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Processing Complexity in Networks: A Study of Informal Collaboration and its Effect on Organizational Success

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Do organizations with more collaborative partners perform better than organizations with fewer partners? And is this relationship conditional on the ability of those partners to provide nonredundant resources from their network of contact with other actors? This article answers these questions with data describing the participation of governmental and nongovernmental organizations in the Cooperative Funding Initiative (CFI), a program sponsored by the one of the five water management districts in Florida. Results show a positive relationship between the inclusion of more partners in a project and the chances of getting funded, but also that once the project becomes too inclusive; those chances decrease if the partners fill more structural holes (e.g., provide more nonredundant resources). In other words, organizations perform better by adding more partners as long as this addition does not result in excessive complexity. These results are valuable for the growing community of policy scholars seeking to understand the specific conditions under which collaborative behavior positively affects organizational performance.

KEY WORDS: informal collaboration, networks, organizational partners, structural holes, complexity, southwest Florida water management district, water projects

Introduction

How organizational actors that are active in fragmented policy arenas reach their goals through collaborative behavior is a long-standing question in public policy. In the last decade, novel responses to this question have been produced by researchers who explore the theoretical links between the performance of organizations and the characteristics of the inter-organizational networks in which those organizations are embedded. Findings have ranged from general explanations of how the success of organizational performance ties to the networking capacity of the organization (Agranoff, 2003; Agranoff & McGuire, 2003, 2004; McGuire, 2006), to detailed descriptions of the relationship between individual positioning in networks, and the organizational capacity to generate cooperative responses to collective action dilemmas (Berardo & Scholz, 2008; Lubell, Henry, & McCoy, 2009; Scholz, Berardo, & Kile, 2008).

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Yet, despite the fact that networks are being treated "seriously" in public policy research (Robinson, 2006), major challenges remain. Perhaps one of the most important is the lack of empirical evidence on *how* exactly networks affect the ability of organizational actors to achieve their goals. It is to be expected that by more decisively addressing the question of how networks matter, scholars will be able to gain a better understanding of the conditions that make some organizational actors more successful than others.

In this article, I make a 2-fold contribution to the study of networks and their effect on organizational performance. First, I test the common expectation that an organization (*ego*) can more easily reach its goals when it taps other actors in the network (*alters*) for useful resources. Second, I hypothesize that the previous relationship is conditional on the connections that the *alters* have with other nodes in the network; this second hypothesis argues that an organization might benefit from linking to partners that provide new, nonredundant resources, but that this relationship should diminish in value as the ability of the organization to process nonredundant resources reaches its limits.

In testing these hypotheses, I combine the theory of "structural holes" developed by Ronald Burt (1992, 2005) with the bounded rationality expectation of limited organizational capacity to process new resources. Both the theory of structural holes and the work of scholars in the area of knowledge management have been singled out as potentially important tools to improve our understanding of how organizational actors perform when they are embedded in networks of collaboration (Agranoff, 2006, 2007; Scholz et al., 2008), but empirical applications have been absent.

I test these expectations with data collected in a study of multi-organizational projects designed to solve water-related problems in southwest Florida. The projects are designed mainly by local governments (the *egos*) with the assistance of other organizational actors, both governmental and nongovernmental (the *alters*). The leading organizations in these projects apply for financial support to a program called the Cooperative Funding Initiative (CFI), which is sponsored by the Southwest Florida Water Management District (henceforth, the District or SWFWMD), one of five water management districts in Florida.

The District covers up to 50 percent of the budget of those projects approved for funding, which makes the CFI a prime example of the kind of government-led program that includes a relatively large number of both governmental and nongovernmental actors and that "have become more the rule than the exception" to foster cooperation in the American system (Agranoff, 2006; O'Toole & Meier, 2004). As explained above, the applicant organizations do not act in isolation when they design their projects. Instead, they reach out to other actors to obtain different resources that could strengthen their applications, such as technical or legal expertise, political support and public buy-in, or knowledge about supplementary funding sources that could make the project more appealing to the District. In this way, a network of informal collaboration develops, where the organizations active in this process are the nodes in the network and the links between them represent shared participation in the design of projects. In this article, I analyze how the likelihood of an organization obtaining funding for a project depends not only on the number of partners it attracts to collaborate in the design of the project, but also on how these partners participate in other projects.

The task for ego is to gain sufficient resources for the project to be implemented in a specific type of collaborative environment, one in which a higher authority (the District, in this case) sets the rules of participation and assumes a central role of leadership and in which collaboration among participants develops in a rather informal way. Our understanding of how informal collaboration unfolds in fragmented policy systems and its effects on organizational performance is becoming more complete (Berardo & Scholz, 2008; Schneider, Scholz, Lubell, Mindruta, & Edwardsen, 2003; Scholz et al., 2008), but it remains under-theorized and insufficiently explored from an empirical standpoint. This article contributes to the solution of this problem.

The following sections present the major theoretical underpinnings of this research, detail the structure and functioning of the CFI program, explain the data collection process and network-related definitions and methods of analysis, and discuss results and implications for future research.

Availability of Resources and Organizational Performance

For almost 50 years, particularly in Sociology, resources exchange theorists have studied how organizational actors acquire the resources from their environments that they need to accomplish their goals (Aldrich & Pfeffer, 1976; Cook, 1977, 1982; Cook & Yamagishi, 1992; Emerson, 1962; Markovsky, Willer, & Travis, 1988; among others). The main assumption of this branch of research is that actors rarely have sufficient resources to pursue their activities and reach their goals, and therefore, need to exchange resources with others, providing resources that are abundant and acquiring others that are scarce. The more needed resources an actor is able to gather, the more likely the actor will accomplish its goals or improve its performance.

The basics of resource exchange theory are particularly helpful to explore collaboration in policy arenas where multiple organizational actors interact to reach their individual goals. In the typically fragmented policy scenarios of American federalism, inter-organizational conflict and institutional collective action dilemmas are always a latent danger, but the fragmentation of the system can also favor the promotion of collaborative efforts and innovative responses to common problems (Breton, 2000; Feiock, 2007, 2009). This is especially true when organizational actors need to obtain resources from their environments that they do not have readily available and are unlikely to produce internally. When this need for resources (financial support, technical information, legal advice, political support, public buy-in, etc.) grows, organizations must create connections to those other actors who possess the needed resources (Berardo, 2009; Feiock & Scholz, 2009). It is by expanding their set of contacts in the search for those much-needed assets that organizational actors might augment their chances of being successful in their initiatives.

In the case of the CFI program that I study here, this basic expectation should hold. Organizational actors prepare their project proposal with the main goal of getting it funded by the District, but rarely do the proponents have all the needed resources to put together the strongest possible proposal. In particular, proposals need to address technical issues, demonstrate public buy-in for the project, describe how permits will be obtained, and possibly secure multiple funding sources. Putting together a successful proposal might be a very complex enterprise that requires the applicant organization to gather specialized resources to address multiple issues. By securing the assistance of a larger number of actors in the process of designing a project, the applicant actor obtains access to resources that can be used to strengthen its proposal, which should—*ceteris paribus*—increase the chances of obtaining financial support from the District.

Hypothesis 1: The more resources an organization gathers for an initiative through the establishment of informal collaborative links with other organizations, the greater the chance of the initiative succeeding.

Resource-processing Ability and Organizational Performance

While being able to attract resource-rich partners could improve the chances of an initiative's success, we remain ignorant about how this relationship may be affected by the connections that the partners have to other actors active in the system. The number of participants in an initiative might be important to explain success, but it is certainly plausible that this relationship is conditioned by the way those partners are connected to other nodes in the network. In the case of the Cooperative Funding Initiative, one could reasonably argue that a leading organization in a project is more likely to succeed in getting its project funded not only when it attracts more partners, but mostly when these partners can contribute new resources during the project design phase.

Burt's ideas on structural holes provides one promising way of exploring how access to new resources through partners affects project success. Burt describes "structural holes" as areas in a network that separate nonredundant nodes (Burt, 1992, p. 18) and *brokers* as those that can fill these holes (Burt, 2005). Nodes are nonredundant when they tend to lie in separate parts of a network, and thus are more likely to be endowed with resources that are unique. *Brokers* are those nodes or actors that fill the structural holes by building links to nonredundant nodes, hence bringing themselves to a position of privilege in which they control the flow of resources between otherwise disconnected areas of the network.

Burt links the occupation of structural holes to the accumulation of organizational social capital and improved flows of communication and resources in the overall network, and his ideas are clearly applicable to the study of informal collaborative efforts in fragmented policy systems. In the inter-organizational network of collaboration composed by the actors and the projects that link them, it is conceivable that an organization will be more successful in obtaining support for a given project when it is assisted by partners that fill structural holes in the overall network of inter-organizational collaboration. This is so because partners who fill structural holes are in better positions to facilitate an innovative project design; they have access to other actors in the network that are nonredundant, and therefore, more likely endowed with unique resources that can be used by the leading organization to strengthen the project application.[1]

Hypothesis 2: The more an organization's partners fill structural holes through the establishment of informal collaborative links with other organizations, the greater the chance of the initiative succeeding.

But how does the availability of partners who span structural holes affect the relationship outlined in hypothesis 1? On one hand, it seems plausible that a positive reinforcing relationship should exist, since actors benefit from the resources accumulated by their connections (Argote, McEvily, & Reagans, 2003; Reagans & Zuckerman, 2001). When partner organizations in projects fill structural holes in the network, the leaders of the projects have access to nonredundant resources that can be used to improve the quality of the proposals that are presented to the District.[2] Unless there is a limit to the leading organization's capacity to process these resources, having more rather than less nonredundant resources is a good thing. If this is the case, the positive relationship between the number of partners that an organization attracts and the success of its efforts should become even more accentuated when the partners span more structural holes (a positive interactive effect should exist).

Hypothesis 3a: The positive relationship between the amount of resources that an organization collects for an initiative through informal collaborative links with other organizations and the success of that initiative is conditional on the capacity of the collaborators to span structural holes in the network. The more the partners span structural holes, the more accentuated the previous relationship becomes.

But of course, *there is a limit* in the amount of nonredundant resources any leading organization can effectively process at any given time, as research in the areas of knowledge management and information overload has consistently shown (Keller & Staelin, 1987; O'Reilly, 1980; Zandt, 2004; among others). In the case of information processing, for instance, we know that a wealth of it tends to deplete the attention of the recipient (Simon, 1971), which in turn can negatively affect performance. More information is preferable to less, but this is true only as long as the recipient of that information is not overwhelmed by its availability. Additionally, when that information is unique, or nonredundant, the required processing time and ability grows as well.

In the case of the organizations that participate in the CFI, they should see an increase in their chances of obtaining funds when they connect to more partners that can give access to nonredundant resources, but only to the extent that this access does not overload their capacity to process them. Once the lead organizations in projects applying for funding to the CFI go above their "processing ability" threshold, the addition of new partners that span structural holes might harm rather than benefit the project. In those circumstances, a leading organization might benefit from incorporating partners that, in general, do not increase the amount of nonredundant resources that the leading organization will need to process when putting together the application that will be presented to the District. Hence, one would expect to see a negative interactive effect of the two main independent variables.

Hypothesis 3b: The positive relationship between the amount of resources that an organization gathers for an initiative through informal collaborative links with other organizations and the success of that initiative is conditional on the capacity of the collaborators to span structural holes in the network. At some point, increasing the number of collaborators will result in higher chances of the initiative to be successful only if the collaborators provide access to redundant resources (e.g., they do not span structural holes).

The following section describes in more detail the main features of the CFI program. Later sections present the data collection process, measurement of variables, and results.

The Cooperative Funding Initiative

Southwest Florida contains approximately one quarter of the state's population, the majority of which settles in the Tampa Bay metropolitan area.[3] Unfortunately, the magnitude of water use poses increasing environmental threats to the stability of ecosystems (Marella, 2004). For instance, excessive withdrawal of water from underground sources can result in the reduction of spring flows, affecting the ecosystems around them, and the invasion of salty water into the aquifers (Barlow, 2003). Also, the excess in the utilization of surface water can have negative consequences for the environment. Over-irrigation of fields, for instance, can impoverish the quality of both surface and groundwater sources, since excess runoff can carry pollutants such as pesticide residuals and soluble nutrients back to those sources. Riparian habitats are then likely to be affected, with both flora and fauna suffering the consequences of water mismanagement.

To contribute to the solution of these types of problems, the Southwest Florida Water Management District created the Cooperative Funding Initiative. The program attracts applicants—mostly local governments, but also nongovernmental organizations—who elaborate project proposals linked to the main areas of the District's responsibility: (i) protection of natural systems, (ii) prevention of flooding, (iii) enhancement of water quality, and (iv) provision of water for human uses. The main goal of the applicants is to obtain financial resources from the District to pursue these projects, reducing the high costs of going solo in the elaboration of responses to water management problems. The District, on the other hand, also obtains clear benefits by taking advantage of local water management expertise.

The process of applying for funds is relatively straightforward. The deadline for the presentation of applications is the first Friday of December, when applicants present their proposals to one of eight basin boards into which the District is divided. Each filled application contains information such as the name of the leading organization presenting the application and its "contact person" (an individual who works for the applicant organization and serves as liaison with the District), milestones, budgetary requirements, etc. In the following months the District's staff reviews applications and elaborates a ranking of the projects (from high to low priority). Finally, the basin boards make funding decisions in July.

CFI projects require informal collaboration among multiple actors because rarely does the leading organization possess all the knowledge, expertise, and/or political clout to design and implement the project 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 other actors in the area that can help improve the design of the proposals. In this sense, the CFI program could be thought of as an example of collaborative public management because organizational actors join forces to remedy problems that can hardly be solved individually (McGuire, 2006, p. 33).

Data Collection and Measurement of Variables

To test the hypotheses presented above, I use data collected from respondents participating in 92 projects that applied for CFI funding in December 2006.[4] The applications for each of these projects are published in the "Budget Notebooks" that each of the District's basin boards releases on a bi-monthly basis (in February, April, June, August, October, and December). The Notebooks provide two critical pieces of information. First, the Budget Notebooks released in August of each year inform whether projects presented in the previous year have been granted funds or not. I use this information as a dichotomous indicator of the dependent variable—success of the organizational initiative. A project receives a score of 1 if funding has been granted and 0 if funding has been denied.

Second, the Budget Notebooks contain detailed information about each project, including the name of the leading organization in the project and its representative in front of the District for project-related matters. In the summer of 2007, phone interviews were conducted with the organizational representatives of each of the 92 projects using a semi-structured survey. Specifically, each respondent to the survey identified other organizations that participated in the project as providers of resources that could be used to strengthen the application. These resources could be of four kinds: (i) technical information to be used in the design of the project, (ii) assistance to secure adequate funding for the project, (iii) assistance to achieve public buy-in and or political support, and (iv) assistance to deal with permitting and regulatory issues. I used this data to build an affiliation matrix that informs on the pattern of participation of organizations in projects. An affiliation network is represented in a 2-mode matrix X with N rows and M columns. The rows index actors (the organizations, in this case), while the columns contain the events in which the actors participate (the projects). In this matrix X, an entry $x_{ip} = 1$ when organization i participates in project p by providing any type of resources, and 0 otherwise. By counting the number of 1s in each column, I obtain the measure for the first independent variable discussed in this article: the *number of organizational actors participating in an initiative (a project).*

The affiliation network for the participation in CFI projects contains 92 columns and 197 rows, representing a total of 197 organizational actors participating in 92

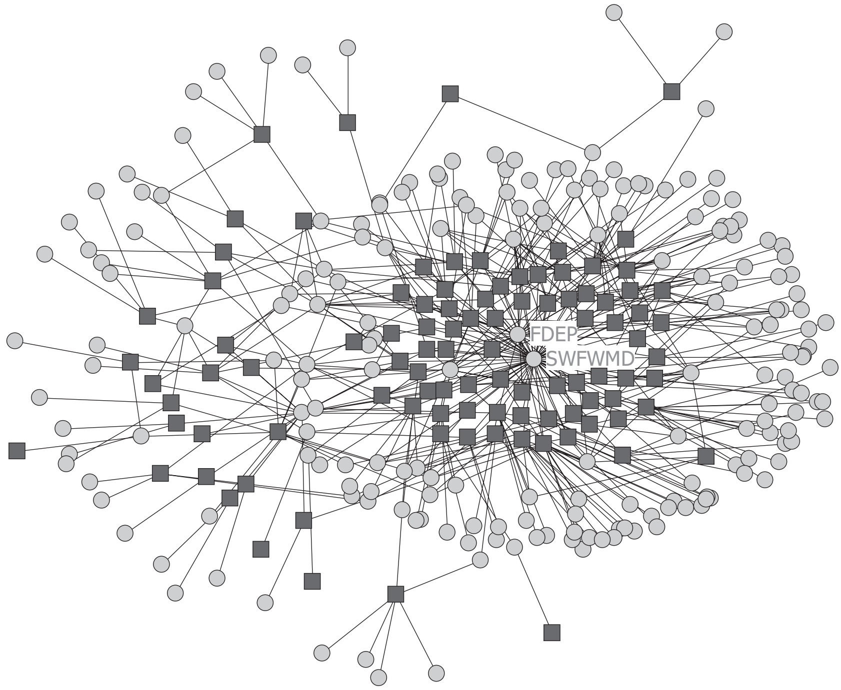

Figure 1. CFI Projects and Participating Organizations.
Note: Produced with Netdraw.

projects. The mean number of participants per project is 5, with a standard deviation of 2.83. The range of values goes from a minimum of 2 to a maximum of 14.[5] The graphic representation of this matrix is contained in Figure 1, where light gray circles represent organizations and darker squares represent projects.

I have suppressed the majority of labels to preserve readability, but have left those of the two most central actors: the SWFWMD (the District), and the Florida Department of Environmental Protection (FDEP). That the District is named as a source of consultation for project related reasons is to be expected since it is the organization that distributes funds and maintains a stable *cadre* of water experts who may contribute significantly to the improvement of proposals. The FDEP is also popular and participates in a large number of projects, mainly because the projects are likely to need access to expertise on regulatory or permitting issues, in which case a contact with FDEP can be of great value.

The next stage consisted of measuring how the partners in a project span structural holes in the network of inter-organizational collaboration. This is necessary to test the remaining hypotheses presented in a previous section. To produce such a measure, I proceeded in three steps. First, I multiplied the original 2-mode matrix by its transpose (XX'). The product of this calculation returns an $N \times N$ square matrix in which the organizations in the original 2-mode matrix now occupy both rows and columns. In this new square and symmetrical matrix, the value in a cell x_{ij} shows the number of projects in which organizations i and j participate together (they both have

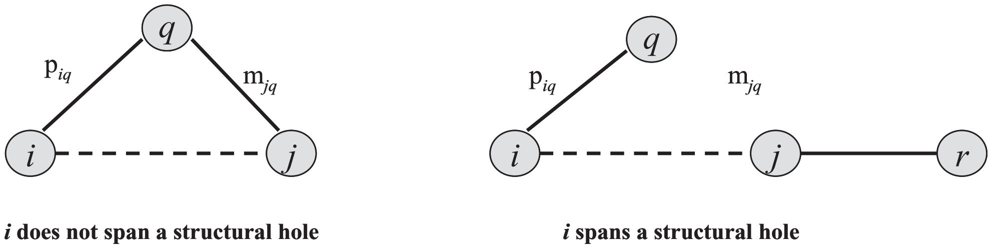

Figure 2. A Simple Illustration of the Structural Holes Argument.

been identified as participating in the project). In other words, the matrix contains information about organizations (the nodes) and common membership in projects (the links), according to the survey respondents.

The second step was to enter this new square matrix into UCINET (Borgatti, Everett, & Freeman, 2002) in order to calculate Burt's measure of "structural holes efficiency" for each actor in the network (Burt, 1992). The measure is calculated with the following formula.

$$\frac{\sum_{j}\left[1-\sum_{q} p_{iq} m_{jq}\right]}{N} q \neq i\ j \tag{1}$$

The numerator of the formula is the "effective size" of *i*'s structural holes. The first component p_{iq} represents the proportion of *i*'s network that is invested in a given alter *q*. The next component, m_{jq}, represents the marginal strength of *j*'s contact with *q* (the strength of the link between *j* and *q* divided by the strongest value that *j* has to any node in the network). The product $p_{iq}\ m_{jq}$ equals 1 when *i* invests all its resources in *q* and *q* is also the most important contact for *j*. In other words, when $p_{iq}\ m_{jq}$ equals 1, actor *j* is redundant for *i* regarding its access to actor *q*. The sum across all *q*s gives the total value of redundancy of actor *j* to *i*. This calculation is performed across all *j* (all contacts of *i*). A high score signals that *i* is effective in spanning structural holes because it ties to nonredundant alters (*j*'s). The denominator (the total number of nodes in the network) simply gives *i*'s value of structural holes a range between 0 and 1 (hence capturing *i*'s "efficiency" in linking to other nodes). A value of 1 indicates that actor *i* fills structural holes to the maximum possible extent, and 0 represents complete redundancy (less "efficiency") in the contacts *i* makes. Figure 2 provides a simple description of the concept.

In the illustration on the left side of Figure 2, actor *i* links to *q*, which is also linked to *j*. If actor *i* establishes a link to *j* (represented by the dotted arrow) it will not span a structural hole; however, in the illustration on the right side of Figure 2, a link going from *i* to *j* would allow *i* to actually span the hole since *j* is part of a different subgroup (it is linked to *r* but not to *q*). Burt's measure will assign *i* in the illustration on the left a lower value for structural holes efficiency in comparison to *i* in the illustration on the right. In the study context, the figure on the left indicates that *i*, *j*, and *q* are all linked by participation in common projects; the figure on the right indicates that *i* has projects in common with both *j* and *q*, who do not share projects with each other. Thus, *i* provides the only link between these projects, and would, for example, be in a unique position to share the relevant experiences of one project with organizations involved in the other project.

The third and last step consists of taking the information obtained in step 2 and calculating the mean score of structural holes efficiency for all the participants in a given project. For instance, if a respondent to our questionnaire stated that the District, the Florida Department of Environmental Protection, and Pinellas County had been involved in the design of the project, then the average score of structural holes efficiency for those three organizations was calculated and assigned to the project in question. A higher value in this variable substantively means that the leading organization in the project has to process more nonredundant resources from the overall network that are brought by active partners, who fill structural holes through their participation in other projects. The measure of average structural holes efficiency for the participants in the projects analyzed here ranges from an observed minimum value of 0.42 to a maximum of 1, with a mean of 0.71 and a standard deviation of 0.1.

Control Variables

In addition to the independent variables that I described already and are contained in the main hypotheses, I include in the estimation other variables that serve as controls. Their inclusion serves the double purpose of increasing the explanatory power of the model and helping to rule out the possibility of spurious relationships between the main independent variables and the success of the projects in obtaining funds from the District.

Number of Projects in Which the Respondent's Organization Participates. This information is obtained from the 2-mode affiliation matrix that I described in the previous section. It is a simple count of the number of projects (columns) in which the organization participates (the organizations are contained in the rows of the matrix). I include this variable in the model to account for the possibility that the decision to grant funds for a project is in some way a positive response by the District to the overall level of activity of the respondent's organization—the lead organization in the project—in the Cooperative Initiative Funding program.

Frequency of Contact with the Partners. For each organization identified as active in their project, the respondent asked to answer the question, "How frequently have you been in contact with this organization for project-related issues in the last year?" Responses were located in a five-point scale with the following values: weekly (4), monthly (3), quarterly (2), and less than quarterly (1). I obtained the mean value for these responses, which indicates the average frequency of contacts between the respondent's organization and the other organizations participating in the project. The mean of this variable equals 2.6, with a standard deviation of 0.61. There is an expectation of a positive relationship between this variable and the probability of obtaining funding for the project, under the assumption that stronger ties results in improved project proposals.

The District as a Partner. I include a dichotomous variable in the model that captures whether the respondent identifies the District as a formal partner in the project (value of 1) or not (0). The CFI is an example of a government-led program managed by a "control agency" (Bardach, 1998), and as we have seen in Figure 1, this control agency—the District—is highly active in the inter-organizational network of collaboration. Given its central importance as the main fund provider, the District tends to be contacted by the managers of many projects who try to maximize their chances of getting funded. If the District is responsive to these efforts, we should observe a positive relationship between this variable and the indicator for the dependent variable (obtaining funding for the project).

Frequency of Contact with the District. Regardless of whether the respondents identified the District as a participant in the projects, interviewers asked the question, "How frequently have you been in contact with the District for project-related issues in the last year?" Responses adopted one of five values: weekly (5), monthly (4), quarterly (3), less than quarterly (2), and never (1). I include this variable as an additional control to account for the potential favorable treatment that the District may dispense to those organizations that seek its advice on project-related issues, which should result in a stronger application and increase the chances of the project of getting funded.

Ranking of the Project. In an earlier section, I described the functioning of the CFI funding cycle, and how the District's staff ranks the projects and presents this information to the different basin boards that make funding decisions (the rankings are contained in the Budget Notebooks released every year in April). A project can be ranked in one of the following categories: highest priority (value of 5), high priority (4), medium (3), low priority (2), or not recommended (1). Most of the time, the basin boards make funding decisions that go in line with the rankings, although instances where the opposite happens are not uncommon. Hence, the expectation is that there will be a positive relationship between a project's ranking and the likelihood of obtaining funding.

Project Budget. A final variable that I account for is the amount of funds budgeted for the project in the application (in dollars). Some of these projects are very small and require lesser efforts by the partners for design and implementation, but others are very large, with budgets in the tens of millions of dollars. The size of the budget of a project is a good indicator for the overall importance that this project has for the leading organization and for other actors involved in it. I include this variable in the model to explore whether the District is responsive to the sheer magnitude of the project when making decisions about funding or not.

Results

Since the dependent variable is binary (1 = project is funded and 0 = the project is not funded), I estimate a logit regression reported in Table 1.

The overall results support the expectations contained in hypotheses 1, 2, and 3b. A larger number of partners in a project results in an increased likelihood for a project to be funded as predicted. A higher score for the average of the partners' Structural Holes Efficiency also increases the likelihood of obtaining funds, but the negative interaction term indicates that at some point attracting more partners who span structural holes might decrease the likelihood of the project getting funded.

Most of the other coefficients in the model are not significant. Contacting partners more frequently, or even securing the explicit assistance of the district during the stage of developing the project does not result in an increased likelihood of getting funds approved. The project's budget size is not a good predictor of likelihood of funding either. But the ranking that the District's staff elaborates is a good predictor for the dependent variable. Not surprisingly, projects with higher ranking are more likely to be funded. The level of activity of the leading organization—measured by the number of projects in which the organization participates—is also a good predictor of changes in the dependent variable. Organizations that are more active in projects are more likely to get funds for those that they lead.

Table 1. Determinants of Project Success (Funding Granted)

	Coefficient (Standard Error)
Number of organizations participating in project	3.25*** (1.25)
Structural holes efficiency (avg. for participants in project)	18.13** (8.39)
N. orgs. participating in project × struct. holes eff. (avg. for participants in projects.)	–4.66*** (1.80)
N. of projects in which the respondent's org. participates	0.13*** (0.05)
Freq. of contact with partners (avg.)	–0.54 (0.72)
District as a partner	1.07 (0.94)
Freq. of contact with district	0.79 (0.59)
Project ranking	1.09*** (0.38)
Project budget	7.55e–08 (5.84e-08)
Constant	–18.43*** (6.81)
Number of obs = 92	
Wald $chi^2(12)$ = 23.27	
Prob > chi^2 = 0.005	
Log pseudolikelihood = –33.36	
Pseudo R^2 = 0.30	

$^{***}p < .01$, $^{**}p < .05$ (2-tail). Errors clustered by Respondent's Organization ID.
Note: An alternative estimation of this model included a variable capturing the average number of projects in which the partners participate to account for the possibility that projects get a higher likelihood of being funded when all the organizations participating in it are more active overall. The coefficient was positive but not significant, hence indistinguishable from 0. The remaining coefficients in the model performed very similarly, maintaining the direction, overall magnitude, and levels of significance. Results are available from this author upon request.

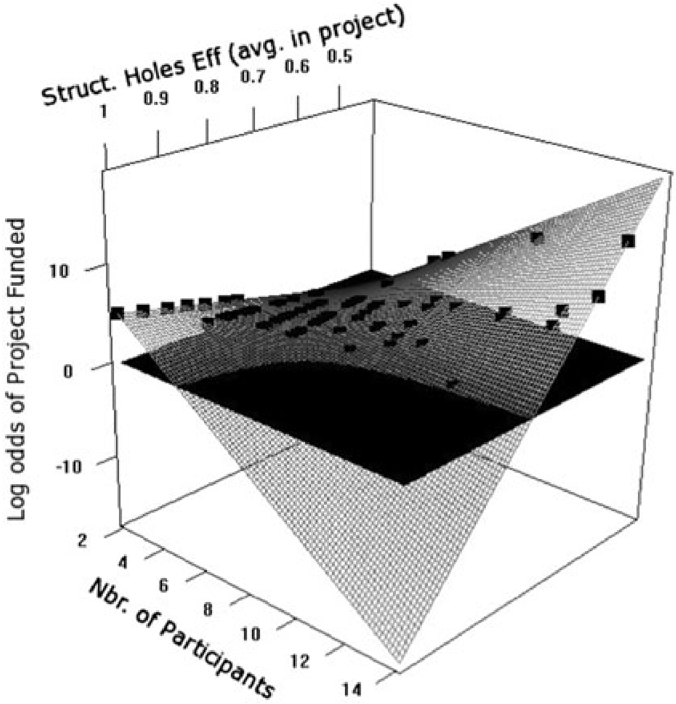

Figure 3. Marginal Effect of Number of Participants on the Log Odds of a Project Being Funded Conditional on the Structural Holes Efficiency (Average for Participants).

To provide a more concise interpretation of the main results, I present the effect of the interaction term on the log-odds of a project being funded in Figure 3.[6] In order to calculate this effect, I fixed all the independent variables in the model to their means, except for the variable "District as a Partner," which I set to its modal value of 1 (the District is identified as a partner in the project). In so doing, I try to illustrate a "typical" CFI project and its odds of getting funded.

The bottom x-axis shows the range of values for the number of participants in the project, while the top y-axis contains the range of values for the average score of structural holes efficiency. The vertical z-axis contains the log-odds ratio of a project being funded. The transparent plane shows the conditional effect of the independent variables given their interaction with each other and holding all the variables in the model at the values described above, while the black plane running through the middle marks the 0 point for the log-odds where the probabilities of getting funded or being denied funds are equal (0.5). The area above that plane is associated with the probability of a project being funded being greater than 0.5 while the area below represents a probability lower than that number. Finally, the black dots in the plane mark the actual positioning of the projects according to how they score in the two variables. It is worth noticing that none of the projects fall below the black plane, so while the interaction term predicts a negative relationship over some potential ranges of the data, these do not occur in practice.

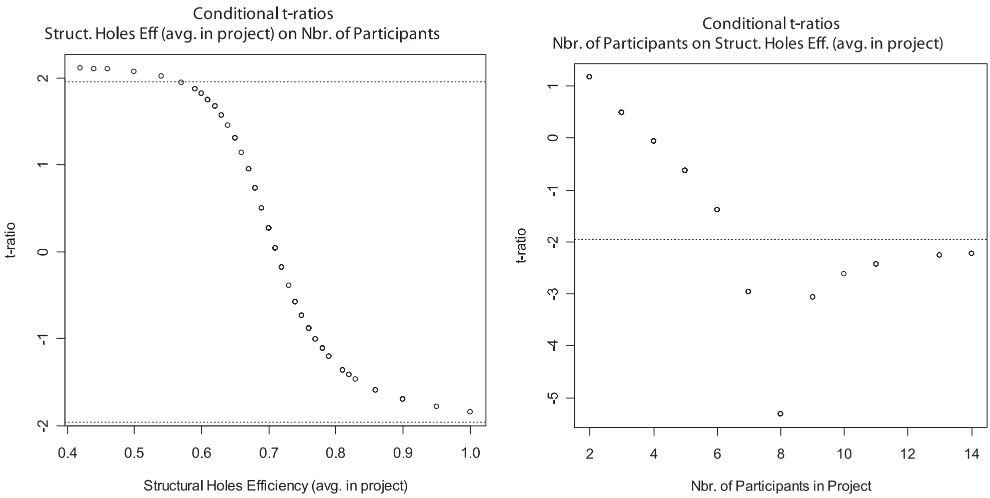

Figure 4. Conditional t-Ratios of the Two Components in the Interaction Term.

A larger number of partners in a project results in an increase in the likelihood of getting a project funded, as was predicted in hypothesis 1. More partners mean more resources that can be used to improve the quality of the applications that are presented to the District's basin boards. However, the interesting story that these results tell is that the positive relationship between the number of participants in the project and the log odds of getting the project funded becomes stronger only when there are many participants in the project who do not score, on average, high values in the measures of structural holes efficiency, in support of the prediction of hypothesis 3b. In other words, success is more probable for large collaborative initiatives when the leading organization does not need to process lots of new resources that are brought in by partners who fill structural holes in the project. As a general rule, leading organizations are more likely to be successful when partners collaborate with each other in other projects as well (when they are redundant).

Figure 4 shows the conditional *t*-ratios of the interaction terms, which indicate that the interaction relationship is significant when there are at least seven organizations participating in the project and the average value of structural holes efficiency is lower than 0.6. When the number of partners grows beyond seven, the odds of getting the project funded decline *if* the average value of structural holes efficiency for the partners increases.[7] This corresponds to the area in the top right of Figure 3. The District responds favorably to larger projects until the number of participants reaches a threshold. After this threshold has been reached, likelihood of funding increases only if the participants in the project partake in an overlapping structure of membership in other projects, which reduces their scores of structural holes efficiency.

The positive coefficient for the structural holes efficiency variable indicates that the leading organizations in the projects derive benefits from the potential to use resources that are considered novel or nonredundant and that are brought into the project by partners who span structural holes. However, the negative interaction between this variable and the number of partners shows that at some point the complexity that is added by attracting partners that span structural holes results in project proposals that become less likely to be successful in terms of securing funds from the District. Increasing the number of partners in collaborative practices is beneficial as long as it is guaranteed that the partners will not add unmanageable complexity by feeding new resources that the lead agency is not prepared to process effectively.

This is in itself a valuable lesson for the community of scholars interested in the study of how organizational behavior is shaped by the interactions among organizations that exchange resources; there is a limit to the benefits of engaging in collaborative activities with more and more partners, and that limit is given by the increasing complexity that an organization is likely to face when the partners provide large amounts of nonredundant resources that need to be processed effectively to achieve certain goals.

Conclusion

This study is an initial attempt to understand how the networking capabilities of partners involved in informal collaborative efforts might affect the chances of success of these efforts. I have stated and tested four hypotheses of how inter-organizational networks matter for actors who participate in collaborative processes. The baseline hypothesis is that collaborative efforts are more likely to succeed when the leading organization can secure the assistance of a larger number of partners who provide valuable resources. Results provide empirical support for this theoretical expectation.

An important extension is that success is even more probable for large collaborative initiatives when the organizations whose assistance is secured concentrate their connections in a relatively redundant set of members of the network—when the leading organization does not need to process large quantities of new resources that are likely to be generated if the partners' participation in projects is not overlapping. Having access to more nonredundant resources through collaborative partners is a good thing, as long as that access does not overload the resource-processing capacity of the leading organization.

In general, I argue that the results and the overall approach of this article are important for two main reasons. First, they address theoretical expectations through the analysis of collaborative links in the overall network of interactions developed by organizations involved in the CFI. In this sense, they help us get beyond the purely metaphorical use of the term *network* that is so common in public policy studies (Berry et al., 2004). Second, the results are important because they identify some *specific conditions* under which organizational actors can improve the likelihood of obtaining support from central actors who occupy leadership positions in programs such as the CFI—an example of the type of program that has become the rule to foster cooperation in the American federal system (O'Toole & Meier, 2004). At least in the context of the informal collaborative efforts that I study here, merely attracting more partners is not a wise strategy to follow in order to improve performance if those partners extend their own collaborative links to distant, relatively disconnected parts of the network. Resources flow and need to be processed, and if they are nonredundant, the organization in charge of processing them may find it difficult to do so effectively. Managers need to be aware that more collaboration is not *per se* a guarantee for better performance, and that under certain circumstances it can actually reduce the organization's effectiveness in reaching its goals.

Despite offering this initial evidence on how the networking activities of actors affect their performance, this work has a number of limitations. First of all, the research design does not capture the entire "ecology of games" in which organizational actors play their collaborative cards (Lubell et al., 2009). The CFI is only one item in the larger menu of collaborative programs in southwest Florida, and the performance of an organization in this program might be affected by the organization's participation in other, similar programs. Future research needs to account for the complexity of the policy arenas in which actors participate by exploring how collaborative behavior develops as a result of interactive behavior in multiple settings.

Second, the data that I use in this analysis do not provide enough detail to assess how much the resources in the network really flow among its nodes. One of the assumptions of this work is that the shared participation in certain initiatives favors the transference of resources among partners. Of course, it is very likely that this transference exists in the context of shared participation in projects, but we remain largely ignorant about the quality or quantity of such distribution of resources. In addition, despite the control variables that have been included in the model, our understanding of how certain organizational characteristics may affect performance is not clearly enhanced. For instance, it is not possible, with the available data, to sort out how the decisions made by the District are affected not only by the way the applicant organization interacts with others, but also by the way different resources flow *inside* the organization preparing a project.

Finally, the network I studied here is a realization of a specific type of collaborative environment, one where a governmental actor sets the rules of participation and assumes a central role of leadership, but where the participant nodes link to each other in a mostly informal way, rather than by following a central mandate to collaborate with each other. It would be interesting to know if the findings presented here remain robust in different settings, like in the case of centrally managed networks of interorganizational service provision that are so prominently explored in policy studies (Agranoff & McGuire, 2003; Graddy & Chen, 2006; Provan, Huang, & Milward, 2009; Provan & Kenis, 2008).

Overcoming these limitations will bring us closer to our final goal of understanding the conditions under which collaborative behavior renders the greatest benefits for the actors embedded in the fragmented policy arenas of American federalism.

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Notes

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1. For a clear description of how the capacity to mobilize resources may affect the performance of an organization, see Sandström and Carlsson (2008).
2. It is worth noticing that there is one way in which this application of the notion of structural holes departs from the original one proposed by Burt. In his work, Burt emphasizes the benefits that an actor gets when filling a structural hole, while in this research I focus on the benefit an actor gets when connecting to those actors who fill the holes. One could say that Burt's approach is "ego-centered" whereas the one offered here is "alter-centered." The implicit assumption here is that the organizations that design projects and connect to brokers benefit because the brokers will share the nonredundant resources to which they have access by the nature of their participation in other projects. In this sense, the collaborative nature of the program I study contrasts sharply with the competitive environments that serve as background for Burt's theory.
3. There are almost 19 million people currently living in Florida, and this number is expected to climb to approximately 25 million by 2030 according to the Demographic Estimating Conference Database. For more information on demographic composition in the State of Florida, visit the website of the "Office of Economic & Demographic Research" of the Florida Legislature at: http://edr.state.fl.us/conferences/population/demographic.htm (last accessed January 23, 2009).
4. This research was funded by the National Science Foundation (SES-0519459). A total of 138 projects applied for funding in December of 2006. The 92 projects for which there is complete data available represent 66.6 percent of the total number of 138.
5. Descriptive statistics for all the variables in the model are contained in Table S1 in the Appendix.
6. The figure was produced with the rgl 3D visualization device system available in R (Adler & Murdoch, 2009).
7. An interesting parallel can be drawn between this finding and the experimental results reported over half a century ago by George Miller on the ability of the human mind to process new information (Miller, 1956). Specifically, he found that human subjects can simultaneously process a limited number of pieces of information when using their short-term memory. The number of chunks of information that can be processed effectively is seven!

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Appendix

Table S1. Descriptive Statistics

	Mean	St. Dev.	Min	Max
Project funded	0.78	0.41	0	1
Number of organizations participating in project	5	2.83	2	14
Structural holes efficiency (avg. for participants in project)	0.71	0.10	0.42	1
N. of projects in which the respondent's org. participates	6.30	5.99	1	29
Freq. of contact with partners (avg.)	2.60	0.61	1	4
District as a partner	0.73	0.45	0	1
Freq. of contact with district	2.92	0.85	1	5
Project ranking	3.99	1.07	1	5
Project budget	3,937,576	9,709,712	1,000	6.14e + 07