

VI. Verification and Validation (V&V)

The Foundation has both qualitative and quantitative GPRA goals. Its qualitative goals include the three broad strategic outcome goals related to People, Ideas, and Tools and two investment process goals related to implementation of merit review criteria. The outcome goals are presented in a format that requires qualitative assessment of achievement. These assessments are based largely on information included in reports prepared by committees of independent, external experts (e.g. Committees of Visitors and the Advisory Committee for GPRA Performance Assessment) who assess the quality of program results based on their collective experience-based norms. NSF's quantitative goals focus on management activities, with the majority presented in a format that enables quantitative assessment of progress toward goal achievement. Assessment for these goals is based on data collected with NSF's central data systems.

QUALITY OF REPORTED PERFORMANCE INFORMATION

NSF recognizes the ongoing need to improve data systems for collecting performance information and data, especially that related to facilities. We view the improvement of the quality of data and data systems as an evolutionary process and intend to maintain it as a priority as budget and time allow. Implementing GPRA has enabled NSF to gather information in a structured way and to address issues in a more formal, focused manner than in the past³⁵.

In their December 2002 report³⁶ IBM Business Consulting Services (IBMCS) addressed system aspects of NSF data quality for the Awards system, Enterprise Information System, Financial Accounting System, FastLane, Integrated Personnel System, and the Proposal, Principal Investigator (PI), and Reviewer System. IBM Business Consulting Services *“reviewed NSF’s information systems to evaluate controls that are in place to produce reliable data. The control techniques presented in the table below are based on interviews with NSF managers and staff--rather than a full application review. Pursuant to GAO’s assessment guide, we relied on previously conducted work and on departmental sources to determine whether there were any known problems with the data sources or the data itself that would cast doubt on the credibility of the information.”*

A data project was initiated in FY 2001 to substantially improve the quality, consistency and availability of data, reports and charts that are used by COVs. These committees, in addition to providing advice to the NSF organization, provide assessments that may be used in NSF's annual GPRA reporting. Currently, each NSF organization produces its own reports and charts for each of its committees. With the completion of this COV project it is expected that the reports will be generated centrally to reduce costs and improve quality and consistency across NSF.

DATA V&V ACTIVITIES

We used a V&V process similar to the one used in FY 2001 to verify and validate selected FY 2002 GPRA performance information. In FY 2000 and FY 2001, we engaged an external third party, (PricewaterhouseCoopers LLP (PwC), to verify and validate selected GPRA performance results as well as the process through which supporting data was compiled. The business unit within PwC responsible for this type of activity was sold to IBM in 2002 and is part of IBM Business Consulting Services. For FY 2002 data verification and analyses, we engaged IBMCS to document the processes we follow to collect,

³⁵ GPRA data quality was a management challenge cited by the OIG in FY 2002 (See Section X).

³⁶ Page 77 of the IBMCS report.

process, maintain, and report selected performance data. They identified relevant controls and commented on their effectiveness. Based on General Accounting Office (GAO) guidance, they provided an assessment of the validity and verifiability of the data, policies, and procedures we used to report results for the FY 2002 goals. For the outcome goals, IBM Business Consulting Services reviewed the processes NSF used to obtain external assessment of NSF activities with respect to these goals. IBM Business Consulting Services also provided high-level review of NSF's information systems based on GAO standards for application controls³⁷.

In their report³⁸ (December 2002), IBM Business Consulting Services concluded *“We determined that NSF has reported on all 19 management goals and one EHR performance goal under review in a manner such that any errors, should they exist, would not be significant enough to change the reader’s interpretation of the Foundation’s reported outcome in meeting the supporting performance goal. Overall, NSF relies on sound business processes, system and application controls, and manual checks of system queries to report performance. We believe that these processes are valid and verifiable.”*

For reporting on goal achievement, all of our outcomes are compiled for programs and activities across the agency. To enable a uniform and systematic organization of reporting information for the strategic outcome goals, we have developed specially designed templates and reporting guidelines for use by committees of external experts (COVs and AC/GPA). These templates and guidelines are reviewed and refined annually. Options for rating NSF are limited to either successful or not successful.

TYPES AND SOURCES OF PERFORMANCE DATA AND INFORMATION

Most of the data that underlie achievement assessments for strategic outcome goals originate outside the agency and are submitted to us through the Project Reporting System, which includes annual and final project reports for all awards. Through this system, performance information/data (compiled by our staff) such as the following are available to program staff, third party evaluators, and other external committees:

- Information on People – student, teacher and faculty participants in NSF activities; demographics of participants; descriptions of student involvement; education and outreach activities under grants; demographics of science and engineering students and workforce; numbers and quality of educational models, products and practices used/developed; number and quality of teachers trained; and student outcomes including enrollments in mathematics and science courses, retention, achievement, and science and mathematics degrees received;
- Information on Ideas – published and disseminated results, including journal publications, books, software, audio or video products created; contributions within and across disciplines; organizations of participants and collaborators (including collaborations with industry); contributions to other disciplines, infrastructure, and beyond science and engineering; use beyond the research group of specific products, instruments, and equipment resulting from NSF awards; and role of NSF-sponsored activities in stimulating innovation and policy development; and
- Information on Tools – published and disseminated results; new tools and technologies, multidisciplinary databases; software, newly-developed instrumentation, and other inventions; data, samples, specimens, germ lines, and related products of awards placed in shared repositories; facilities construction and upgrade costs and schedules; and operating efficiency of shared-use facilities.

Most of the data supporting management goals can be found in NSF's central systems. These central systems include the Enterprise Information System (EIS); FastLane, with its Performance Reporting

³⁷ An executive summary of the IBMCS report is provided in Appendix III of this Chapter.

³⁸ Page 2 of the IBMCS report.

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System and its Facilities Reporting System; the Online Document System (ODS); the Proposal, PI, and Reviewer System (PARS); the Awards System; the Electronic Jacket; and the Financial Accounting System (FAS). These systems are subject to regular checks for accuracy and reliability.

The Division of Human Resources Management/Office of Information and Resource Management (HRM/OIRM) maintains information related to staff recruitment and staff training, under the guidance of the Chief Information Officer. The Office of Equal Opportunity Programs (OEO) databases are also available for reporting purposes.

The qualitative aspects associated with the goals on implementation of both merit review criteria are addressed in reports of external committees (COVs and AC/GPA) and/or staff analyses.

Data / Information Limitations

For outcome goals, the collection of qualitative data during assessment may be influenced by factors such as a lack of long-term data/information to assess the impact of outcomes, the potential for self-reporting bias, the unpredictable nature of discoveries, and the timing of research and education activities. For the quantitative management goals, the assessment may be influenced by factors such as accuracy of data entry into central computer systems, lack of experience in using new reporting systems or modules, or individual non-responsiveness (e.g., self-reporting of diversity information; workplace surveys).

Finally, external expert assessments (presented in COV and AC/GPA reports) may lack sufficient justification for ratings or may provide incomplete information. To address this issue NSF is continuing to modify its reporting templates and improve guidance to committees and staff in order to improve the completeness and consistency of the reports. This will aid in compiling qualitative information. Additionally, we have focused on clarifying language in goal and indicator statements.