

Evaluation of FGDC's NSDI Grants Program

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Executive Summary

This report describes the results of a postal survey of organizations that applied for FGDC metadata clearinghouse grants over the period 1994- 1999. The main goal of the survey was to evaluate the effectiveness of FGDC's grants program. A further goal was to compare the characteristics of successful versus unsuccessful applicants, as well as non-applicants. Key findings include the following:

Among successful grant applicants:

- 95% indicated that the FGDC grants program had contributed significantly to the success of their metadata projects.
- post-FGDC-grant investment in project development/maintenance averaged \$22,000 per annum per applicant.
- more than half of the grant recipients indicated that their FGDC- related project had created spillovers to other organizations (demonstration effects were positive).
- FGDC grants typically covered between 50-60% of project costs for most applicants.
- most applicants were from the government sector, with few from the private sector.
- FGDC grants were ranked highly in terms of their contribution to project success.
- most grant applicants (71%) were first-time applicants.
- all of the successful applicants have established web-based clearinghouses to support metadata dissemination.
- a majority of the organizations that were surveyed intend to apply for FGDC funding in the future.
- most applicants would have proceeded with their projects in the absence of FGDC support, albeit at a slower speed or at a reduced scope.
- 32% indicated that their project would not have proceeded without FGDC funding (most of these applicants operate with very small GIS units).
- the chief benefit of FGDC-funding is that it supports full-scale projects

Among unsuccessful grant applicants:

- unsuccessful applicants typically employed smaller numbers of GIS personnel than successful applicants (this contrast is statistically significant).
- approximately half of the organizations that were denied FGDC funding proceeded with some variant of their original proposal.
- because of their limited in-house resources (GIS expertise), unsuccessful applicants were more likely to seek outside help from professionals in other organizations, including private consultants, academics, and other collaborators.
- most of the unsuccessful applicants intend to apply for FGDC support in the future

Overall, the picture that emerged from our analysis can be summarized as follows. First, FGDC grants contribute significantly to the development of metadata clearinghouses among successful applicants. The existence of a critical mass of in-house GIS specialists appears to be the chief discriminator between

successful versus unsuccessful applicants. Second, projects that were supported by FGDC were in most cases associated with spillovers to other organizations (demonstration effects). In addition, virtually all of these projects have been supported by post-grant investment from within the recipient organization itself. Third, FGDC grants have improved the in-house technical capacity (or broadened the range of in-house activities) of many of the grant recipients. Fourth, all of the successful applicants have created metadata clearinghouses. A substantial majority of the successful applicants ranked the importance of FGDC support either highly or very highly. Finally, the main reason that eligible non-applicants failed to submit proposals was that they were unaware of the existence of FGDC grants.

Section 1. Introduction

To evaluate the effectiveness of FGDC's NSDI Grants Program, the National Center for Geographic Information and Analysis (NCGIA) conducted a postal survey (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. 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. One of NCGIA's 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. In addition to the surveys mentioned above, 151 questionnaires were mailed to eligible organizations that did not apply for FGDC funding over the 1994-1999 period. The survey of non-applicants was designed to assess the reasons for non-applicant status.

A total of 59 successful applicants responded 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 relatively low response rates, both samples exhibit a sectoral distribution that closely matches FGDC's total pool of applicants. One reason for the low response rate among successful applicants is that appropriate contact people could not be traced. Given that the survey instruments were designed to be dealt with by individuals with a detailed knowledge of specific grant applications, the low level of survey participation can ultimately be explained by staff turnover (we received close to 100 responses indicating that people with a knowledge of the project(s) in question were no longer employed by the organization). This said, chi-square tests failed to uncover significant differences in the sector mix of respondents versus nonrespondents. In terms of sectoral coverage, then, our samples can be considered representative of the broader population.

Of the 59 respondents that received FGDC funding over the study period, 4 were recipients of multiple grants. Given that no significant variations emerged between multiple versus single-grant recipients, these

two groups were merged into a single category (i.e. successful applicants). Copies of the survey instruments that were mailed to successful and unsuccessful applicants can be found in Appendix 3. These instruments were tailored to reflect the year that the organization applied for its first and/or last FGDC grant.

The remainder of this report is structured as follows. Section 2 provides an overview of the main characteristics of FGDC applicants; Section 3 provides a description of those organizations that received FGDC funding; Section 4 provides a description of unsuccessful versus successful applicants; Section 5 presents a description of non-applicants; Section 6 offers an assessment of the effectiveness of FGDC's NSDI Grants Program; while Section 7 offers a series of policy suggestions for program modification.

Section 2. General characteristics of FGDC applicants.

Difference of means and/or chi-square tests revealed that successful applicants were broadly similar to failed applicants in terms of several variables, including: (1) sector membership; (2) the types of personnel employed to develop and/or implement GIS-related projects; (3) the types of GIS and/or statistical software packages used by GIS units within the organization; (4) awareness of FGDC's NSDI Grants Program; (5) the information sources that first drew attention to the existence of FGDC funding opportunities; and (6) the types of professional and/or academic specializations represented by personnel within the organization's GIS unit. To keep the description simple, then, the remainder of this section treats successful and unsuccessful applicants as a single group.

Sector membership.

Most of FGDC's grant applicants come from the government sector (52.5%), academic institutions (23.7%), State/Regional GIS Coordinators (10%) and non-profit organizations (5.1%). Other applicants include tribal governments (1.7%) and private industry (5.1%) (see Figure 1). A crosstabulation of sector membership by proposal status (funded versus declined) failed to implicate sectoral affiliation as a factor in successful grantsmanship. More simply, the sectoral distribution of successful versus unsuccessful applicants is close to identical.

Personnel involved in proposal development and implementation.

No statistically significant differences emerged between successful and unsuccessful applicants in terms of the types of personnel that were used for the development and/or implementation of GIS-related projects. For both groups, in-house staff and management personnel were the key actors in the development and implementation of proposals, along with external collaborators (i.e. personnel from other organizations). Approximately 20% of FGDC's applicants used private consultants for the development of proposals, 29% actively involved prospective users in the development of proposals, 30% used academics, while 0% employed a professional grant writer.

Section 3. Characteristics of Successful Applicants

Seventeen of the 59 successful applicants indicated that earlier research proposals had been submitted to FGDC. Thus, 42 (71%) of the respondents represent first-time applicants. Over 95% of the respondents indicated that a Website related to their FGDC grant had been developed. All of these websites are currently active. Fourteen respondents noted that other external grants had been obtained to support their FGDC-related project, though 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 cost of the project). Approximately 50% of the successful applicants also noted that their project had exceeded the scope of the original proposal (Figure 2). The modal range of grant coverage for the sample of successful applicants lies between 50% and 59% (Figure 3). In short, FGDC support has typically covered roughly half of total project costs (excluding recurrent costs) for most applicants.

Most of the respondents indicated that their projects were either 'very important' or 'critically important to internal and (60% fall into these two impact categories), while 70% indicated that their projects were important to external users (Figure 4). A substantial majority (85%) of these respondents noted that the role of FGDC-support in project success was either 'very important' or 'critical' (Figure 5). 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.

Categories of project impact.

Ranked along a 5-point scale (ranging from 1 = no impact at all, to 5 = critically important impact), successful applicants rated their project outcomes from a user perspective as follows:

Table 1. Impact of FGDC-supported project upon users.

<u>Impact category</u>	<u>Mean score</u>
1. ability to access information	4.28
2. saving time for users	3.85
3. simplifying the user's job	3.57
4. assists in strategic planning	3.50
5. contribution to decision-making	3.47
6. improved data affordability	3.39
7. promotes innovation among users	3.28

Other impact classes.

Respondents were asked to comment on their internal technical 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 as follows: (note: only cases where a change occurred are listed).

Table 2. The development of new capabilities among grant recipients.

Not present before, but present now:	<u>successful applicants</u>	
	Number	Percent
1. metadata clearinghouse	29	49.1
2. contribute to regional data efforts	21	35.6
3. develop data jointly with others	20	33.8
4. develop framework data	19	32.2
5. map server via internet	19	32.2
6. metadata software	18	30.5
7. share data with outsiders	18	30.5
8. metadata collection	16	27.1
9. meet to discuss data with others	10	16.9
10. internet connectivity	9	15.2
11. use outside data sources	3	5.1

Inputs to project success.

Ranked along a scale similar to that described above, respondents rated the contribution of specific inputs to project success as follows:

Table 3. Inputs to project success among grant recipients.

<u>Contribution category</u>	<u>Mean score</u>
1. FGDC funding	4.76
2. in-house expertise	4.37
3. project team	4.25
4. external collaborators	3.66
5. FGDC feedback on proposals	2.91
6. external funding (non-FGDC)	2.74
7. Academics	2.37
8. student interns	2.33
9. private consultants	1.75

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 (> 4.0).

Additional issues

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: (1) report high levels of positive outcomes for projects; (2) indicate that outcomes and/or project scope exceeded initial expectations; (3) depend upon FGDC for at least 50% of total project costs.

Second, 68% of the successful applicants indicated that some variant of the original project would have proceeded in the absence of FGDC funding. Of the latter, 26 indicated that a project of reduced scale and/or scope would have proceeded, 1 noted that an identical project would have proceeded (albeit at a slower pace), while 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, 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). By itself, this finding (Figure 6) suggests an impact category that warrants a separate and detailed investigation.

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 are confident that their projects can be sustained over the long-term.

Section 4. Characteristics of Successful Versus Unsuccessful Applicants.

Difference of means and/or chi-square tests were applied to successful versus unsuccessful applicants (winners and losers) across all of the ordinal and/or ratio-level data that were common to both postal surveys. Here, the goal was to search for systemic differences in the nature of these two groups. Our results revealed that the two groups are similar in terms of sector membership, but quite different in terms of other variables (see Table 4). The key differences include the following (all of these differences are statistically significant at $p = 0.05$ or better): (1) the number of GIS-related personnel within the division or unit that applied for the grant (winners are larger); (2) the perceived importance of academics (losers are more likely to involve academics in proposal design than 'winners'); (3) the importance of FGDC feedback on proposals (winners are more satisfied, though neither group ranked this factor very highly); (4) project sustainability (winners attached higher sustainability scores to their projects than the 12 losers that proceeded with some version of the original proposal); and (5) the importance of external collaborators (winners involved more external agencies in the proposal development process than losers).

Table 4. Differences between successful and unsuccessful grant applicants.

<u>Attributes</u>	<u>Group Means</u>		<u>p-value</u>
	Successful n = 59	Unsuccessful (t-tests) 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.

In addition, it should be mentioned that:

- Failed applicants were all first-time applicants, a majority of whom intend to apply for FGDC grants in the future. It should also be noted that 4 of the 59 successful applicants do not intend to apply for future funding (FGDC grants are perceived as being too small to be useful).
- Failed applicants ranked the importance of external inputs to proposal and/or project development more highly than successful applicants. This relationship is likely to reflect the limited in-house resources available to failed applicants (recall that successful applicants are significantly larger than failed applicants in terms of GIS-related employment). Our estimates suggest that successful applicants employ an average of 10.1 GIS employees, compared to 4.4 employees among failed applicants.

Predicting winners and losers.

Table 5 presents a logistic regression model that expresses proposal success as a function of three sets of binary variables, including: (1) the presence of a professional geographer (0 = no; 1 = yes); (2) GIS employment (0 = below 10; 1 = 10 or >); and (3) the presence of external collaborators (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 4 winners that were misallocated (i.e. predicted as losers), 3 employed less than 5 GIS workers and had no external collaborators, while 1 had external collaborators but no geographers. All of the 5 losers that were predicted as winners scored positively on each of the independent variables.

Looking at the odds ratios for the predictor variables (all 3 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 (< 10 GIS employees) to large (10 GIS employees or >). 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 indicate 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 extent of external collaboration, and the presence of a professional geographer.

Table 5. Logistic regression: successful versus unsuccessful applicants.

<u>Independent variables</u>		<u>Odds ratio</u>	<u>Significance</u>
GIS employment (< 10, > 10)		4.24	0.005
Employment of geographers (yes/no)		3.41	0.006
Use of external collaborators (yes/no)		2.61	0.042

<u>Classification (E)</u>	<u>Successful</u>	<u>Unsuccessful</u>	<u>Total</u>	<u>% correct</u>
(O) Successful	55	4	59	93.2
Unsuccessful	5	18	23	78.2

Overall classification efficiency = 89.0%

Scenarios: the contingency problem.

Winners and losers were also compared in terms of several conditional questions that were posed. Among winners, we asked for an assessment of what would have happened in the absence of FGDC funding. Among losers, we asked what actually did happen. A summary along these lines is shown in Table 6. 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 support. Among successful applicants, 68% noted that some variant of the original project would have proceeded if FGDC funding had been denied (the comparable proportion for unsuccessful applicants was 53%). Clearly, then, failure to obtain external grants does not necessarily kill projects (though it does seem to slow them down and/or encourage diluted versions).

Table 6. Project scenarios and outcomes (successful versus unsuccessful applicants):

Project scenario or outcome:	*		**	
	<u>Successful</u>		<u>Unsuccessful</u>	
	n	%	n	%
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

* *hypothetical impact of a failed FGDC grant application ----> scenario*
 ** *actual impact of a failed FGDC grant application -----> outcome*

Table 7 compares our 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 40 applicants that would have proceeded anyway. 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 less than 5 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.

Table 7. Applicant size (GIS employment) by project cancellation (scenario plus outcome). *

<u>Project status</u>	<u>Successful</u>		<u>Unsuccessful</u>		<u>Total</u>	
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	

* *mean GIS employment per group shown in parentheses ().*
 ** *T-test significance levels are for column contrasts (GIS employment).*

No significant differences emerged in terms of the project effectiveness ratings reported by successful applicants that would have abandoned their projects without FGDC help versus successful applicants that would have proceeded anyway. 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 (e.g. user impact, sustainability, and spillover effects to nearby organizations).

Section 5. 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. The non-applicant sample included 50 educational institutions, 52 state agencies, 48 counties, and 5 tribal governments (replicating the sectoral distribution of applicants).

Educational Sector

A total of 114 funding applications came from educational institutions over the period 1994-1999. Of these, about half (59, or 51.7%) came from members of the University Consortium for Geographic Information Science (UCGIS). Since these applications came from 30 different UCGIS members, we stratified the educational part of the non-applicant sample into UCGIS and non-UCGIS components. For the UCGIS component we excluded the University at Buffalo, and sent non-applicant surveys to the other 25 UCGIS members. To obtain a sample of non-UCGIS institutions, we took ESRI's On-Line Database of GIS Programs (<http://gis.esri.com/university/onlinedb.cfm>), which contains 238 programs. After excluding foreign institutions and UCGIS members, 146 US institutions remained, of which 13 had applied for FGDC grants. We then took a random sample of 25 of the remaining 133 non-UCGIS non-applicants in order to balance the UCGIS sample.

State Government Sector.

For the 37 states from which some state agency applied for FGDC funding, we picked some other non-applicant agency to survey. These included 14 Departments of Natural Resources, 21 Departments of Environmental Protection, and 2 State Departments of Transportation. We also sent surveys to 15 NSGIC contacts in 13 states that had no State government applicant.

County Government Sector.

Because there are more than 3000 counties in the US, we selected a relatively large number of non-applicant counties to survey. Twenty four counties were responsible for the 27 county applications, so we selected 24 non-applicant counties from those same states, and 24 from states with no county applicants. Because size of counties may have an influence on their behavior, for each applicant county we selected another county that was just above or below them in county rankings by population. From states with no applicants, we also selected 24 counties matched as closely as possible in size to the applicant counties.

Tribal Government, Industry and Other Sectors.

In consultation with Bonnie Gallahan of FGDC and USGS, we selected 5 non-applicant tribal GIS coordinators and sent surveys them. Because of the difficulty of identifying the population to sample from, we decided not to survey non-applicant commercial firms. We also did not sample from local governments and NGOs.

Main Results for Non-Applicants.

Of the 151 surveys that were mailed, valid returns were obtained from 59 non-applicants (giving a response rate of 39%). Eleven additional returns were received, but these were discounted as a result of large numbers of 'missing responses'. Respondents included 19 educational institutions, 18 state agencies, 21 counties, and 1 tribal government. This distribution broadly matches FGDCs main applicant classes.

No significant sectoral differences were found in terms of three major variables: (1) the reasons for non-applicant status; (2) future intentions regarding FGDC grants; and (3) the types of GIS software employed within the responding unit. Further, no significant differences were found between applicants

versus non-applicants in terms of organizational size (including GIS employment), occupational structure, and internal capability (as measured by the range of software employed). Indeed, non-applicants look more like successful applicants than failed applicants, notably in terms of size and occupational structure (see Appendix 1). 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 (though 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 has 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 (see Figure 9). While it is likely that FGDC's grant announcements do reach non-applicants, it would seem that these announcements do not reach the people that most need to be informed.

Section 6. Effectiveness of FGDC's NSDI Grants Program

Overall, our results suggest that FGDC's grants program has delivered tangible results, in that virtually all of the grant recipients that were surveyed now have a website that functions as a clearinghouse for metadata (most of these websites are operational, while others are usable but still under construction). These clearinghouses were established (or are currently being built) with support from FGDC. From a categorical perspective, then, FGDC's program can be considered successful. A substantial majority of FGDC's grant recipients view the contribution of FGDC funding as being either very important or critically important; a majority rank the long-term sustainability of their projects in a positive light; most respondents (slightly over half) indicated that FGDC covered at least 50% of total project costs; around 50% indicated that their FGDC-funded projects resulted in the development of clearinghouses that surpassed initial performance expectations; and a majority of the organizations that were surveyed (both winners and losers) indicated that they intend to apply for FGDC grants in the future. Further, it is evident that many organizations have acquired post-grant technical expertise (new capabilities) that did not previously exist. Finally, it should be emphasized that roughly 60% of the projects that received FGDC support resulted in spillovers (demonstration effects) that assisted in the development of similar projects by other organizations.

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 (see Appendix 2).

As an example, consider the following scenario (extracted from the survey data plus 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 five years after the termination of the grant (assuming average post-grant spending of \$22K per annum. The grant:post-grant 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 respondents 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 anyway, and that most smaller applicants would have aborted their initiatives altogether, a strategic implication is that smaller applicants should be given preferential status (subject, of course, to proposal quality and/or importance).

Section 7. Policy Implications

The survey data summarized in this Report suggest that FGDC's grants program has supported the NSDI in a number of significant ways. Specifically, FGDC grants have facilitated the creation of metadata clearinghouses by all of the successful applicants that were surveyed. Given that the central goal of FGDC's grants program is to promote data sharing via the formation of clearinghouses, the results of this program over the period 1994-1999 can be considered a success. Other elements of program success include: (1) relatively high levels of post-grant investment in project development; (2) spillover effects to nearby organizations; (3) high levels of project sustainability (as well as positive impact rankings for both internal and external users); and (4) the development of new technical capabilities among grant recipients.

This said, the survey data also suggest that FGDC might want to consider program modifications to maximize the impact of its metadata grants. These modifications include the following:

1. Increase the number of small grants, especially to small applicants.

The logic surrounding this recommendation comes from the fact that most of FGDC's larger applicants would have proceeded with some variant of the original proposal without grant support from FGDC. Further, the survey data suggest that smaller applicants invest almost as much in post-grant project development as larger applicants. Given that there are no statistically significant differences in the various project effectiveness ratings between small versus larger applicants, an implication is that wider benefit streams could be obtained by supporting smaller applicants. In this regard, post-survey follow-up inquiries revealed that many larger applicants perceive their FGDC grants as being endorsements of project legitimacy (rather than critical funds for project development). Presumably smaller grants would confer this legitimacy just as well as larger grants.

2. Conduct user surveys to assess project impact more directly.

The various surveys described in this Report provide project impact assessments from the perspective of grant recipients. Estimates of spillover effects also come from grant recipients. A structured survey of users would go some way toward verifying (or refuting) the evidence regarding project impact. At the same time, it would be useful to probe the exact nature of spillovers by surveying the organizations that allegedly benefitted from demonstration effects. On this note, one of the chief weaknesses of this Report is that project impact has been defined by grant recipients rather than metadata users.

3. Supply applicants with detailed feedback on proposals.

When asked if FGDC could have done more to assist in the project development process, a majority of applicants (both successful and unsuccessful) noted that feedback on proposals would have been useful. At present, FGDC does not supply applicants with detailed comments regarding the merits and/or flaws of specific proposals, making it especially difficult for unsuccessful applicants to develop better proposals. Specific reasons for proposal rejection ought to be supplied, along with suggestions for proposal improvement. At a minimum, applicants ought to receive the comments supplied by both internal and external reviewers.

4. Target key people within the various non-applicant sectors.

Participants at the FGDC Coordinating Group Meeting (August 7, 2001) noted that thousands of non-applicants receive FGDC announcements via e-mail and/or other channels, and that the primary reason for non-applicant status revealed in this Report (ignorance of FGDC programs) was frustrating in light of current efforts to advertize as widely as possible. Yet over 60% of the organizations that participated in the non- applicant survey claimed that they were unaware that FGDC grants were available. A clear implication is that FGDC announcements do not always reach those individuals that have an interest in metadata grants. For example, it is possible that FGDC announcements are filtered, destroyed, or inappropriately redirected by recipients that do not understand the significance and/or potential relevance of the incoming information. Appropriate individuals within eligible non-applicant organizations should be identified.

5. Monitor the activity levels of clearinghouses over time.

Most successful grant applicants indicated that their projects were sustainable over the long-run (i.e. 5-10 years or more). To verify the accuracy of these claims, it would be useful to conduct an annual audit based on a random sample of former grant recipients. The audit need only verify the continued existence of the clearinghouse. As a further check, it might be useful to compare small versus large grant recipients in terms of the sustainability claims documented in this Report. A simple format is suggested below:

	<u>Grant Size</u>			
	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Total</u>

Applicant size:				
Small	ss%	sm%	sl%	s%
Medium	ms%	mm%	ml%	m%
Large	ls%	lm%	ll%	l%

*Where: s = small m = medium l = large
% = percentage of organizations sampled that still have the clearinghouse that was initially established with FGDC grant support.*

Structured as a longitudinal database, a monitoring procedure of the type suggested above could serve as an inexpensive program evaluation tool. Simple chi-square tests could be periodically conducted to probe for shifting sustainability distributions over time. For instance, consistently above average ss% scores would confirm the validity of this Report's primary recommendation (i.e. increase the number of small grants to small applicants). On the other hand, consistently high ll% scores would imply the opposite (i.e. give big grants to large applicants).

6. Develop a simple survey instrument to accompany grant applications.

Given the enormous amount of time and energy that is expended in obtaining basic applicant information via surveys of the sort described in this Report, it would be helpful if FGDC were to systematically record such information in spreadsheet form (e.g. size of applicant unit, number of project partners, level of funding requested, types of user target groups, and so on). A one-page survey instrument requesting these types of data could be included within the grant application package, rendering future surveys of grant recipients easier to conduct (e.g. shorter survey instruments).

7. Commission independent program reviews on a regular basis.

It would be useful to commission independent FGDC program reviews on a regular basis (e.g. every 5 years) to monitor trends in project effectiveness over time. Grants to support such studies could be awarded on a competitive basis.

Figure 1. Sectoral Affiliation of FGDC Grant Recipients.

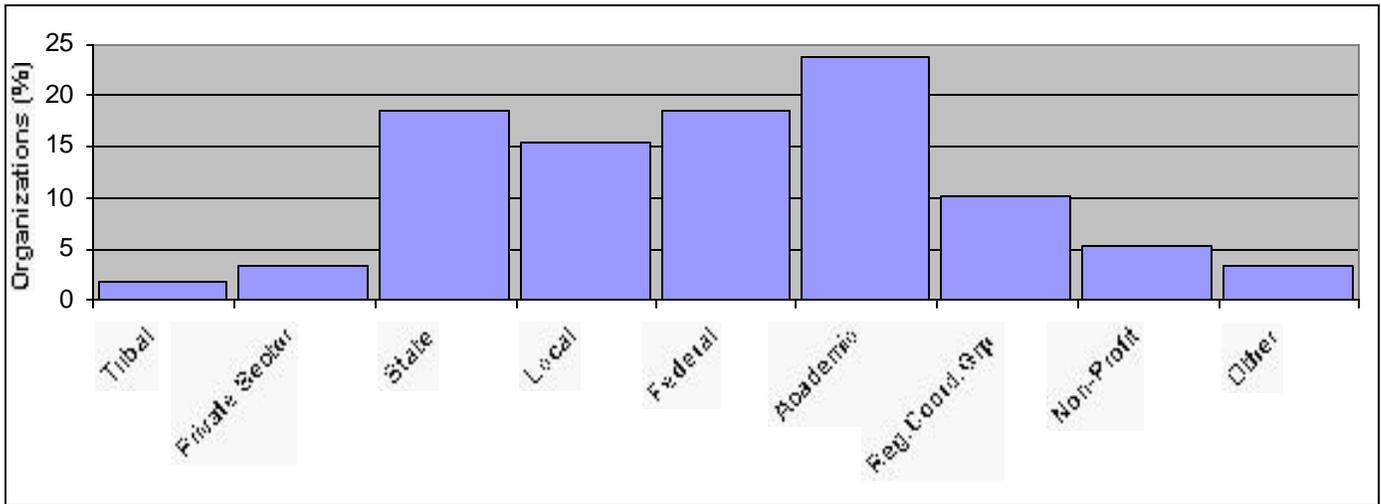


Figure 2. Percentage of Projects that Exceeded Proposed Expectations.

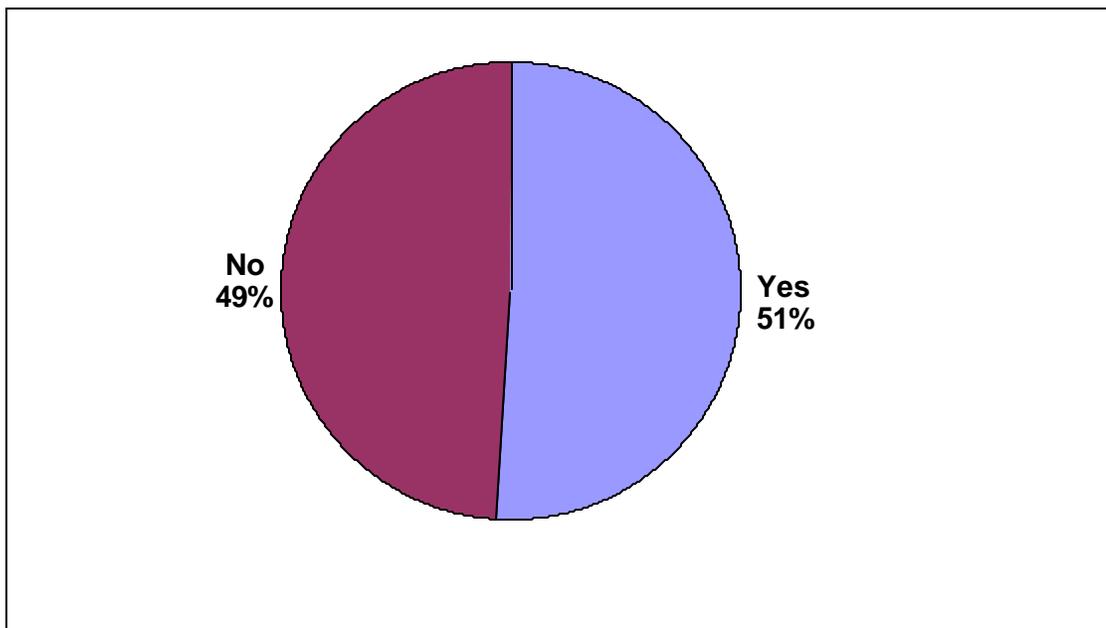


Figure 3. Percent of Project Covered by FGDC Grant.

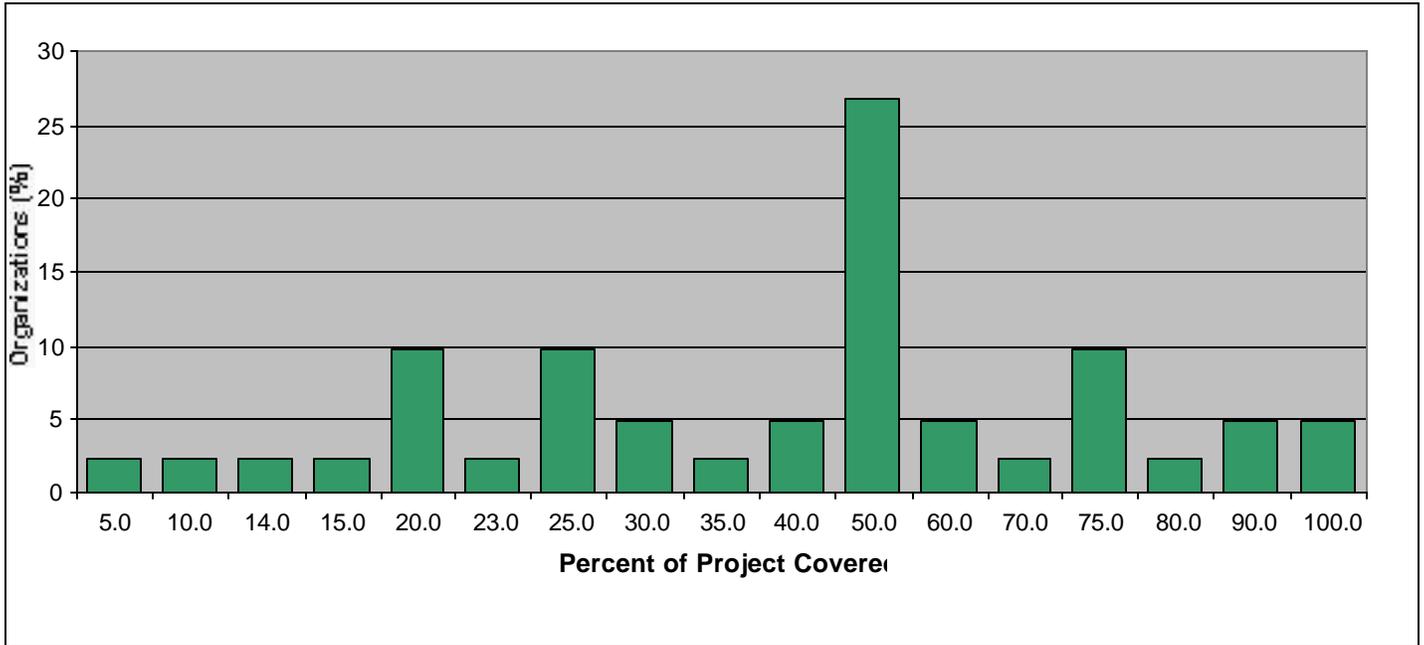


Figure 4. Usefulness of Project for All Users (Internal and External to the Organization).

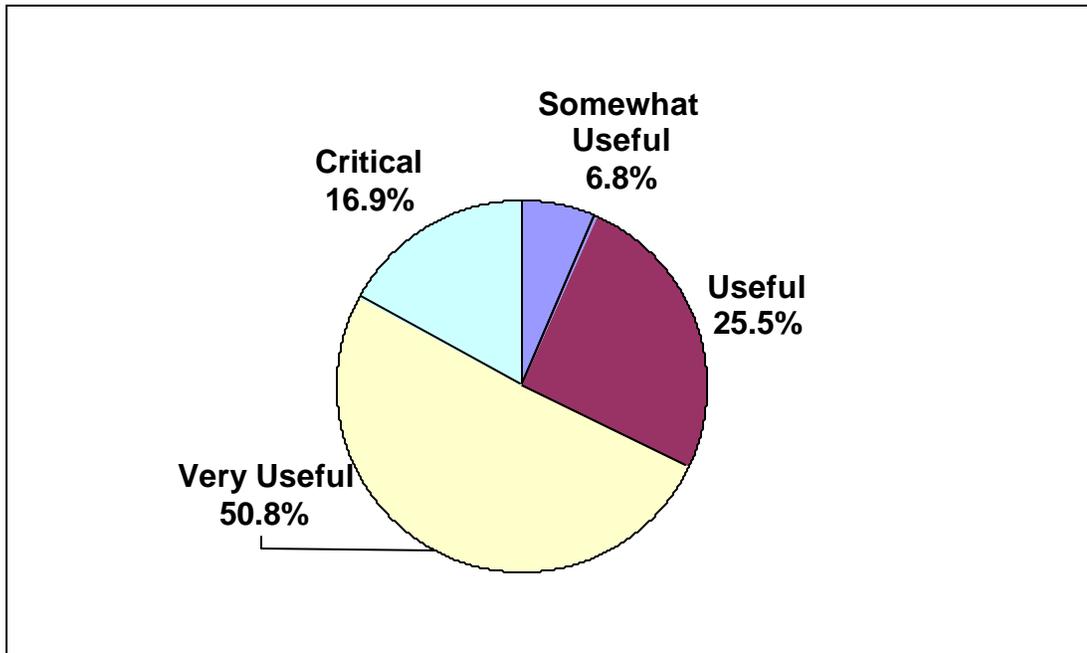


Figure 5. The Importance of FGDC Funding for Project Development and Implementation.

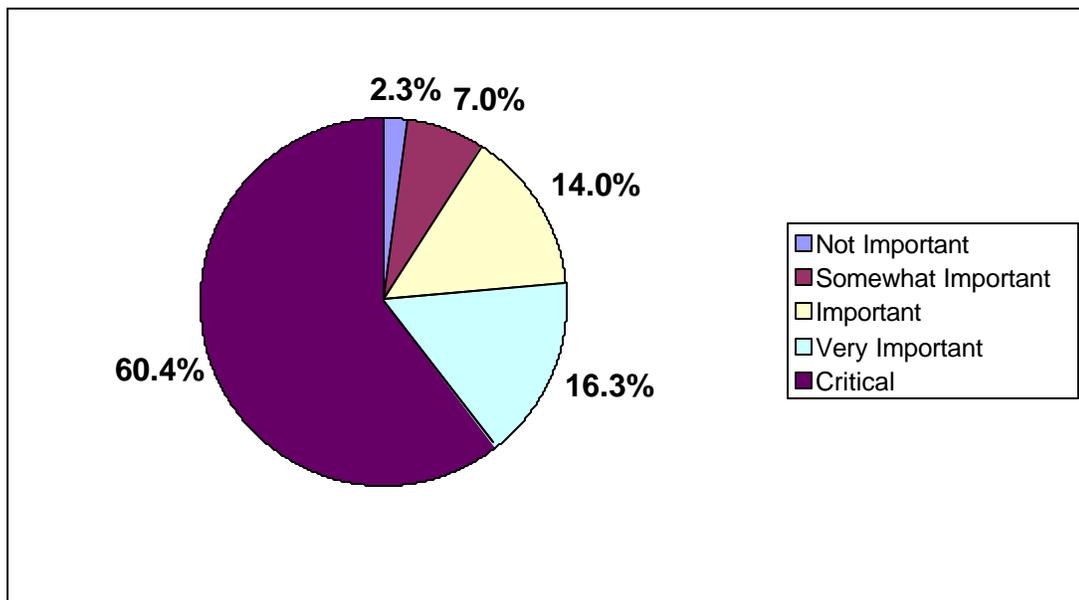


Figure 6. Percentage of Projects that Influenced the Initiatives of others.

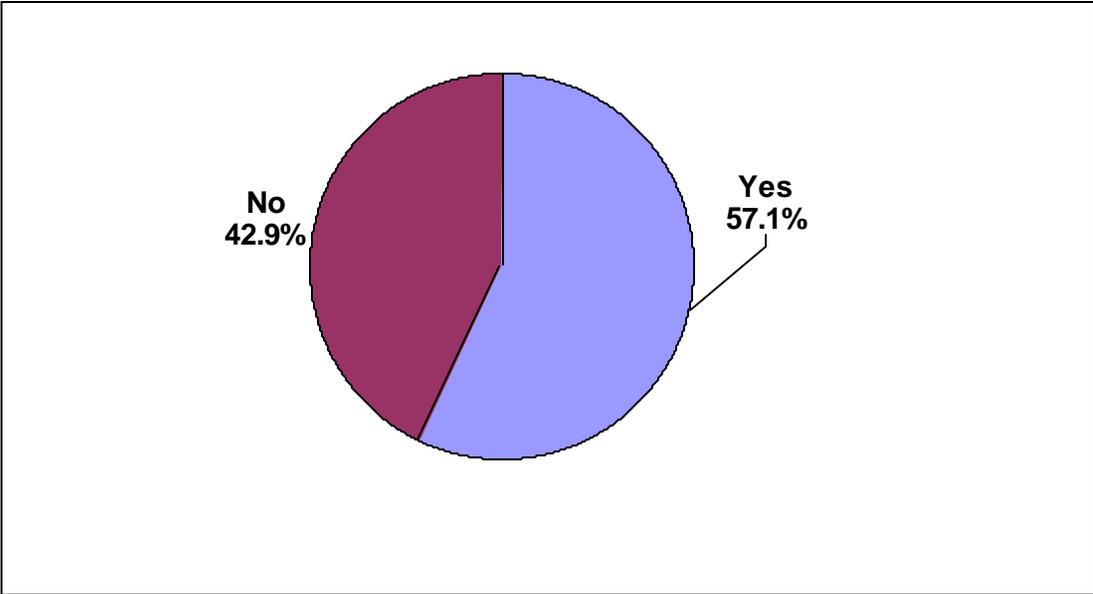


Figure 7. Importance of FGDC Feedback for Development and Implementation of Project.

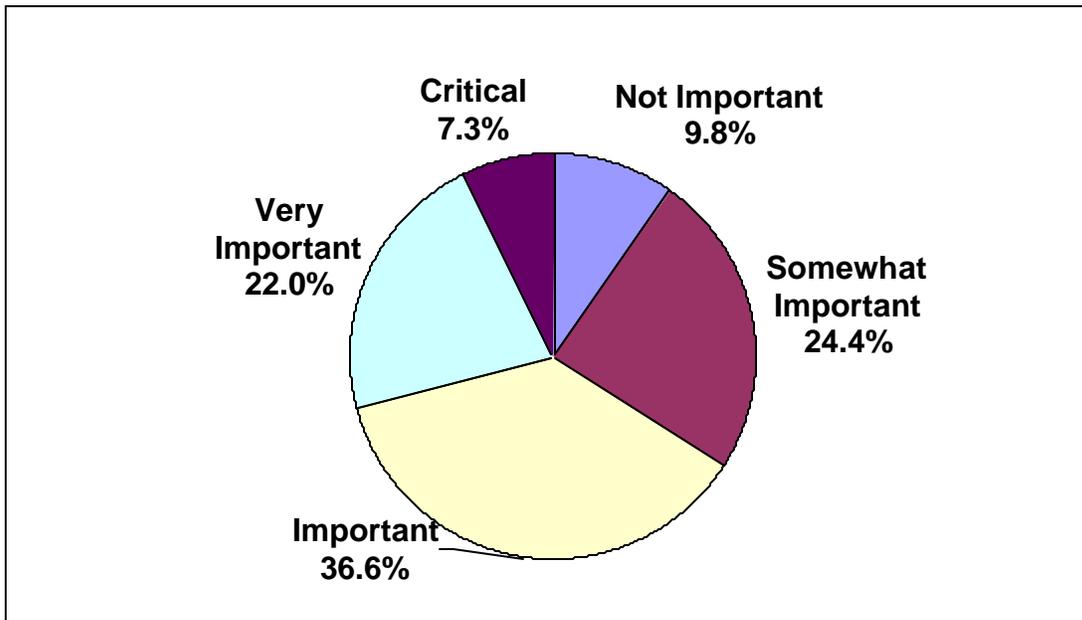


Figure 8. The Manner Organizations became aware of FGDC Project.

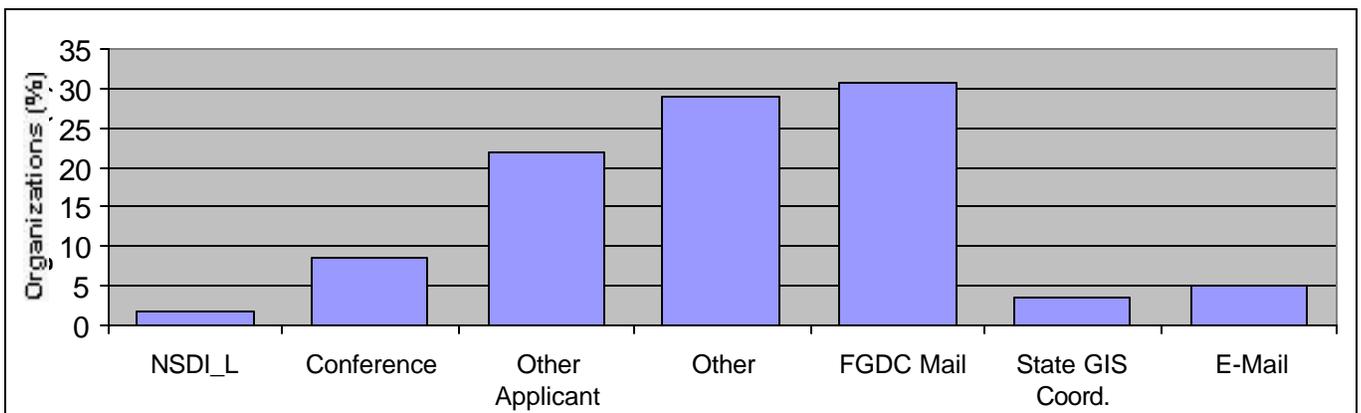
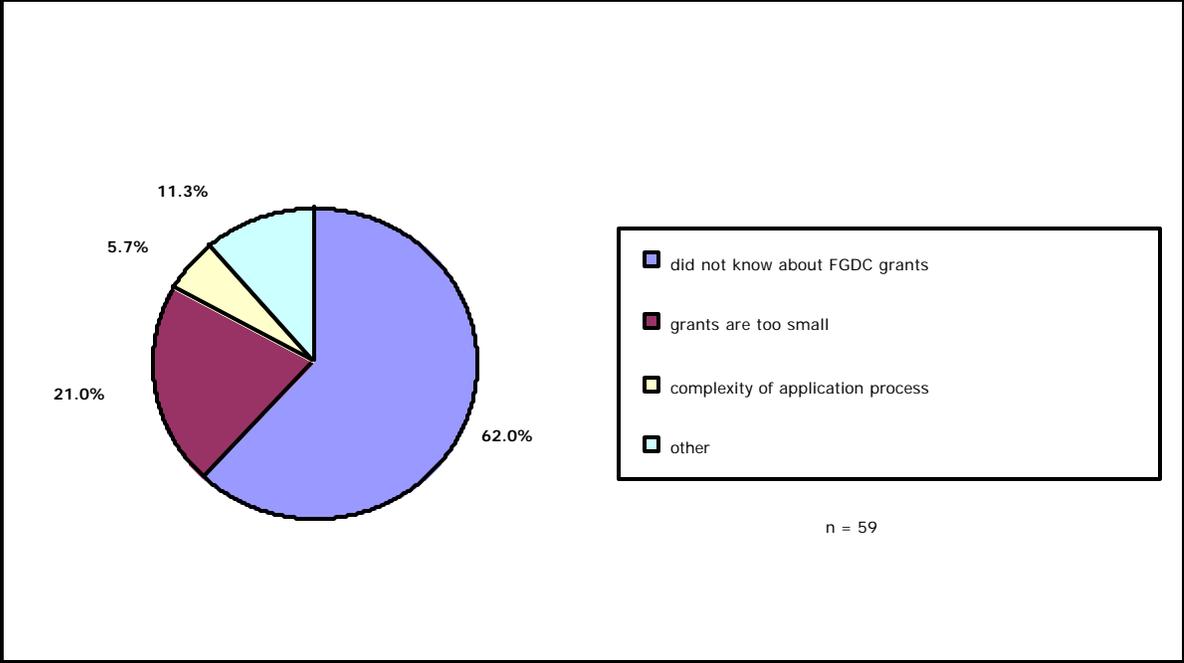


Figure 9. Reasons why non-applicants did not apply



APPENDICES

Appendix 1. Selected characteristics of successful applicants, unsuccessful applicants, and non-applicants.

Types of software used for GIS-related projects (% of respondents indicating 'yes' per software class).

<u>Software class</u>	<u>Successful</u>	<u>Unsuccessful</u>	<u>Non-applicants</u>
Arcview	98.3	95.7	96.0
Arcinfo	83.1	73.9	91.4
Intergraph	1.7	13.0	10.7
Mapinfo	13.6	39.1	41.2
Smallworld	3.4	4.3	5.0
Other GIS	22.0	39.1	10.7
Excel	76.3	82.6	91.4
D-Base	27.1	26.1	20.2
MS Explorer	64.4	52.2	65.6
Netscape	72.9	78.3	80.0
SAS	13.6	17.4	16.5
SPSS	11.9	26.1	25.2
Size of Organization *			
(employment)		**	**
GIS Unit	10.1	----- 4.4	----- 15.4
			**
Division	30.4	22.9	----- 41.4

* group means
 ** Losers are significantly smaller than winners and non-applicants in terms of mean GIS employment; losers are also significantly smaller than non-applicants in terms of Divisional employment (the statistical tests are t-tests, with $p < 0.05$).

Appendix 2. Grant size and post-grant investment.

<u>Year</u>	* <u>Average grant size (\$000s)</u>	** <u>Post-grant investment</u>	*** <u>Survey responses (n-size by year)</u>
1994	25.0	17.7	3
1995	25.0	16.9	5
1996	35.0	21.3	6
1997	40.1	20.2	11
1998	42.0	19.7	15
1999	18.9	23.4	19

* Estimated from FGDC's CAP Summary (1994-1999).

** Estimated from NCGIA's survey of successful applicants. These data refer to annual post-grant investment in project maintenance or development.

*** Survey responses by grant year.

Notes:

1. There is no statistically significant relationship between average grant size and post grant investment for the sample as a whole.
2. The drop in FGDC's average grant size between 1998 and 1999 reflects the introduction of the 'Don't Duck Metadata' program, which involved 95 funded projects (compared to an average of 32 per annum over the 1994-1998 period).
3. FGDC data on grant funding at the level of specific organizations were available for the 1999 cohort of applicants only. For this cohort (95 organizations), we obtained survey data from 19 (20%). The Pearson's correlation between grant size and post-grant investment for this group was positive but statistically insignificant ($r = 0.187$; $p = 0.173$). To compensate for slightly negative skew in the data, a Spearman's correlation was also computed (this test also failed to detect a significant relationship). In short, it would appear that grants as low as \$1000 can deliver as much post-grant investment as grants of \$50,000 or more.

Appendix 3: Copies of Letters and Surveys sent out to Organizations