

# The Impact of FGDC Grants upon the Success of Metadata Clearinghouse Projects: Do Grants Really Make a Difference?

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**Abstract:** *This article examines the role of government grants in the creation of metadata clearinghouses by organizations that received financial help from the Federal Geographic Data Committee (FGDC) over the period from 1994 to 1999. The results of a postal survey of FGDC grant applicants are presented. The survey included a sample of successful and unsuccessful applicants, and covered the lifespan of FGDC's metadata program from 1994 to the present. A sample of eligible organizations that did not apply for FGDC grants was also included in the project. Our findings suggest that successful applicants typically operate with larger in-house geographic information system units than their unsuccessful counterparts. The data also point to a significant relationship between proposal success and the extent of external collaboration during the grant-writing process. From a public policy perspective, our data suggest that large organizations often do not need external grants, whereas small organizations are highly grant-dependent. The article concludes with a brief discussion of the extent to which social benefits might be maximized by funding smaller rather than larger applicants.*

## Introduction

Public agencies that provide grants to organizations such as universities or local planning units have an inherent interest in assessing the extent to which funded projects represent good value for money. In many cases, moreover, such agencies might also want to know whether specific projects would have proceeded in the absence of grant funding. While most funding agencies are confronted with this type of contingency problem, very little empirical work has been carried out on the extent to which grants really make a difference. For example, there is little doubt that certain types of projects would never be undertaken in the absence of external support (the present article is a good example). On the other hand, grant applicants that fail to obtain outside funding might proceed with their original proposals regardless (especially for innovative or important projects). In between these extremes lie multiple positions, several of which ought to be of interest to both grant applicants and funding agencies. For instance, applicants that fail to obtain outside support could modify their original project in favor of a diluted version, seek alternative funding, cancel the project, or proceed with the project in its entirety (perhaps at a slower pace than initially hoped). One might also ask what the successful applicants would have done if funding had been denied?

This article examines the role of government grants in the creation of metadata clearinghouses by organizations that received financial help from the Federal Geographic Data Committee (FGDC) over the period from 1994 to 1999. Data for the inquiry come from a postal survey of FGDC grant applicants (both successful and unsuccessful). The survey was conducted by the National Center for Geographic Information and Analysis (NCGIA) at the University at Buffalo during the Summer of

2000. Three main questions are addressed in the analysis. First, what factors best discriminate between successful versus unsuccessful grant applicants? Second, to what extent do government grants contribute to project development? And third, what types of organizations benefit the most from external grants? The overall goal of the article is to evaluate whether or not government grants make a difference to applicants. However, it should be emphasized that we do not purport to test any theoretical perspectives in this article. Additionally, we do not wish to imply that our survey was structured to test specific hypotheses. Instead, the survey was designed with hands-on input from FGDC (the client), with a goal to maximize the ability to draw policy implications from the responses.

This said, we did have a number of general expectations during the design stages of the project. First, we expected to find a positive relationship between applicant size (e.g., geographic information system (GIS) employment) and successful grant proposals. The logic here is that larger organizations can allocate stronger resources to the grant development process than smaller applicants. Second, we anticipated a negative relationship between successful proposals and the degree of academic involvement in the grant submission process (discussed later). This is because previous research in the GIS area has shown a tendency for academics to work on high-risk ventures in radically new areas (i.e., there is significant potential for project failure). Third, we expected that an important dimension of project success would come in the form of "spillover" to other organizations (e.g., demonstration effects). Finally, we expected that successful projects would generate significant levels of post-grant spending by applicants. In effect, we anticipated positive spending multipliers by successful applicants.

Beyond these general expectations, however, we should concede that the project was exploratory in nature. Our primary goal was to satisfy our client (the FGDC) and provide them with recommendations regarding future FGDC grants. However, we believe that in some cases the results have turned out to be of broader interest to the GIS community, and thus we present them here. Prior to a discussion of the survey results, however, it is first necessary to provide a research context for the article.

## Research Context

The FGDC is an interagency commission that was formed in 1990 by the Office of Management and Budget (OMB) under OMB Circular A-16. The FGDC was established to deal with a proliferation of GIS data within Federal agencies in the hope that efficiency could be achieved through coordination and data sharing. The mission of FGDC is to coordinate geospatial information activities within the United States Federal government. FGDC is chaired by the Secretary of the Interior and during the 1990s high visibility was given to GIS and geospatial data. The main purpose of FGDC is coordination across Federal agencies and between the Federal government and governments at other levels. The FGDC has taken the lead within the Federal government on the development, approval, and maintenance of standards for geographic data and for metadata.

On April 11, 1994, the National Spatial Data Infrastructure (NSDI) was established by Executive Order 12906. The purpose of this was to establish "a coordinated National Spatial Data Infrastructure to support public and private sector applications of geospatial data in such areas as transportation, community development, agriculture, emergency response, environmental management, and information technology" (Clinton 1994). The Executive Order charged the FGDC with the responsibility to implement NSDI. In addition to activities within the Federal government, FGDC is also charged to encourage participation by state, local, and tribal governments in the building of the NSDI.

To promote participation among state, local, and tribal governments and other sectors of society in building the NSDI, FGDC initiated a series of seed money programs. In September of 1994, FGDC awarded nine Competitive Cooperative Agreements Program (CCAP) grants, which totaled \$225,000 (Federal Geographic Data Committee 1994). The seed money programs expanded in subsequent years, and the program requirements also were modified, with special topic competitions as well as general ones. Many of the programs were directed toward establishing local nodes in the NSDI clearinghouse.

In 2000, the NCGIA received FGDC funding to assess the effectiveness of the NSDI grants program. While FGDC's seed money programs were found to be both cost-effective and successful (National Center for Geographic Information and Analysis 2001), we are not concentrating on the impact of these programs in this article. Instead, we focus on two important questions that were part of the NCGIA's approach toward the program evaluation process. Specifically, what would grant recipients have done

had they failed to obtain seed money from FGDC? And what did unsuccessful grant applicants do when they were denied FGDC support?

## Methodology

To evaluate the effectiveness of FGDC's NSDI grants program, the NCGIA conducted a postal survey in July 2000 of 207 organizations that received FGDC funding for metadata projects over the period 1994-1999. Postal surveys were also distributed to 132 grant applicants that failed to obtain FGDC support over the same period.<sup>1</sup> The survey of successful applicants was designed to elicit information on: (1) project outcomes and prospects; (2) the usefulness of individual initiatives to specific user groups; (3) the importance of FGDC funding to project success; (4) the nature of the GIS units that received funding; and (5) the current status of individual projects. The survey of unsuccessful applicants was designed to elicit information on: (1) whether or not the organization proceeded with the project described in the original proposal (or some variant of that project); (2) the usefulness of the project (if implemented); (3) the contribution of FGDC's grant review process to project design; and (4) the nature of the GIS units that applied for FGDC funding. As mentioned earlier, one of NCGIA's principal goals was to assess whether specific projects would have proceeded in the absence of FGDC funding. A related goal was to compare the relative success of funded versus nonfunded projects, notably in terms of sustainability, institutional commitment, subsequent investment, and user impact.

A total of 59 successful applicants provided valid responses to the first survey (giving a response rate of 28%), whereas 23 unsuccessful applicants responded to the second survey (giving a response rate of 17%). Although these are low response rates by almost any yardstick, the single most important reason for minimal participation in the survey was that many of the key contact people listed in FGDC's files could not be traced (several had changed jobs since the organization's last FGDC grant application, while others had changed positions within the organization itself). In short, the task of finding the right person to answer the survey proved problematic (the survey instrument was designed to be answered by individuals with a detailed knowledge of the project's origins, development, implementation, and/or completion). Given that some of these projects were completed as far back as 1995, it is not surprising that our survey did not generate a high response rate. While we received over 40 partially completed surveys in addition to the 59 valid returns, the partially completed surveys were unusable in light of the minimal information provided. Precisely the same problem was encountered with regard to the survey of unsuccessful applicants. Given this, it should be emphasized that our results are exploratory rather than conclusive.

This said, the sectoral distribution of respondents (both successful and unsuccessful) closely matches FGDC's applicant records in that project submissions mainly come from the government sector (47.5%), followed by academic institutions (29.3%), private companies (4.9%), and nonprofit organizations

**Table 1.** The Impact of FGDC-Supported Project upon Users\*

Impact Category	Mean Score
Ability to access information	4.28
Saving time for users	3.85
Simplifying the user's job	3.57
Assists in strategic planning	3.50
Contribution to decision-making	3.47
Improved data affordability	3.39
Promotes innovation among users	3.28

\* Scoring ranged from 1 to 5, with 1 being no impact at all and 5 being critically important impact.

(4.9%). In terms of sector mix, the sample resembles the broader population.

### Characteristics of Successful Applicants

Of the 59 successful applicants, 17 indicated that earlier research proposals had been submitted to FGDC. Thus, 42 (71%) of the respondents represent successful first-time applicants. Over 95% of the respondents indicated that a website related to their FGDC grant had been developed. All of these websites were active when this survey was conducted (Summer 2000). Fourteen respondents noted that other external grants had been obtained to support their FGDC-related project, although all of these "additional" grants were smaller than the original FGDC grant (i.e., in all 14 cases, the FGDC grant covered more than 50% of the initial external cost of the project). Approximately 50% of the successful applicants also noted that their project had exceeded the scope of the original proposal. The modal range of grant coverage for the sample of successful applicants lies between 50% and 59%. In short, FGDC support has typically covered roughly half of total project costs (excluding recurrent costs) for most applicants.

Virtually all of the respondents indicated that their projects were either "very important" or "critically important" to both internal and external users (80% fall into these two impact categories). A substantial majority (85%) of these respondents noted that the role of FGDC support in project success was either "very important" or "critical." Of course, these are self-assessments, and may be biased toward the more positive categories. In sum, FGDC support has been especially important to organizations that rated their project outcomes toward the high end of the impact scale. This said, roughly half of the respondents also felt that FGDC could have done more in terms of technical assistance and/or financial support.

### Project Impact

Ranked along a 5-point scale (ranging from 1 [no impact at all] to 5 [critically important impact], Table 1 summarizes how successful applicants rated their project outcomes from a user perspective. Respondents were asked to comment on their internal technical

**Table 2.** The Development of New Capabilities Among Grant Recipients

Capabilities Not Present Before, But Present Now Among Successful Applicants	Number	Percent
Metadata clearinghouse	29	49.1
Contribute to regional data efforts	21	35.6
Develop data jointly with others	20	33.8
Develop framework data	19	32.2
Map server via Internet	19	32.1
Metadata software	18	30.5
Share data with outsiders	18	30.3
Metadata collection	16	27.1
Meet to discuss data with others	10	16.9
Internet connectivity	9	15.2
Use outside data sources	3	5.1

**Table 3.** Inputs to Project Success Among Grant Recipients\*

Contribution Category	Mean Score
FGDC funding	4.76
In-house expertise	4.37
Project team	4.25
External collaborators	3.66
FGDC feedback on proposals	2.91
External funding (non-FGDC)	2.74
Academics	2.37
Student interns	2.33
Private consultants	1.75

\* Scoring ranged from 1 to 5.

capabilities and/or activities prior to receiving FGDC support versus their post-grant capabilities/activities (i.e., a before-and-after approach). The results are shown in Table 2 (only cases where a change occurred are listed). Ranked along a scale similar to that described above, Table 3 shows how respondents rated the contribution of specific inputs to project success. FGDC stands out as the single most important external input (a mean score of 4.76 on FGDC funding), while internal inputs to project success also score highly (greater than 4.0). 2

At least three additional issues are evident from the survey data. First, organizations that ranked the contribution of FGDC assistance in a strongly positive light were more likely to report high levels of positive outcomes for projects, to indicate that outcomes and/or project scope exceeded initial expectations, and to depend upon FGDC for at least 50% of total project costs.

Second, 71% of the successful applicants indicated that some variant of the original project would have proceeded in the absence of FGDC funding. Of course, this is a hypothetical question, and the responses must be interpreted in that context. However,

**Table 4.** Differences Between Successful and Unsuccessful Grant Applicants

Attributes	Group Means		P Value (t-tests)
	Successful n = 59	Unsuccessful n = 23	
a. GIS employment	10.1	4.4	0.019
b. Collaborators (people)	6.3	3.1	0.018
c. Collaborators (agencies)	4.1	2.2	0.036
d. Importance of FGDC feedback *	2.9	1.6	0.002
e. Importance of academics *	2.4	3.6	0.008
f. Project sustainability *	4.1	3.4	0.020 **

- a. Number of GIS personnel in the unit that submitted the grant proposal.
- b. Number of external collaborators involved in preparing the proposal.
- c. Number of external agencies involved in preparing the proposal.
- d. Perceived importance of FGDC feedback on the proposal.
- e. Perceived importance of academics to proposal preparation.
- f. Perceived long-run sustainability (>10 years) of the project.

\* Ranked along a 5-point scale, ranging from 1 (low) to 5 (high).

\*\* T-test for the unsuccessful group contains only the 12 organizations that proceeded with some variant of the original proposal.

we should assume that, at least in most cases, respondents truly expected the contingent outcomes that they reported. Of those reporting that the project would have proceeded without FGDC support, 44% (n = 26) indicated that a project of reduced scale and/or scope would have proceeded, 1.7% (n = 1) noted that an identical project would have proceeded (albeit at a slower pace), while 25% (n = 15) implied (via written responses) that some variant of the original proposal would have been implemented (typically with redefined goals in terms of available financial resources). These data suggest that FGDC support plays an important role in helping organizations to proceed with full-scale projects (as defined by the original proposals).

Third, 64% (n = 38) of the respondents indicated that their projects had created spillovers to other organizations (i.e., specific initiatives were either replicated or complemented by nearby agencies). This is important, in that one of FGDC's goals is to promote the creation of metadata initiatives via demonstration effects.

Fourth, successful applicants ranked the long-term sustainability (beyond 5 years) of their projects according to the following perceived classes: "high sustainability" (46%) or "very high sustainability" (34%). In other words, 80% of the organizations that received FGDC support were confident that their projects could be sustained over the long term.

### Characteristics of Successful and Unsuccessful Applicants

Table 4 presents some of the main differences between the groups of applicants. In this article, successful applicants are referred to as "winners" and unsuccessful applicants are referred to as "losers." T-tests revealed that winners typically operate with larger in-house GIS units (p = 0.019), as well as larger numbers of external collaborators (p < 0.05). As a group, the winners employed an average of 10 GIS specialists, compared to less than 5 among the losers. In terms of external collaborators, moreover, winners generally operate with three times as many outside partners as losers. Perhaps not surprisingly, winners ranked the importance of FGDC feedback on grant applications more highly than losers (p = 0.002).

More interesting, perhaps, is the fact that losers indicated a stronger degree of dependence upon academics than winners (p = 0.008). Here, the data were obtained from a 5-point scale regarding the importance of specific sets of internal and external inputs to the development of grant proposals (ranging from 1 [no importance whatsoever] to 5 [critically important]). While a variety of sources were specified in the survey instrument, the only significant difference between winners and losers turned out to be the perceived importance of academics (we shall return to this point presently).

Table 4 also shows that winners ranked the long-run sustainability of their projects more highly than losers that proceeded with some variant of their original FGDC proposal (n = 12).

**Table 5.** The Role of Academics and Geographers in Proposal Success and Controlling for Applicant Size\*

	Winners	Losers	Total	
Were academics involved in the FGDC proposal?				
Yes	1 (0)	9 (8)	10	Chi2 = 21.6 p < 0.01
No	58 (9)	14 (9)	72	
Does the GIS unit employ a geographer?				
Yes	27 (5)	5 (1)	32	Chi2 = 4.1 p = 0.045
No	32 (4)	18 (16)	50	
Total	59 (9)	23 (17)	82	

\* The numbers in parentheses indicate the number of small applicants (those applicants with fewer than 10 GIS employees).

This is interesting in at least two respects. First, no significant differences emerged between winners and losers in terms of several other metrics of project success, including scaled measures of user impact (both internal and external), spillovers to other organizations (i.e., demonstration effects), and in-house investment in project start-up (for a detailed discussion of these impact categories, see National Center for Geographic Information and Analysis 2001). Over the long-run, however, winners appear to operate with projects that are easier to sustain. This suggests that FGDC's grant-screening process is effective.

Nevertheless, one of the more curious findings reported in Table 4 is that academics are used more heavily by losers than by winners. This is analogous to what we term the "Hartung paradox." Recent empirical work on the innovation performance of the commercial GIS sector (Hartung 1997, Hartung and MacPherson 2000 and 2001) suggests a statistically significant but negative relationship between successful product development and the degree of industry-university interaction. In short, academics are associated with project failure. A similar relationship would seem evident in the case of FGDC grant applicants. Why is this?

**Table 6.** Logistic Regression: Successful versus Unsuccessful Applicants

Independent Variables	Odds Ratio	Significance
GIS employment (<10 or 10 or more)*	4.24	0.005
Employment of geographers (yes or no)	3.41	0.006
Use of external collaborators (yes or no)	2.61	0.042

  

Classification (E)	Successful	Unsuccessful	Total	Percent Correct
(O) Successful	55	4	59	93.2
Unsuccessful	5	18	23	78.2

\*Overall classification efficiency = 89.0%.

A first step toward answering this question can be gleaned from Table 5, which cross-tabulates our FGDC applicants (winners/losers) against the incidence of academic involvement (yes/no). Table 5 also indicates whether or not applicants employed a professional geographer at the time of the grant proposal (yes/no). The results indicated that failure is strongly associated with academic involvement ( $p < 0.01$ ), whereas success is positively associated with the presence of a geographer ( $p = 0.045$ ). Interestingly, only one of the nine losers that forged academic links employed a geographer at the time of the FGDC application. In this regard, a significant but negative  $2 \times 2$  association emerged between academic involvement and the employment of a geographer (chi-square = 6.91;  $p = 0.031$ ). More simply, applicants that employ geographers are less likely to seek academic help for proposal development.

One possible reason for these patterns is that losers are typically much smaller than winners, notably in terms of GIS employment. This implies a relative shortage of in-house technical skills. To an extent, then, recourse to academics may simply reflect weaknesses that flow from the limited scale of failed applicants (a similar effect has been reported by Hartung and MacPherson 2000). This interpretation is reinforced by the fact that virtually none of the unsuccessful applicants had geographers on staff to support their FGDC grant submission. The academic linkage paradox, as originally described by Hartung (1997), was ultimately explained by two important covariates (company scale and project risk). While we can point to a negative relationship between GIS employment and academic interaction, we are not in a position to assess project risk in the context of the present study. Having said this, Hartung (1997) found that GIS companies often forge links with academics for complex, ambitious, and/or high-risk projects. Such projects typically entail the use of radically new technical concepts or procedures. Perhaps our failed applicants were simply too ambitious? 4

### Predicting Winners and Losers

Table 6 presents a logistic regression model that expresses proposal success as a function of three sets of binary variables, including the presence of a geographer (0 = no; 1 = yes), GIS employment (0 = below 10; 1 = 10 or more), and the presence of external col-

**Table 7.** Project Scenarios and Outcomes (Successful versus Unsuccessful Applicants)\*

Without FGDC funding, the project would have been (or was):	Successful		Unsuccessful	
	%	No.	%	No.
Abandoned altogether (project cancellation)	19	32.2	11	47.8
Radically re-designed (new variant)	12	20.3	5	21.7
Implemented fully, but at a slower pace	1	1.6	1	4.4
Implemented partially (reduced scale or scope)	26	44.0	5	21.7
Implemented fully (on time, with no cutbacks)	1	1.6	1	4.4
Total	59	100.0	23	100.0

\* The hypothetical impact of a failed FGDC grant application is the “scenario,” and the actual impact of a failed FGDC grant application is the “outcome.”

laborators (0 = no; 1 = yes). While several other variables were also tested (e.g., sector membership, recourse to professional grant writers, the degree of management involvement in proposal development), our best model contained only the three variables mentioned above. Together, these variables correctly allocated 89% of the cases to their proper categories. More specifically, the model correctly classified 93% of the winners and 78% of the losers. Of the four winners that were misallocated (i.e., predicted as losers), three employed fewer than five GIS workers and had no external collaborators, while one had external collaborators but no geographers. All of the five losers that were predicted as winners scored positively on each of the independent variables.

Looking at the odds ratios for the predictor variables (all three of which are significant at  $p < 0.05$ ), GIS employment emerged as the strongest factor. Specifically, the odds of submitting a successful FGDC proposal increase by a factor of 4.2 as the applicant’s status moves from small (fewer than

10 GIS employees) to large (10 or more GIS employees). In a similar vein, the probability of success increases by a factor of 3.4 by adding a geographer to the GIS unit. Finally, the results indicated that the odds of success improve by a factor of 2.6 as applicants move from non-collaboration to active collaboration. Almost 90% of the time, then, success can be predicted by GIS employment, the incidence of external collaboration, and the presence of a professional geographer.

### Scenarios: The Contingency Problem

As a further step in the analysis, winners and losers were compared in terms of several conditional questions that were posed. Among winners, for example, we asked for an assessment of what would have happened in the absence of FGDC funding. Among losers, we asked what actually did happen. While there are serious limitations to this approach (i.e., data reliability), we believe that our results offer insights that are worth thinking about.<sup>5</sup> A summary along these lines is shown in Table 7. Among winners, 32% ( $n =$

19) indicated that their project would have been abandoned in the absence of FGDC support, whereas 47% ( $n = 11$ ) of the failed applicants stated that their plans were terminated after failing to obtain FGDC funding. Among successful applicants, 68% noted that some variant of the original project would have proceeded if FGDC assistance had been denied (the comparable proportion for unsuccessful applicants was 53%). Clearly, then, failure to obtain external grants does not necessarily kill projects, although it does seem to slow them down and/or encourage diluted versions.

Keeping this context in mind, Table 8 compares the two groups in terms of scenarios (winners) and outcomes (losers). Among winners, the mean GIS employment size of the 19 applicants that would have canceled their projects is collated against the mean GIS employment size of the 42 applicants that would have proceeded regardless. The t-test for this contrast is significant ( $p = 0.015$ ). Specifically, applicants that pointed to a “cancellation scenario” were almost 3 times smaller than their counterparts that would have proceeded without FGDC funding. While no significant contrast emerged along these lines among losers, it is noteworthy that the mean GIS employment size under the cancellation category is close to identical for both winners and losers (i.e., slightly fewer than five workers). An important implication is that external grants play a critical role in the project development efforts of smaller applicants. Put another way, most of the sample’s larger applicants would have implemented their projects without an FGDC grant.

Keeping this point in mind, it should be noted that there is no significant difference in the amount of grant money requested by winners versus losers (or by the “cancellation” versus “proceed” categories). The same holds true in terms of the contribution of FGDC grants to total project expenditures (i.e., grants are typically requested to cover around 50% of total costs). Equally important, no significant differences emerged in terms of the project effectiveness ratings reported by successful applicants that would have abandoned their projects without FGDC help

**Table 8.** Applicant Size (GIS Employment) by Project Cancellation (Scenario plus Outcome)\*

Project Status	Successful	Unsuccessful	Total
Cancel the project	19 (4.8)	11 (4.5)	30 (4.7)
Proceed with project	40 (12.5)	12 (4.3)	52 (10.8)
T-test**	p = 0.015	0.929	0.018

\* The numbers in parentheses indicate the mean GIS employment per group.

\*\* T-test significance levels are for column contrasts (GIS employment).

versus successful applicants that would have proceeded regardless. More simply, smaller applicants that received FGDC grants implemented metadata projects that matched those of larger applicants in terms of several measures of project effectiveness.

### Characteristics of Non-Applicants

To give a sense of why different types of eligible organizations did not apply for FGDC funding over the 1994-1999 period, we conducted a stratified survey of non-applicants within FGDC's main applicant classes (for methodological details regarding the selection process, see National Center for Geographic Information and Analysis 2001). The non-applicant sample included 50 educational institutions, 52 state agencies, 48 counties, and 5 tribal governments (replicating the sectoral distribution of applicants).

Of the 155 surveys mailed, valid returns were obtained from 59 non-applicants (giving a response rate of 30%). Respondents included 19 educational institutions, 18 state agencies, 21 counties, and 1 tribal government. This distribution broadly matches FGDC's main applicant classes.

No significant sectoral differences were found in terms of three major variables: the reasons for non-applicant status; future intentions regarding FGDC grants; and the types of GIS software employed within the responding unit. Further, no significant differences were found between the applicants versus the non-applicants in terms of organizational size (including GIS employment), occupational structure, and internal capability (as measured by the range of software employed). Non-applicant respondents look more like successful applicants than failed applicants, notably in terms of size and occupational structure. At first glance, then, it is not possible to characterize non-applicants as being smaller or less sophisticated than successful applicants. If anything, in fact, the two groups look remarkably similar.

Across all of the sectors represented, the principal reason for non-applicant status was that the organization was unaware

that FGDC grants were available. Fully 61% (n = 37) indicated that this was the primary reason for not submitting proposals to FGDC (although a majority of these organizations were aware of FGDC's existence). Of the 37 organizations that did not know about FGDC's grant programs, 34 indicated that they intend to apply in the future. To an extent, then, the survey of non-applicants served two purposes: first, FGDC can expect to receive at least some new grant applications from the 34 organizations mentioned above, and, second, it is evident that FGDC needs to advertise its programs more effectively. While it is likely that FGDC's grant announcements reach non-applicants, it would seem that these announcements do not always reach the people that most need to be informed.

### Discussion

Some of the results presented above raise important questions regarding the contingency issue mentioned earlier. For example, most of the successful grant applicants indicated that failure to obtain FGDC support would not have resulted in project cancellation. Instead, most of these organizations would have proceeded with some variant of the original proposal. Among unsuccessful applicants, moreover, it is clear that failure to obtain external funding does not necessarily lead to project cancellation. This said, the survey data suggested that smaller applicants are more grant-dependent than larger applicants, while evidence presented elsewhere suggests that smaller applicants do not differ significantly from their larger counterparts in terms of several metrics of project success (National Center for Geographic Information and Analysis 2001). In light of this evidence, it would seem reasonable for funding agencies to consider the extent to which their financial resources really make a difference. Our evidence implies that the biggest impact can be obtained by funding proposals that come from smaller units that lack the in-house resources to proceed in the absence of outside support. Given that larger units are likely to implement clearinghouse projects with or without external

grants, the net societal impact of funding smaller units would presumably be more positive overall. Is this the case?

Our findings also raise questions for grant applicants. For example, working in isolation appears to be a poor strategy, in that external collaboration contributes significantly to the odds of success (hiring a geographer might make sense too). Given that small units cannot become large units without major internal investment, collaboration is essential. Even so, there is substantial literature in economic geography that points to a direct relationship between an organization's size and its ability to identify and/or network with appropriate collaborators (for a recent overview, see Hartung 1997). This may explain, in part, why small organizations are more likely to turn to the academic sector for collaborative inputs.

Regarding the interests of the FGDC, it is noteworthy that winners ranked the sustainability of their projects higher than losers. While the initial sustainability ratings were self-reported along a 5-point scale, stronger evidence for this contrast came from a more direct check: specifically, all of the winners had a metadata clearinghouse that was up and running at the time of the survey, whereas 7 of the 12 losers that claimed to have produced successful projects without FGDC funding did not have clearinghouses that we could find. Despite the speculative nature of our contingency analysis, then, there is at least some hard evidence that grants make a difference.

Of particular note is the fact that post-grant internal support for individual metadata projects averaged \$22,000 per annum over the study period. Several issues warrant attention with regard to this finding. First, there is no relationship between grant size and post-grant investment. Second, there is no relationship between applicant size and post-grant investment. Third, there is no relationship between applicant size and grant size. Fourth, there is no relationship between grant size and perceived levels of project effectiveness (including spillover propensity). A strategic implication is that smaller grants (delivered to smaller applicants) might represent a more effective way to distribute FGDC funds.

As an example, consider the following scenario (extracted from FGDC's files on grant funding by year). Our estimates suggest that the average FGDC grant over the period 1994-1999 was approximately \$40,000 (note that we were given detailed grant data by recipient for 1999 only). On this basis, a typical FGDC grant delivers a total of \$110,000 in post-grant investment 5 years after the termination of the grant (assuming average post-grant spending of \$22K per annum). The grant:postgrant spending ratio (1:2.75) suggests that the typical FGDC grant stimulates almost three times as much additional spending over a 5-year horizon (note that most applicants indicated that their projects would last at least 5 years). Second, small applicants indicated post-grant outlays of roughly \$20,000 per annum, compared to \$24,000 per annum among larger applicants (the difference is not statistically significant). Given that most of FGDC's larger applicants would have proceeded with some variant of their proposed projects regardless and that most smaller applicants would have

aborted their initiatives altogether, an implication is that smaller applicants should be given preferential status (subject, of course, to proposal quality). This prescription contradicts the popular notion that large grants deliver better payoffs.

## Conclusions

FGDC's initiatives to support the NSDI appear to be effective, in that all of the grant applicants that obtained funding over the 1994-1999 period have clearinghouses that are now fully operational (note that some of these clearinghouses were under construction during the immediate post-survey phase of our study). Although more than 65% of the successful applicants stated that they would have proceeded with some version of their original proposal without FGDC support, a majority indicated that their projects would have taken longer to implement. The project effectiveness ratings differed little between those successful applicants that said they would have abandoned their plans in the absence of FGDC help and their counterparts that would have proceeded without a grant. Other things being equal, an implication is that allocating funds toward smaller applicants might deliver wider social benefits.

This interpretation must be tempered by the fact that our measures of project effectiveness were perceptually based (and self-reported by respondents) rather than grounded in cost-benefit analysis. Nevertheless, we believe that our survey results have broader implications for the academic community as a whole. Specifically, some grants are not needed (the research would have taken place regardless), some grants are helpful but not critical (the research would have taken place eventually), while other grants are essential (the research would not have taken place at all). Assuming that all grant applications are equal in terms of societal importance, policy efforts to focus upon the latter category would seem warranted. Evidence presented earlier suggests that grants make a substantial difference to small applicants that lack in-house financial and/or technical resources. From a social cost-benefit perspective, then, the task remains to assess the potential impact of supporting small versus large applicants.

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## Footnotes

- 1 Over this period, the overall success rate for grant applicants was 6%. The average grant amounted to \$40,000, typically with a 50% match from the applicant's organization.
- 2 Averages for ordinal scales are reported throughout this article. We assume that respondents treated items on our various 5-point scales as being equally different.
- 3 Defined as a BA or post-BA graduate with a major in Geography.
- 4 Hartung's (1997) research also suggested that small GIS companies with academic linkages were often younger than average, and more likely to be staffed by risk-oriented individuals with ambitious technical goals.
- 5 It should be acknowledged that our analysis may be biased due to a common-method variance problem that is sometimes present when assessing the responses of winners versus losers across variables that require perceptually based answers.