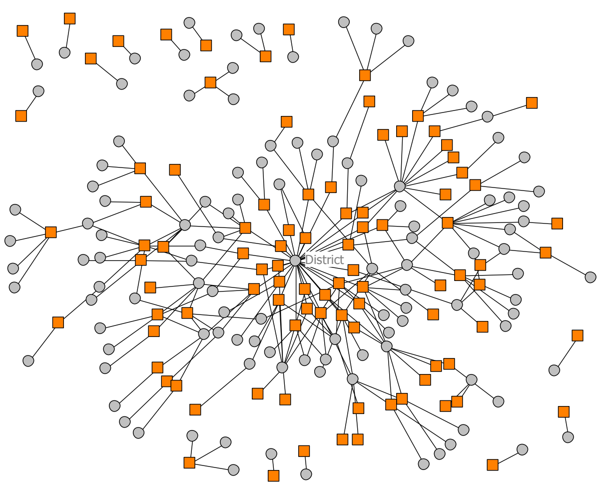
Figure 2. Bridging Social Capital (Organization Star)



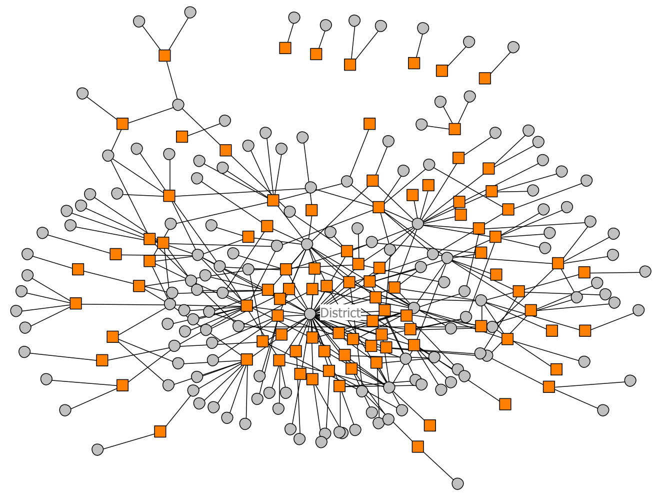
3A. Assistance in Securing Adequate Funding



3B. Assistance in Solving Regulatory and Permitting Issues



3C. Assistance in Securing Public Buy-in and/or Political Support



3D. Assistance in Obtaining Technical Information.

Figure 3. Networks of Assistance to Projects. [21]

[21] Illustrations in the figure were produced with UCINET (Borgatti, Everett, and Freeman 2002).

Labels of all projects and most organizations were removed to preserve readability.

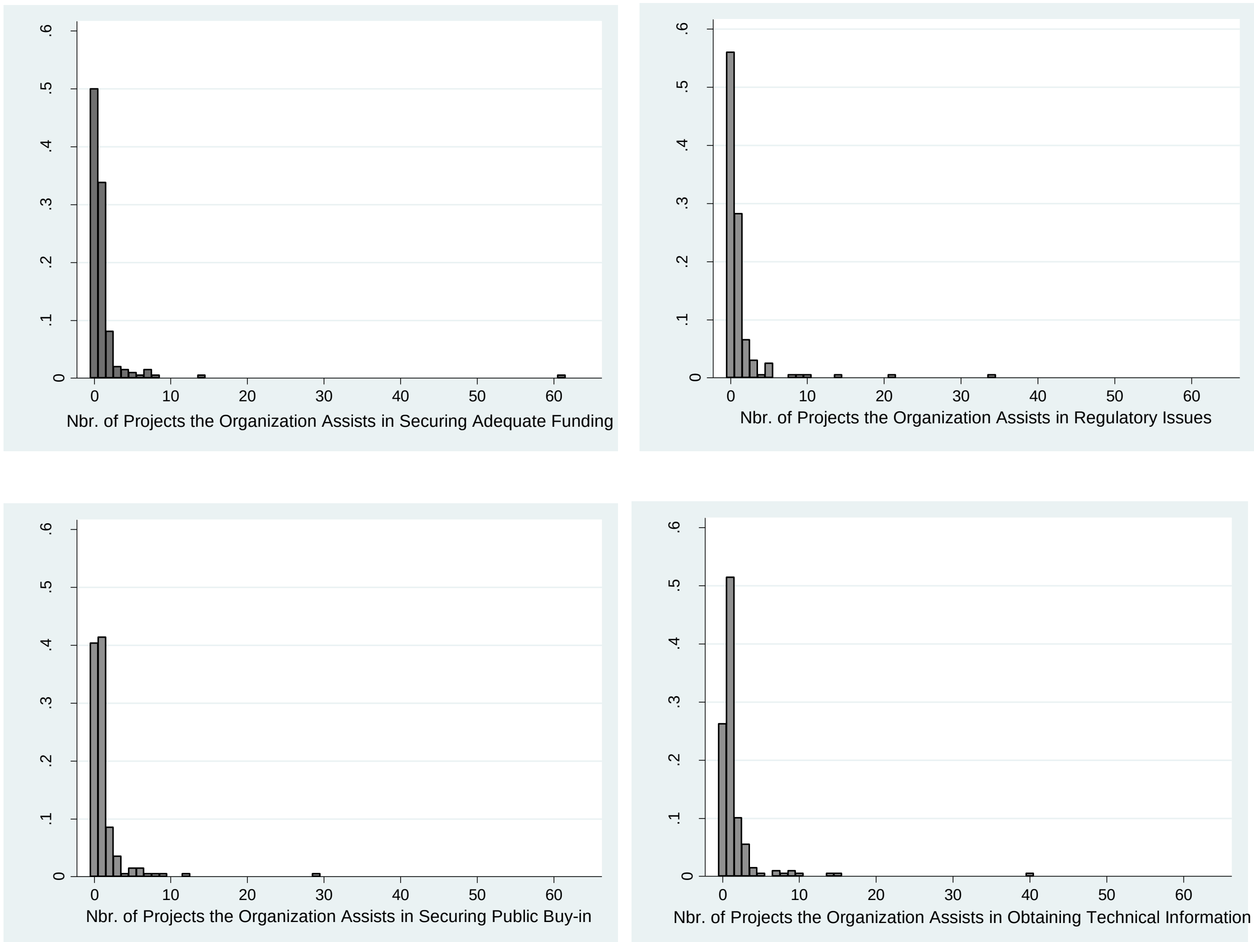


Figure 4. Degree Distributions by Issue Area

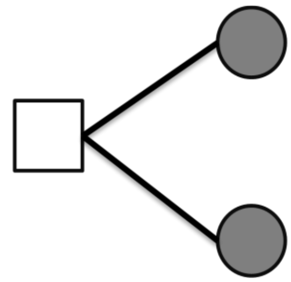


Figure 5. Organization Type Homophily.

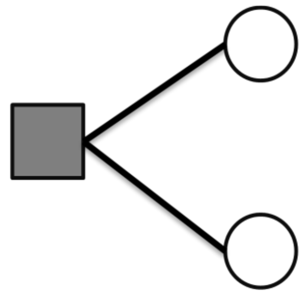


Figure 6. Activity Level of Funded Project.

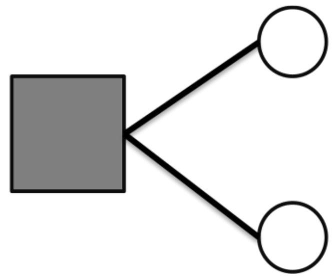


Figure 7. Activity Level of Larger Projects.

Figure 8. Overall Activity Level.

Table 1: Cohesion Measures in the Four Two-mode Collaboration Networks with and without the District.

	Density		Average Distance	
	With District	Without District	With District	Without District
Assistance on Regulatory Issues	0.012	0.010	4.49	4.81
Assistance to Secure Funding	0.013	0.010	3.89	6.61
Assistance to Obtain Public Buy-in	0.013	0.011	5.01	6.83
Assistance to Obtain Technical Information	0.017	0.014	4.57	5.51

Table 2. ERGMs for the 2-mode Matrices of Organizations Participating in Projects (District present in all models).

	Assistance to Secure Funding	Assistance to Solve Regulatory & Permitting Issues	Assistance to Achieve Public and Political Support	Assistance on Technical Issues
Bonding Capital				
Strong reciprocity	-0.65* (0.31)	-0.69* (0.26)	-0.17 (0.18)	-0.10 (0.13)
Extended bonding (Project Star)	0.58 (0.55) λ =3	0.79 (0.52) λ =2	0.10 (0.36) λ =3	0.08 (0.31) λ =3
Strong triangle	Models Don't converge	Models Don't converge	Models Don't converge	Models Don't converge
Bridging Capital				
Organization Star	1.45* (0.10)	1.55* (0.10)	1.03* (0.11)	0.96* (0.10)
Controls				
Organization Type Homophily	0.10 (0.07)	0.11 (0.06)	0.17* (0.05)	0.09* (.04)
Activity of Funded Projects	-0.03 (0.09)	0.19 (0.11)	0.05 (0.07)	0.08 (0.05)
Activity of Larger Projects	0.00 (0.00)	0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)
Activity of Better-Evaluated Projects	-0.01 (0.01)	-0.02 (0.02)	0.01 (0.01)	-0.00 (0.00)
Density Parameter (Overall Activity)	-5.48* (0.36)	-5.97* (0.33)	-5.48* (0.29)	-5.28* (0.32)

*p < .01. Standard errors in parentheses.