

The Redesign of the National Science Foundation's Business R&D and Innovation Survey: What Worked and What Didn't in Trying to Measure Global R&D, Intellectual Property, Technology Transfer, and Innovation

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**Abstract**

Over the last five years, the National Science Foundation's Division of Science Resources Statistics (SRS) and the Census Bureau's Economic Directorate have collaborated on a redesign of the Survey of Industrial Research and Development. SRS took the lead in this redesign following recommendations from the Committee on National Statistics (CNSTAT), National Research Council. The resulting 2008 Business Research & Development and Innovation Survey (BRDIS) was a 56-page instrument to collect data on R&D and other innovation activities, which in January 2009 was sent to approximately 39,500 businesses in the United States. This paper briefly describes the process for redesigning the R&D survey, summarizes the survey content, and presents some preliminary findings from the effort. 2008 data processing is not yet finalized. Preparations for a follow-up 2009 data collection, to be launched in January 2010, are nearing completion.

**Context for the Redesign**

The National Science Foundation (NSF), as part of its original Congressional authorization, is charged "... 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". The Division of Science Resources Statistics (SRS) is a federal statistical agency within the NSF that is responsible for fulfilling this NSF mandate for data collections and analyses on the science and engineering enterprise. One means for doing so is a suite of SRS surveys that collect information on science and engineering education, the scientific and technical labor force, and spending on research and development (R&D) and related infrastructure.

Based on data collected from its Survey of Industrial Research and Development, SRS has published annual information on U.S. industry R&D performance since 1953. SRS

has been funding this survey for over 50 years, with the U.S. Census Bureau as its data collection agent since 1955. The results of the survey are used to assess trends in R&D expenditures by industry sector, investigate productivity determinants, formulate science and tax policy, and compare individual company performance with industry averages. This survey is the Nation's primary source for international comparative statistics on business R&D spending.

As part of a host of data-quality activities, in 2002 SRS commissioned a review of its R&D surveys by the Committee on National Statistics (CNSTAT) of the National Research Council. CNSTAT appointed a panel of experts representing the fields of statistics, survey research, economics, data analysis, research policy, and R&D to review current data coverage and relevance, collection systems, and survey and statistical methodologies. The report, *Measuring Research and Development Expenditures in the U.S. Economy*, was published in 2005. As its core recommendation, the panel concluded that it was time to implement a major redesign of NSF's Survey of Industrial Research and Development. They noted that the redesign should take a four-pronged approach:

- "The redesign would begin with a reassessment of the U.S. survey against the "standard," that is, the international definitions as promulgated through the *Frascati Manual*<sup>1</sup>, thereby adding some data items. It would benchmark U.S. survey methodology against best practices in other countries...
- In order to sharpen the focus of the survey and fix problems further identified in this report, the redesign would update the *questionnaire* to facilitate an understanding of new and emerging R&D issues...
- The redesign would enhance the program of *data analysis and publication* that would facilitate additional respondent cooperation, enhance the understanding of the industrial R&D enterprise in the United States, and provide feedback on the quality of the data to permit updating the survey methodology...
- The redesign would revise the *sample* to enhance coverage of growing sectors and the *collection procedures* to better nurture, involve, and educate respondents and to improve relevance and timeliness." (CNSTAT, 2005: 50-52)

The Panel further concluded "that innovation, linked activities, and outcomes can be measured and the results used to inform public debate or to support public policy development... The panel recommends that this collection be integrated with or supplemental to the Survey of Industrial Research and Development." They noted that "... it is useful to discuss the measurement of innovation because of the close interaction between traditional R&D and the process of innovation. Innovation measures must cover five activities: the introduction to the market of new products; the development of new processes to produce, or deliver, products for the market; the development of new markets; the finding of new sources of supply of raw materials; and changes in the organization of firms. Introducing new products to the market has implications for economic growth, and new processes provide opportunities for improvements in productivity, quality, or other desired objectives, such as reduced environmental emissions or a happier labor force." (CNSTAT, 2005: 91)

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<sup>1</sup> Organisation for Economic Cooperation and Development. 2002. "Frascati Manual: Proposed Standard Practice for Surveys on Research and Experimental Development." Paris: OECD.

## Redesign Activities

During the period 2005 through 2008 SRS and Census staff engaged in a number of activities to inform the redesign. Many of the steps were guided by the CNSTAT recommendations. Data needs were solicited from data users, including through the sponsorship of two—Federal and nonfederal—data-user workshops. The workshop findings helped guide question identification and development. Specifically, users participating in both workshops identified their greatest interests as (1) expanded information on the domestic and foreign sources of R&D funding and (2) obtaining added detail on R&D expenditures below company-level aggregates. (The then-current industry R&D survey collected only a single R&D total for the entire consolidated company that was then classified into a single NAICS code representing the company's main or primary economic activity.) In addition to these core data needs, participants in both workshops noted an additional overlapping interest in data on the character of R&D; on the R&D labor force; on R&D by technology areas and areas of application; and on the outputs and outcomes of R&D. Nonfederal data users also valued data on foreign R&D operations and finer geographic detail, whereas Federal users requested data on infrastructure and capital investments and detail on types of R&D costs.

Early on, SRS established and convened Industry/Business Experts Panels, the purpose of which was to advise SRS on priorities and strategies for ongoing activities to improve the relevance of its industry R&D statistics. The panels each were comprised of about 15 industry leaders (generally chief technology officers and vice presidents of R&D, or equivalent) representing mostly major R&D performing companies, but with small company representation as well. Most industry sectors were represented by the panel, including pharmaceuticals, defense, automotive, information technology, financial services, and the food industry. The first Industry Expert Panel met three times in 2006 and focused on measurement of past and future drivers of industry R&D, the need for respondent-relevant R&D definitions, the role of collaboration in R&D, and the importance and complexity of R&D globalization. These meetings helped cement the decision to explicitly utilize accounting definitions as a starting point for R&D data collection, as well as help identify a number of specific survey questions for investigation.

A follow-up Business Expert Panel was established and met twice in 2008. The role of this panel was (1) to provide perspectives on the fast-changing environment for business R&D; (2) to identify emerging issues and trends that are important to maintaining the accuracy and relevance of the new survey instrument and (3) to discuss ways to introduce and advertise the new survey to the business community. It was from discussions with these industry leaders that SRS and Census determined to explicitly and immediately expand the R&D survey to include specific innovation-related questions patterned on the European Union's Community Innovation Survey (CIS) and to field these questions to all businesses in the sample, including both R&D and non-R&D performers.<sup>2</sup> Also about

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<sup>2</sup> SRS initially determined that it could not undertake simultaneously the development of an instrument to collect expanded R&D data *and* data on innovation. However, there was increasing interest in

that time, the survey's name was formally changed to the Business R&D and Innovation Survey (BRDIS).

The redesign effort also benefited extensively from site visits and interviews with businesses throughout the U.S. Early in the redesign, SRS (with assistance from the Energy Information Administration) conducted recordkeeping/environmental scanning interviews with about 25 companies, which specifically included probes to confirm that companies maintained records to track R&D flows coming into the company as well as paid out to others. Building on the recordkeeping studies, SRS and Census further conducted five rounds of further cognitive testing of possible BRDIS questions. Through more than 100 iterative businesses site visits and respondent interviews, a questionnaire was developed that matched user needs with the data sets or institutional knowledge businesses had available.

The cognitive interviews further confirmed the previous record-keeping findings that data accuracy would be highly dependent on the different parts of the redesigned survey being answered by different experts within a single company. This was a critical finding, which entailed a number of collection challenges, since the new survey includes an expanded set of topics from what was previously collected, including on R&D financing; R&D management and business strategy; R&D human resources; and R&D results and outcomes. New questions were developed to address emerging topics within each of these subject categories. [A summary of new content questions is provided in the next section of this paper.]

The cognitive interviews helped determine not only which questions should be included, but also those that could not be collected. For example, initially there were plans to measure the rate of return on R&D and to collect information on specific R&D projects. These concepts proved rather intractable. At the outset of our cognitive testing, there also was a much more extensive list of proposed questions dealing with worldwide R&D activity and outsourcing than the questions that ultimately survived. Decisions were made to reduce the number of these questions, since many multinational companies do not consolidate all records in a single domestic location, and because a number of the questions were determined to be either unanswerable or too burdensome.

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understanding innovation and its relationship to research and economic productivity both in the academic and policy communities. Subsequently, SRS determined to attempt to collect some innovation related data as part of the redesign. The concept SRS developed was to collect a basic set of intellectual property and technology transfer data that would facilitate implementation of a full-scale innovation module to a subsample of respondents to the redesigned survey in the future. But by spring/summer 2008, interest was extraordinarily high for "something" covering innovation specifically (not just IP) in the survey. Hence, SRS developed a basic summary question on innovation covering the three year period 2006–08. This question would enable SRS to determine if the respondent felt that their company had undertaken any activities that are "defined" as innovation in the CIS questionnaire without using the word innovation. The 2008 pilot BRDIS survey requires all 40,000 firms in the sample to answer the module on IP/technology transfer/innovation, whether or not the firm actually conducts R&D. The intent is to establish a base line of firms that are conducting innovation activities and to potentially follow up with a more detailed module to these firms in a later survey cycle.

## Resulting Questionnaire Content

Unlike its predecessor that was sent to a single respondent within a company, the new BRDIS questionnaire was structured to allow different experts within a single business provide responses to their areas of expertise. Specifically, the form has six sections to aid in accurate data collection, addressing questions of (1) company characteristics, (2) R&D expense—what the company funds, (3) R&D management and strategic and technical attributes, (4) R&D performed by the business using funds paid for by others—often tracked as "cost of sales" rather than as "R&D", (5) R&D human resources, and (6) intellectual property, technology transfer, and innovation. The questionnaire directs respondents/accountants with financial expertise to answer topic 2, R&D managers to respond to topic 3 questions, accountants/contract experts to address topic 4, HR experts to answer topic 5, and business strategists or those with legal expertise to respond to the IP, technology transfer and innovation questions.

In addition to the core R&D expenditure questions that are intended to provide—to the extent possible—a bridge between the historical time series and results from the BRDIS collection, a variety of new questions were included on the redesigned survey to address a number of the data needs identified by users and by businesses themselves. Specifically, companies are requested to detail and report by individual business code (generally, NAICS categories) their domestic and worldwide sales, domestic and worldwide R&D expense, and domestic R&D performance. There are also extensive questions related to their domestic and worldwide R&D relationships, including R&D agreements and R&D funding transfers across sectors. These questions include R&D expenses performed by others, including R&D purchased or "outsourced" to other domestic and foreign companies; R&D agreements with institutions in other sectors, other countries, and with customers, vendors, and competitors; and questions on R&D funded by others, including foreign sources, federal sources, and other business sector sources. This latter category will help address major questions related to sources of inter-company R&D funding, including at contract research organizations (CROs). There are a number of questions on the strategic purpose of a company's worldwide R&D; their technology applications; and questions on businesses' worldwide R&D employment. The last section of the survey includes questions on patenting, licensing, and technology transfer activities. It includes basic questions used to define which companies are innovative similar to those included in the E.U.'s Community Innovation Survey, and prescribed in the *Oslo Manual*<sup>3</sup>. The last section of the survey must be answered by all companies, whether they perform or fund R&D, or not.

The 2008 survey is intended to serve as a platform for collecting an expanded set of innovation metrics. The specific innovation questions on the 2008 survey are summarized in Appendix A, including variables for disaggregating R&D expenditure totals to mirror *Oslo Manual* recommendations for collecting broader innovation data. Those 2008 questions will be repeated on the 2009 BRDIS survey, which will include additional innovation questions, based on the guidance provided in the *Oslo Manual*.

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<sup>3</sup> Organisation for Economic Cooperation and Development. 2005. "Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data." Paris: OECD.

The innovation questions planned for the 2009 survey are summarized in Appendix B. The complete list of topics covered on the 2008 BRDIS follows.

- **Section 1-Company characteristics**
  - Ownership details
  - Domestic and worldwide sales and revenue
    - by detailed business code (below the company)
  
- **Section 2-Financial measures of R&D activity paid for by your company:**
  - Detail on domestic U.S. R&D and on worldwide R&D activity
  - Company R&D expense
    - by detailed business code
    - by U.S. state location of performance
      - at largest specific domestic location
    - by country location of performance
    - by type of expense (wages, materials, etc.)
    - outsourced R&D
      - by sector (universities, other companies, etc.)
      - by location (domestic vs. foreign)
    - Includes social science R&D
  - Capital expenditures for R&D (buildings, software, equipment)
  - Projected R&D expense
  
- **Section 3-Measures related to R&D management and strategy**
  - Share of R&D
    - devoted to new business areas for the company
    - involving science or technology new to the company
    - on science or technology that is new to the market
    - spent on research (basic or applied) versus development
    - devoted to specific application areas (health, defense, energy, etc.)
    - devoted to specific technology areas (software, biotechnology, nanotechnology, clinical trials, etc.)
  - R&D partnerships
    - by sector (universities, companies, government)
    - by type of organization (customer, vendor, competitor)
    - by location (domestic vs. foreign)
  - Interaction with academia
    - use of consultants, interns, postdocs, monetary gifts
  - Company characteristics
    - year first started operations
    - receipt of venture capital
    - commercialize academic research
  
- **Section 4-Financial measures of R&D activity paid for by others:**
  - R&D as part of “cost of sales”, performed by Contract Research Organizations (NAICS 5417), funded under collaborative agreements

- Characteristics of the R&D performer
  - by detailed business code
  - by U.S. state location and country location
  - by type of expense (wages, materials, etc.)
  - outsourced R&D
    - by sector (universities, other companies, etc.)
    - by location (domestic vs. foreign)
- Characteristics of the R&D funder
  - from type of organization (federal government, other companies, etc.)
  - from foreign vs. domestic organization
  - by business purpose (aerospace, pharma, computer products, etc)
  - by type of funding mechanism (grant, contract, co-op agreement)
  - for clinical trials and the production and testing of prototypes
- **Section 5-Measures related to R&D employment**
  - US R&D headcount and worldwide R&D headcount
    - by occupation (scientists, engineers, technicians, support)
    - by gender (scientists, engineers, technicians, support)
    - by level of education (for scientists and engineers)
    - by US vs. non-US citizenship (for scientists and engineers)
  - Number of U.S. R&D employees working under a visa (H-1B, L-1, etc.)
  - US R&D Full-Time Equivalent (FTE) S&E counts
- **Section 6-Intellectual property, technology transfer and innovative activities**
  - Introduction of new or significantly improved products
    - goods
    - services
  - Introduction of new or significantly improved processes
    - methods of manufacturing or producing goods or services
    - logistics, delivery or distribution methods
    - support activities
  - Patent data
    - number of patents applied for and issued in a given year
    - percent of inventions that the company considered for patenting
    - internal versus external sources of patents
    - applications for foreign patents
  - Licensing to outside parties (counts, revenue)
  - Importance of types of intellectual property protection (utility or design patents, trademarks, copyrights, trade secrets)
  - Participation in specific technology transfer activities
    - acquisitions
    - technical assistance or "know-how" agreements
    - cross-licensing
    - open-source intellectual property

## 2008 Data Collection

The 2008 Business R&D and Innovation Survey was launched in January 2009. BRDIS is being pilot-tested with the full sample of ~40,000 U.S. for-profit companies with five or more employees. The BRDIS questionnaire is a paper booklet mailed to respondents, though they have the option of filling out and mailing back the booklet or entering their data into the Census Bureau's Web-based collection instrument. Sampled companies received one of two forms, the BRDI-1 (a 56-page long form that included questions on all topics summarized above) or the BRDI-1A (a 28-page short form that included a reduced number of questions from Sections 1-5, but all of the questions included in Section 6). Traditionally, companies with known prior R&D greater than or equal to 3 million dollars received a long form. For this year it turned out to be 3,835 companies. The cutoff value for BRDI-1 was adjusted so that companies with prior R&D greater than or equal to ~2 million dollars (somewhat fewer than 5,000 companies) received the longer BRDI-1 2008 form. A representative sample of approximately 35,000 businesses received the BRDI-1A. The Office of Management and Budget approved BRDIS as a mandatory survey. All responses are kept completely confidential.

Initially, the data collection was planned to end by late October 2009. However, sufficiently high response rates, including desired sector-specific coverage, had not been reached by then. Undoubtedly the length and complexity of the survey contributed to slow survey responses; the unique economic environment into which the new survey was launched likely has also been a contributing factor. As of mid-December, data collection was continuing, with response rates increasing favorably. By then, the overall response rate had reached 80.1%, and that of the largest 500 R&D-performing companies—which historically have accounted for roughly 80 percent of the business R&D total—had reached 88.5%.

The remainder of the paper provides some summary observations on which questions proved problematic or difficult, and on several new high-demand items that seemed to work well. These results, however, are preliminary and may change after final data are collected, tabulated, and published. Only aggregate findings and broad conclusions are reported here.

Tracking R&D flows. International standards (*Frascati Manual*) recommend and U.S. practice follows reporting R&D from the performer of the activity. That is, the entity that does the R&D work reports how much money was expended on R&D and who funded the work. This approach assumes that the entity doing the R&D is in the best position to know what they are doing (that it is R&D), when it was done, and who provided the funding (e.g., own self, the government, one's parent company, other companies under contract, etc.) The performer-based reporting had to be reconciled with the BRDIS starting point of requesting businesses to first report their R&D expense. This approach was adopted since our expert panels and site visits confirmed that R&D expense is a well-understood accounting concept: it includes R&D paid for by the company that is performed for the "benefit of the company" regardless of whether the company did the work in its own labs or contracted the work out. However, R&D that a company



undertakes for others—say under contract—would not be included in the definition of R&D expense, but rather might be considered, in an accounting sense as a "cost of sales". The technical activities included in the definition of R&D expense are generally consistent with activities included in a *Frascati* R&D definition. Since both activities, R&D expense performed by the company and R&D performed by the company but paid for by others, are to be included in the performance totals, this information was collected on two separate sections (2 and 4) of BRDIS. Hence, the survey instrument structure was designed to allow tracking of funds across companies, across sectors, and across geographic boundaries.

While the approach proved sound for most businesses, there were three categories of companies for whom such reporting proved difficult.

(1) Defense contractors had a difficult time understanding that R&D paid for by others (generally the Department of Defense or by other defense sub-contractors) should be reported as "R&D". There was initially—and perhaps still is—a large undercount. It appeared that since such external funding generally was not included in their reported R&D expense totals but rather as financially separate "cost of sales" (and indeed such defense work may even be organizationally separate from their civilian R&D activities), it was not a simple matter to extract the data for BRDIS reporting purposes.

(2) A number of "research firms" (or contract research organizations--CROs), particularly small biotechnology firms, consistently treated their R&D performance funded by others as part of their own R&D. Hence although they included the full R&D amount, they reported such R&D funds in Section 2 rather than Section 4.

(3) Since U.S. totals are based on the summation of R&D activities performed in the domestic United States, affiliates of foreign firms were requested to treat all external sources of R&D funding similarly. This effectively meant that the U.S. affiliate, for reporting purposes, should not differentiate between R&D funds received from their foreign parent and those received under contract from any other any domestic or foreign source. This guidance, because it was not sufficiently highlighted, created considerable confusion on the part of such companies—since it was unusual to treat their parent's R&D expense as R&D "paid for by others." These companies required multiple clarifications of what should be reported and were to include such funding totals.

For each of these three situations, however, when Census staff "walked" the respondents through the questionnaire, the reporting intent became clearer and respondents generally were able to provide the data as requested. As a result of these interactions, a number of content and form layout changes were made to the 2008 BRDIS pilot questionnaire to improve reporting of R&D expense performance and R&D funded performance (R&D funding flows) on the 2009 BRDIS questionnaire. Further, for the 2009 BRDIS there will be greater reliance on an expanded instruction booklet to clarify sector- or category-specific reporting anomalies, especially for foreign-owned affiliates.

New question successes. Perhaps the most novel component of the BRDIS survey relating to the R&D statistics was the request to have respondents allocate their sales and R&D totals among *multiple business codes*. This approach was attempted in direct response to recommendations made by CNSTAT and preferences expressed by data

users. Previously all of a company's R&D expenditures were assigned a single industry code, usually reflecting the company's primary economic activity (based on payroll or sales), which may or may not have been the focus of the R&D effort. The responses to this request for disaggregated reporting seem to be positive. For example, approximately 77% of the companies that responded to the BRDI-1 long form reported data for worldwide R&D expense broken out by business code. Of these companies, 27% reported more than one business code for their worldwide R&D expense and 73% reported only one business code for reported worldwide R&D expenses. For companies reporting more than 1 business code, in the aggregate, about 70% of the reported total R&D expenses were reported in their largest business code.

Currently, business R&D totals are reported at the state level, and even then not for all states since doing so for small states would risk company-specific disclosures. Yet data users expressed a strong desire for information on the *location of R&D activities below state aggregations*, particularly by standard metropolitan statistical areas (SMSA) if possible. To that purpose, a question was included in Section 2 on the location and amount of companies' largest domestic R&D location. Information reported for that question seems good. Both among all companies and within individual companies, R&D performance is highly concentrated. Indeed, of the R&D performance total reported by long-form companies, 54% was undertaken at their single largest domestic location.

In response to the increasing prevalence of and interest in global R&D trends, several questions related to such activities were included on the 2008 BRDIS. In particular, Section 2 of the survey attempts to collect information on U.S. multinational companies' worldwide R&D expense. Responses to this question seem complete, including reporting of good information on the *country detail* of where the R&D was undertaken. Countries in which US based companies reported the largest amount of foreign R&D performance included Germany, UK, Canada and India. Relatively smaller amount of companies' R&D was performed in China.

Section 3 of the survey instrument included a number of questions related to *R&D agreements*: their prevalence, the amounts funded, and the partners involved (that is, whether agreements were with universities or other companies, with domestic partners or foreign partners, with customers or competitors...). Many respondents had a difficult time identifying what exactly comprised an agreement versus, say, a vendor relationship<sup>4</sup>, and had an even more difficult time properly identifying and assigning the R&D expenditure (including in-kind contributions) to the "right" R&D partner. Nonetheless, the preliminary tabulations show more than 1,500 companies reported R&D agreements, although some of this most certainly include contracted R&D rather than collaborations.

Early indications are that useful domestic and worldwide workforce data are being reported in Section 5. In particular, the survey should result in a good first-time estimate of U.S. companies' *global R&D workforce*, including by occupation (e.g., scientists

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<sup>4</sup> BRDIS defined R&D agreements as that involving two or more parties pooling resources and expertise to undertake R&D and share in resulting intellectual property. R&D agreements involve shared risk and shared reward.

versus engineers versus technicians) and gender. Fully 16% of the companies responding to questions in this section reported a larger number for worldwide R&D employees than for domestic R&D employees. Our attempt to obtain S&E education levels are getting mixed results: Form layout changes have been made to the 2009 questionnaire to improve reporting of scientists' and engineers' degree data.

The previous industry R&D survey included none of the questions incorporated in Section 6 on "Intellectual Property, Technology Transfer, and Innovation". Unlike sections 2 through 5 which required responses only from businesses reporting any R&D activity, all 40,000 companies in the BRDIS sample were required to answer Section 6 questions. As it turned out, whether businesses reported R&D or not, there was a high likelihood that they responded to this section.

A few stylized facts include the observation that, for companies located in the United States, *innovation* is highly correlated with R&D activity. 73% of the companies reporting any R&D activity reported the recent introduction of new or significantly improved products or processes. By comparison, 12% of the companies without any R&D activity reported an innovation. It is too early to determine the percentage of all innovators that report R&D activities.

The 2009 BRDIS questionnaire will include an expanded number of innovation questions, patterned after those included on the European Community Innovation Survey. Specifically, all companies will be asked the following questions:

- If you introduced new or significantly improved products
  - were they new to one of your markets?
  - were they only new to your firm?
- Percentage of total sales
  - that were they new to one of your markets
  - that were only new to your firm
  - that were unchanged or only marginally modified

A full list of innovation-related questions is included in Appendix A and Appendix B. Further, for the 2009 BRDIS, the innovation questions (but not those on IP or technology transfer) will be moved from Section 6 to the front of the questionnaire.

Further, *patenting* is also highly correlated with, but not dependent upon, R&D activity. 37% of the companies reporting any R&D activity reported having applied for a U.S. patent in 2008. By comparison, 2% of the companies without any R&D activity reported having applied for a U.S. patent in 2008. About 64% of the companies that reported applying for patents from the USPTO also reported that they had applied or planned to apply for a *foreign patent* on their invention. Finally, a very large number (~2,600) of companies reported their participation in *technical assistance or "know-how" agreements and cross-licensing agreements*. A smaller, but substantial number (~2,000), reported the use of *open-source technologies*.

The first release of detailed 2008 tabulations is anticipated for March 2010. The 2009 BRDIS is scheduled to be launched in mid-January 2010.

## **Appendix A – 2008 BRDIS Innovation Questions**

### 2008 BRDIS—innovation questions related to R&D

- Q3.18 What percentage of the domestic R&D performed by your company in 2008...was directed toward business areas or product lines in which your company had no revenues before 2008?
- Q3.19 What percentage of the domestic R&D performed by your company in 2008...involved science/technology that your company had not used in projects before 2008?
- Q3.20 What percentage of the domestic R&D performed by your company in 2008...was both directed toward business areas or product lines in which your company had no revenues before 2008 and involved science/technology that had not been used by your company in other projects before 2008?
- Q3.21 What percentage of the domestic R&D performed by your company in 2008...was for R&D in science/technology new to the market(s) (i.e. first-to-market) in which your company operates?

### 2008 BRDIS—questions on patents, licensing and intellectual property asked of all respondents

- Q6.2 How many patents did your company apply for in 2008 from the U.S. Patent and Trademark Office (USPTO)?
- Q6.3 What percentage of the patent applications reported in Question 6•2 has your company applied for or plans to apply for in foreign jurisdictions?
- Q6.4 What percentage of the patent applications reported in Question 6•2 was for inventions that originated within your company's organized R&D activities?
- Q6.5 How many patents were issued to your company in 2008 by the USPTO?
- Q6.6 What percentage of your company's inventions considered for patenting in 2008 resulted in patent applications?
- Q6.7 In 2008, what was the amount of your company's revenue from patents licensed to others not owned by your company?
- Q6.8 How many new agreements did your company enter into during 2008 to license patents to others not owned by your company?

2008 BRDIS—questions on technology transfer asked of all respondents

Q6.9 Did your company perform the following activities in 2008?

- a. Transferred intellectual property to others not owned by your company through participation in technical assistance or "know how" agreements?
- b. Received intellectual property from others not owned by your company through participation in technical assistance or "know how" agreements?
- c. Transferred intellectual property to a spin-off or spin-out of your company?
- d. Received intellectual property from a parent company as part of a spin-off or spin-out?
- e. Acquired more than 50% ownership in another company for the primary purpose of acquiring their intellectual property?
- f. Participated in cross-licensing agreements—agreements in which two or more parties grant a license to each other for the use of the subject matter claimed in one or more of the patents owned by each party?
- g. Allowed free use of patents or other intellectual property owned by your company (e.g., allowing free use of software patents by the open source community)?
- h. Acquired any financial interest in another company in order to gain access to their intellectual property?
- i. Made use of open source patents or other freely available intellectual property not owned by your company?

2008 BRDIS—innovation question asked of all respondents

Q6.1 Did your company introduce any of the following during the three-year period, 2006 to 2008?

- a. New or significantly improved goods (excluding the simple resale of new goods purchased from others and changes of a solely aesthetic nature)
- b. New or significantly improved services
- c. New or significantly improved methods of manufacturing or producing goods or services
- d. New or significantly improved logistics, delivery, or distribution methods for your inputs, goods, or services
- e. New or significantly improved support activities for your processes, such as maintenance systems or operations for purchasing, accounting, or computing

## Appendix B – 2009 BRDIS Innovation Questions

### 2009 BRDIS—additional innovation questions asked of all respondents

- Q1.10 Did your company introduce any of the following during the three-year period, 2007 to 2009?
- New or significantly improved goods (excluding the simple resale of new goods purchased from others and changes of a solely aesthetic nature)
  - New or significantly improved services
  - New or significantly improved methods of manufacturing or producing goods or services
  - New or significantly improved logistics, delivery, or distribution methods for your inputs, goods, or services
  - New or significantly improved support activities for your processes, such as maintenance systems or operations for purchasing, accounting, or computing
- Q1.11 If you answered "yes" to either 1-10, line a or 1-10, line b, were any of those new or significantly improved goods or services:
- New to one of your markets? Y/N  
Your company introduced new or significantly improved goods or services to one of your markets before your competitors? (It may have been available in other markets)
  - Only new to your firm? Y/N  
Your company introduced new or significantly improved goods or services that were already available from your competitors in your markets.
- Q1.12 Using the definitions above, please give the percentage of your total sales in 2009 from:
- New or significantly improved goods and services introduced during 2007 to 2009 that were new to one of your markets? \_\_\_\_%
  - New or significantly improved goods and services introduced during 2007 to 2009 that were only new to your firm? \_\_\_\_%
  - Goods and services that were unchanged or only marginally modified during 2007 to 2009 (include the resale of new goods or services purchased from other enterprises)? \_\_\_\_%