

Getting an Establishment Survey to the Right Person in the Organization

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Abstract

The National Science Foundation (NSF) has been collecting data on research and development (R&D) since 1953. In 2004, the NSF embarked in earnest upon a series of activities designed to evaluate and renew this important survey. As a result, the entire structure of the survey is being changed. The survey will consist of distinct sections each focused on different types of data. The components are aimed at collecting data on (1) the R&D paid for by the company, (2) R&D management and strategy, (3) R&D paid for by external parties, (4) R&D employees, and (5) intellectual property, technology transfer and innovation issues. Different people within the business will need to answer different sections of the survey. This paper focuses mainly on the development of the paper instrument into a sectional questionnaire and touches briefly on the contact strategies being developed to get the right section to the right person.

Key Words: questionnaire design, establishment survey, multiple respondents

1. Background

The National Science Foundation (NSF) is an independent federal agency created by Congress in 1950 "to promote the progress of science; to advance the national health, prosperity, and welfare; and to secure the national defense..." NSF is the only federal agency whose mission includes support for all fields of fundamental science and engineering, except for medical sciences. The NSF is tasked with keeping the United States at the leading edge of discovery in areas from astronomy to geology to zoology. In addition to funding research in the traditional academic areas, the agency also supports "high-risk, high pay-off" ideas, novel collaborations and numerous projects that may seem like science fiction today, but which the public will take for granted tomorrow.

The Division of Science Resources Statistics (SRS) is the federal statistical agency within NSF and fulfills the legislative mandate of the National Science Foundation Act to "provide a central clearinghouse for the collection, interpretation, and analysis of data on scientific and engineering resources, and to provide a source of information for policy formulation by other agencies of the Federal Government..." To aid in carrying out this mandate, SRS designs, supports, and directs about 11 periodic surveys as well as a variety of other data collections and research projects. SRS also produces the congressionally mandated Science and Engineering Indicators report for the National Science Board.

This paper will focus on the NSF survey aimed at the U.S. business sector. That survey, known as Survey of Industrial Research and Development, was initiated in 1953. Since then, it has been conducted annually for 51 years (1957 – 2007) by the U.S. Census Bureau. The core structure of the survey remained largely the same over time, although questions were added and deleted to reflect changing needs and interests. In 2004, the SRS embarked upon a series of activities designed to evaluate and renew (redesign) this important survey. There were two motivating factors for renewing the R&D survey. First, the business environment and national landscape of R&D have changed substantially over the years. Secondly, two National Research Council of the National Academies (NRC) studies that were commissioned by SRS were emphatic in the need for the survey to be thoroughly and systematically evaluated and updated.

In the 1950s when the survey first began, the U.S. economy was dominated by manufacturing; now the U.S. has a services economy and company research and development efforts have shifted accordingly. In the 1950s, companies were predominately domestically focused both in terms of production and the markets they served. Today companies

aspire to reach customers around the world and likewise take a more global approach to producing their goods and services. In the 1950s, business R&D was dominated by large firms that invested heavily in their central research laboratories. Today, small and mid-sized businesses have a much more prominent role in the U.S. and companies large and small regularly look outside their walls for science and technology resources. The national patterns of R&D resources have also shifted since the 1950s when the federal government funded the majority of the nation's R&D and businesses performed more basic research than universities. Today, the business sector dominates national R&D spending and academia performs the majority of the nation's basic research.

2. Redesign Activities

Beginning in earnest in January 2006, SRS embarked on a series of activities to systematically evaluate all aspects of the Survey of Industrial Research and Development. The first set of activities focused on defining the data and information needs. The two main activities were (1) establishing an Industry Expert Panel consisting of 16 senior officials from A123Systems, Air Products & Chemicals, Colgate-Palmolive, Corning, General Motors, Google, Hershey Foods Corporation, Hewlett-Packard, IBM, Lockheed Martin, North Carolina State University, Pfizer, Science Applications International Corporation (SAIC), T/J Technologies, the University of Arkansas at Little Rock and Wachovia, and (2) holding data user workshops with federal and non-federal users, including the Bureau of Economic Analysis who uses the data as input to a satellite account to the U.S. System of National Accounts.

The second set of activities focused on evaluating and understanding the availability of research and development and related data from businesses operating in the U.S. These activities included (1) a record-keeping study with 34 companies -- 19 on the Fortune 500 list, 5 medium-sized, and 10 small companies from the NSF Small Business Innovation Research list, (2) supplemental surveys and respondent debriefing of current respondents covering a variety of topics of interest, and (3) over 100 cognitive interviews with a variety of respondent companies. The record keeping study, supplemental surveys and respondent debriefings focused on the availability of the data. The cognitive interviews took it even further by not only looking at what data are available but also looking at how we should ask for the data -- question wording -- and from whom -- person within the organization with knowledge and access to the data of interest.

The third set of activities focused on evaluating survey operations and methods. These activities were aimed at evaluating (1) the survey processing, including classification of industry codes, (2) the sample design and sample selection, (3) editing procedures, (4) imputation methods, (5) estimation techniques, (6) contact strategies, and (7) follow-up and other post-processing procedures.

SRS is currently in the final set of activities aimed at revising and implementing changes. Changes and revisions are being made to all aspects of the survey and as a result the survey has been renamed to the Business R&D and Innovation Survey (BRDIS). The new survey, including a revamped questionnaire with new content and new survey procedures, will be pilot tested during 2009 with full implementation planned for 2010.

3. Major Changes to the Questionnaire

The major changes to the questionnaire fall into three categories (1) new and revised content, (2) acknowledgment of the need for multiple respondents within the organization or business, and (3) new structure and flow of the questions and instructions.

The new content includes an emphasis on worldwide, global, operations of the company, details below the company level such as at the business line, information on R&D management and strategy, and measures of intellectual property (IP) and technology transfer. The new and existing financial questions have been restructured and developed to better align with information typically found in company financial and accounting records. The R&D employee questions have been expanded, restructured and developed to provide more detail and to better align with data routinely kept on employees. The intellectual property questions are completely new to the survey and provide a platform for future, more in depth questions on innovation.

It became apparent from our extensive set of activities aimed at evaluating and understanding the availability of research and development and related data from businesses that different people in the company know different things

and have access to different data and information. Thus we have explicitly acknowledged the need for multiple respondents within the organization or business. In general, the accounting or financial department has knowledge of and access to the financial information, the human resources department has access to employee data, and R&D managers can provide information on R&D management and strategy. Information on intellectual property and technology transfer resides in different places depending upon the company structure. Consequently, the design of all of the new BRDS survey materials is geared towards the need for involving multiple respondents within the organization. In addition, the new BRDS questionnaire is being designed with a new structure and flow to the questions and instructions.

4. Research on the Response Process Model in Establishment Surveys

Most establishment surveys face the problem of getting the survey to the right person within the organization. Some establishment surveys face the problem of getting the survey to multiple persons within the organization. Recent research in this area was presented at the 2007 International Conference on Establishment Surveys (ICES-III) in Montreal, Quebec, Canada.

Giesen (2007), Statistics Netherlands, discusses a study using the response process model (Sudman, Willimack, Nichols & Mesenbourg, 2000) as a tool for evaluating business surveys. Giesen notes “When it comes to the actual completion of the questionnaire the most common strategy we see is that one respondent fills out the questionnaire. For this he or she often has to collect information from others in the organization. The case studies showed several problems with both data error and response burden that were related to the selection of the respondent.” Giesen goes on to recommend the following:

- Suggest which type of department should respond to the survey
- Design the instrument for easy forwarding of (parts of) the exact question text
- Design instructional materials to allow for different types of information to go to different persons and locations
- Document the process for the respondent for future reference

Willimack (2007), U.S. Census Bureau, discusses the link between the individual respondent and organizational behavior stating that “...the behavior of persons in organizations is ultimately influenced by the goals of the organization.” The people within an organization assigned to complete the survey are (1) constrained by the type of information the company keeps which is heavily influenced by the goals of the organization and (2) they must abide by company policy regarding completion of surveys. She further notes that “Often data requested by economic surveys are dispersed throughout a company because of organizational structures...” Willimack shares two strategies for handling the multiple respondents issue that have been used in recent Census Bureau surveys:

- Develop spreadsheets that can be easily customized and shared around the organization for collecting the requested data
- Develop separate questionnaires directed at the different respondents

Lorenc (2007), Statistics Sweden, applies the Socially Distributed Cognition (SDC) theory developed by Edwin Hutchins (1995), to create a representation of the response process for a school-based survey involving the need for multiple respondents. Lorenc notes that “SDC is amazing in the sense that it provides the opportunity to inexpensively and objectively study how the cognitive unit – the establishment – processes information.” It helps to focus on questions about “whether and where in the establishments the requested information exists, where there is a way in which the information can be mapped onto the database, what the particular path that the information needs to traverse is, what risks of error are associated with specific steps of the path and so on.” The result is the “surveyor may exert influence on the choice of paths... and thus promote those that are less prone to error.”

5. Tough Design Questions

Initially the design work on the questionnaire was stymied. Should we have one large questionnaire with multiple sections or should we have several separate questionnaires that would be linked together? Would the questionnaire(s) go to one contact or to multiple contacts in the organization? Since the new survey content is so different, should we try to find new company contacts or should we use the most recent respondent from the discontinued Survey of

Industrial Research and Development? The questions arose because the design work was trying to take into account what the current literature said, what our expert panel members told us, what we had heard during all of the redesign activities and interviews and what our survey methodology expert, Dr. Don A. Dillman, Washington State University, was advising.

These questions are linked and a decision on one limits the answers to the others.

Questions 1&2: Should it be one large questionnaire with multiple sections or should it be thought of as several separate questionnaires that would be linked together? Would the questionnaire(s) go to one contact or to multiple contacts in the organization?

Discussion: Separate questionnaires would make it easier for the different topics to be distributed to the different parts of the organization where the data are available. This model has been successfully used at the Census Bureau, see Willimack (2007).

However, multiple questionnaires make it more difficult to coordinate response and to tie the data together over the different topics. For example, the data reported on R&D employees should link to the financial data reported on R&D expenses. If R&D employee data is collected separately at the Human Resources department and never seen by the financial department, would the financial department report expense data for the same R&D employees? Also, the use of multiple questionnaires complicates the processing since we would need to keep track of several questionnaires from each organization and concatenate the data from the separate questionnaires into one comprehensive dataset for the company. Since we have five topics of interest, we could be increasing our coordination and processing five-fold.

On the other hand, a large comprehensive questionnaire may appear overly burdensome to a respondent and encourage response from only one person within the organization. It wouldn't be possible for us to distribute the different topics to different people at the company. We would need to rely on the respondent to get the information from the appropriate source within the company.

The one questionnaire format would make it easier to reference and link different questions across different topics. It would make it possible for different people in the organization to see the linkages across the topics and to have access to the same definitions and context. Coordination of the survey response is less of a processing issue.

Decision: Based on advice from our expert, concern about the processing side and experience with other NSF establishment surveys, we decided to go with a single comprehensive questionnaire.

The decision to go with a single questionnaire forces the answer to the second question to be one contact. However, this led us to a new question. How could we encourage a single contact to either distribute the questionnaire or at least gather information from different people in different parts of the organization? It was clear from the cognitive interviews that different people had knowledge and access to different information. For example, R&D specialists within the organization were the most knowledgeable about the R&D management and strategy of the company but would not necessarily have access to or knowledge of the overall financial information that we were requesting.

A model that has been shown to work at NSF on other SRS establishment surveys is to explicitly designate the contact as a survey coordinator. The primary role of the contact is to coordinate the responses from across the organization. The contact may or may not answer questions but is responsible for going to the right people within the company and for getting the survey completed. When developing the survey materials, it is important to explicitly state and explain the role of coordinator. In addition, the questionnaire can incorporate specific design features to facilitate the distribution to different parts of the company.

Question 3: Since the new survey content is so different from its predecessor, should we try to find new company contacts or should we use the most recent respondent from the discontinued Survey of Industrial Research and Development?

Discussion: There were two main reasons for wanting to get a new company contact. First, given the breadth of the new content and the importance of the survey data to several key policy initiatives including American Competitiveness, our expert panel members recommended we contact the Chief Executive Officer (CEO) about the

survey and involve the Vice President of R&D. Their reasoning was that the CEOs had the broadest knowledge across the company, had the authority to provide the data, and were the ones most interested in how this might relate to the boarder business environment.

The second reason was that we wanted to have the questionnaire distributed around the company or at least to have the contact/coordinator gather information from different people in different parts of the organization. Would someone who is used to filling out the questionnaire themselves change their behavior?

Results from the cognitive interviews and respondent debriefings indicated a couple of things. First, many of the larger companies have a reporting unit for government surveys. That is, they have a designated set of people assigned to respond to government reports. It is already their role to coordinate the response across a variety of areas, so in fact they function as coordinators already. In smaller companies, the respondent often knows and has access to all of the information of interest. In mid-size companies there appear to be a multitude of ways they respond to surveys.

Decision: We decided to go with a hybrid approach. We'll stay with the current respondent for most of the companies. We'll alert the CEO to the new survey and provide them the name of the person to whom we plan to send the survey. For some of the companies, we'll attempt to obtain a new respondent by going to the CEO and asking them to name a new coordinator for the survey. The \$6 million question, of course, is whether companies will actually do what we would like them to do.

6. BRDIS Strategies for Getting to the Right Respondents

The goal is to create a holistic, comprehensive strategy to get the survey to the right respondents within the organization. To achieve that goal, we are employing 'The Tailored Design Method' advocated by Dillman (2007). All the survey materials are being developed with this goal in mind.

The strategies that are being employed in the upcoming 2009 BRDIS to facilitate getting the right questions to the right person within the organization are described below.

- Create clear, explicit, yet simple and flexible, instructions
- Develop a color-coded sectional design for the questionnaire
- Provide a separate set of instructions for each section
- Explain who might be the right type of person within the organization to complete the different sections
- Offer electronic worksheets or spreadsheets of each question and each section to facilitate distribution of the exact question wording
- Coordinate contact letters, questionnaire instructions, phone scripts and web materials in a cohesive manner

In addition, we have instituted guidelines for the development of the questionnaire.

- Created a style guide to maintain a consistent look and feel.
- Embedded the definitions and examples into the questions
- Eliminated a separate instruction book

Unlike the previous Survey of Industrial R&D, the new Business R&D and Innovation Survey questionnaire is explicitly partitioned into distinct sections with each section focused on a different type of data. The sections are aimed at (1) the R&D paid for by the company, (2) R&D management and strategy, (3) R&D paid for by external parties, (4) R&D employees, and (5) intellectual property, technology transfer and innovation issues. The questionnaire design includes a variety of visual cues to indicate the different sections, including different colors, tabs in the margins, and section dividers, see Figures 1 and 2.

How do I complete this survey?
 The Business R&D and Innovation Survey is divided into five sections. Each section asks questions about different aspects of R&D at your company. Due to the specialized nature of each section, it may be necessary to collaborate with colleagues in different departments within your company for each section. The sections are color-coded and cover the following topical areas:

Section 1: R&D Finance
 • Asks for information about R&D expenses, sales and operating revenues and capital expenditures
 • Best answered by persons with knowledge of your company's financial records

Section 2: R&D Management and Strategy
 • Asks for specialized information about the characteristics of this company's R&D reported in Section 1
 • Best answered by persons with first-hand knowledge of R&D operations, such as a VP of Research

Section 3: R&D Funded or Paid for by Others
 • Asks for information about R&D that is paid for by others, such as that paid for by customers or partners
 • Best answered by persons with knowledge of your company's financial records related to contracts and grants

Section 4: R&D Human Resources
 • Asks for information about your company's R&D employees
 • Best answered by persons with knowledge of your company's HR records

Section 5: Intellectual Property and Technology Transfer, and Innovation
 • Asks for information about intellectual property such as patents, technology transfer activities such as patent licensing, and actions taken to improve company performance
 • Best answered by persons with knowledge of your company's patenting, licensing, and general business strategy

You can access electronic copies of the questions or the whole survey on our web site:
www.census.gov/econhelp/rd.

NOTE: Questions 2-1, 2-2, and 2-3 in Section 2 require information from Section 1. If the person completing section 2 is not the same person completing section 1, please provide the requested information to him or her.

Figure 1: Color-coded sectional design of questionnaire

SECTION 1

SECTION 1
R&D Finance

Who should answer this section?
 Persons familiar with accounting concepts and with access to financial records related to your company's R&D activities should complete this section.

Figure 2: Color-coded section cover page

A specific set of instructions at the beginning of the questionnaire is aimed directly at the coordinator and explicitly discusses the specialized nature of the questions and the need to involve different people within the organization who have specialized knowledge and access to the different data, see Figure 3.

SECTION 2 – R&D Management And Strategy

What does this section cover?
 This section requests information about the characteristics of the R&D expenses your company reported in Section 1. This section requests information about your company's worldwide consolidated R&D and R&D your company performs in the domestic United States.

What is the reporting unit?
 The reporting unit is your company, including all subsidiaries and divisions. Include operations of subsidiary companies, where there is more than 50 percent ownership. Also include data for discontinued operations.

What is the difference between R&D expense and R&D performance?
 This section uses two different concepts to collect information about your company's R&D: an accounting concept, R&D expense, and a physical concept, R&D performance. The amount of R&D reported using these two concepts may differ.

R&D expense is based on accounting definitions used by your company. For more information refer to Financial Accounting Standards Board (FASB) Statement of Accounting Standards No. 2 (Accounting for Research and Development Costs). For this survey report R&D expense even if the amount is not considered material to your company.

Exclude:

- R&D from acquired companies prior to acquisition (in-process R&D)
- Costs for routine product testing, quality control, and technical services
- R&D funded or paid for by others not owned by your company (these costs are reported in Section 3).

R&D performance is based on the location where R&D was performed by your company. Exclude costs for R&D performed by others not owned by your company such as contract research organizations, universities, and federal laboratories.

Figure 3: Separate instructions for each section

Definitions and examples have been embedded into the questions as needed, see Figure 4. The need for a separate instruction booklet accompanying the survey has been eliminated.

Worldwide R&D performance funded by others

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|------------|--|---|---------|------|-------|--|--|--|
| 3•1 | <p>What was the cost of R&D performed by your company worldwide in 2008 that was funded or paid for by others not owned by your company?</p> <p>Include:</p> <ul style="list-style-type: none"> • Cost of sales for contract R&D services provided to other parties not owned by your company • Costs for R&D supported by grants from government agencies and private foundations • Costs paid for by others for the development, production, and testing of prototypes prior to their introduction to the market • Costs paid for by others for phase I - III clinical trials of medical products • Independent research and development (R&D) costs for which your company anticipates reimbursement by the U.S. government through indirect charges on government contracts <p>Exclude:</p> <ul style="list-style-type: none"> • Payments in excess of the actual cost of the R&D (such as profits or fees) • Costs accounted for as R&D expenses by your company (reported in Section 1) • Costs for routine testing of products currently on the market • Costs for phase IV clinical trials or other post-marketing testing performed for medical products • Costs for R&D performed by <u>FFRDCs</u> (Federally Funded Research and Development Centers) your company administers • Bid and proposal (B&P) costs | <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%; text-align: center;">\$ Bil.</td> <td style="width: 33%; text-align: center;">Mil.</td> <td style="width: 33%; text-align: center;">Thou.</td> </tr> <tr> <td style="height: 20px;"></td> <td></td> <td></td> </tr> </table> <p style="text-align: center; font-size: small;">This answer is used in Questions 3-2, 3-3, and 3-5</p> | \$ Bil. | Mil. | Thou. | | | |
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Figure 4: Embedded definitions in a question

Following Giesen's advice, the survey is tracking the names and titles of the people providing data for each section of the survey.

The questionnaire will be available both in paper and on the web. Access to the web version is through a secure website maintained by the U.S. Census Bureau and requires a personalized ID and password. In addition, both writeable PDFs and electronic spreadsheets will be available to facilitate the distribution of the whole questionnaire, separate questions or different sections throughout the company. Access to the electronic versions will be available through the same website as the web version of the questionnaire.

A pilot test of the new survey will go into the field in January 2009. An extensive set of evaluations, both qualitative and quantitative, are planned for summer and fall of 2009. Barring any major issues or problems, the full survey will go into the field in early 2010 with data from the new survey available in December 2010.

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