Intangible Assets: NSF's R&D and Related Data Collections

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National Science Foundation
Division of Science Resources Statistics (SRS)
www.nsf.gov/statistics

Division of Science Resources Statistics

The Division of Science Resources Statistics (SRS) 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…"

SRS Activities to Enhance the Comparability, Scope, and Availability of R&D and Related Data (1)

- Redesigning the industry R&D survey
- Redesigning the academic R&D survey
- Two surveys of federal government funding of R&D
  - Committee on National Statistics panel convened to explore issues and new approaches for survey improvement
- New State government agency R&D Survey.
  - Data collections for 2006 & 2007 & periodic in the future
- Research facilities survey in academic and biomedical facilities
  - Expand data collection on cyberinfrastructure

SRS Activities to Enhance the Comparability, Scope, and Availability of R&D and Related Data (2)

- Nonprofit R&D Survey: very early planning stage
- Exploring innovation data collection possibilities from very small firms (1-4 employees)
- R&D Satellite Account—joint work with Bureau of Economic Analysis
- Linking NSF's Business R&D data with BEA data on foreign direct investment
  - U.S. firms' international R&D activities
  - Foreign firms' R&D activity in U.S. by state and industry
- Add R&D/innovation related questions to other surveys
  - Kauffman (third follow-up) Entrepreneurial Firm Survey
  - Census Company Organization Survey

Why Redesign?

Business R&D context: Then and now

1950s

- Government largest source of R&D $$$
- Business largest basic research performer
- Manufacturing
- Large companies dominate R&D $$$
- Domestic focus
- Focus on in-firm S&T resources (central research labs)

2000s

- Business largest source of R&D $$$
- Academia largest basic research performer
- Services
- Large companies not as dominant in R&D $$$ share
- Global focus
- Increased leveraging of S&T resources outside the firm

Why Redesign?

Academic R&D context: Then and now

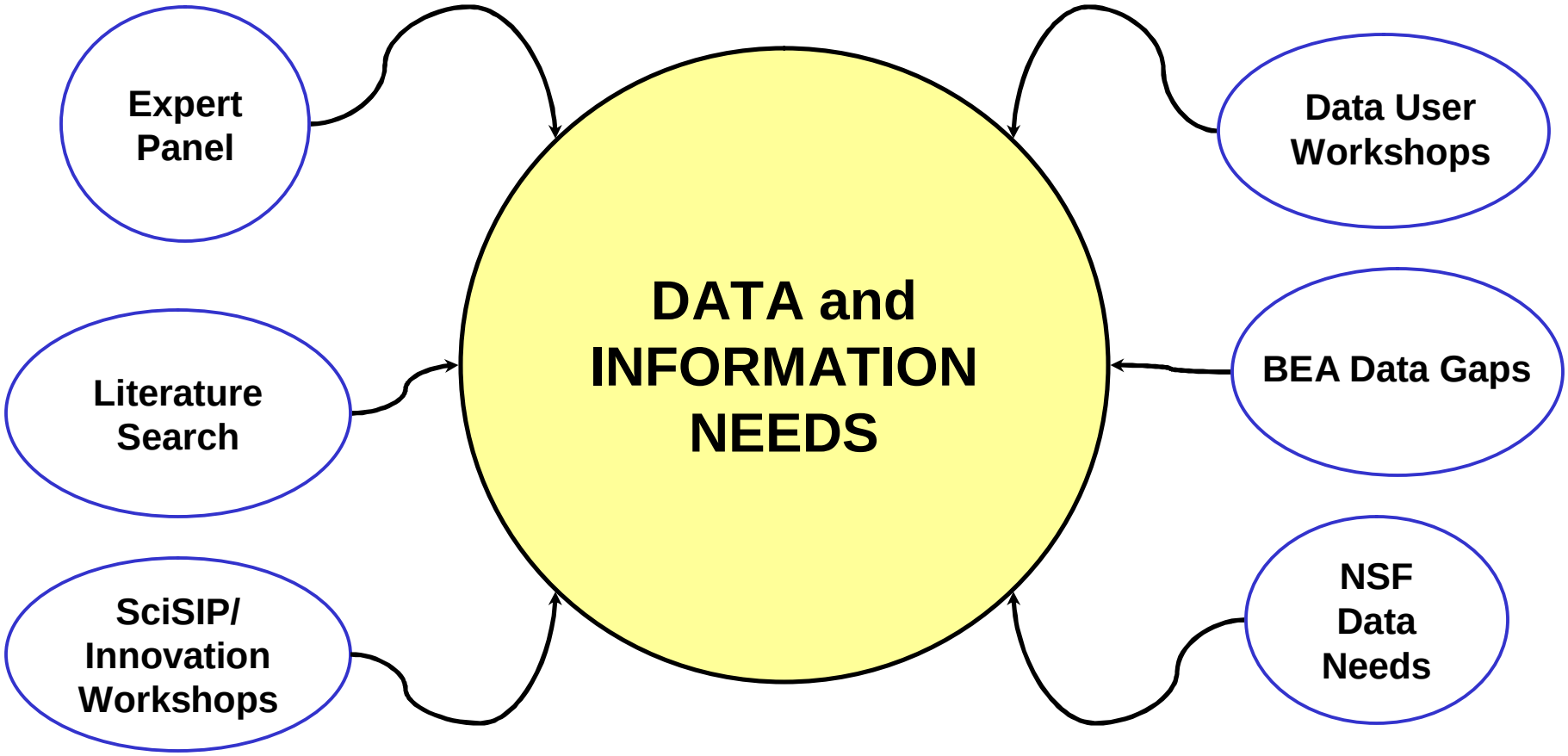
1970s

- Government largest source of R&D $$$; state government and institution own funds ~10% each
- Research at the bench
- Single discipline focus
- Individual PI research
- Individual labs
- Basic research and publications

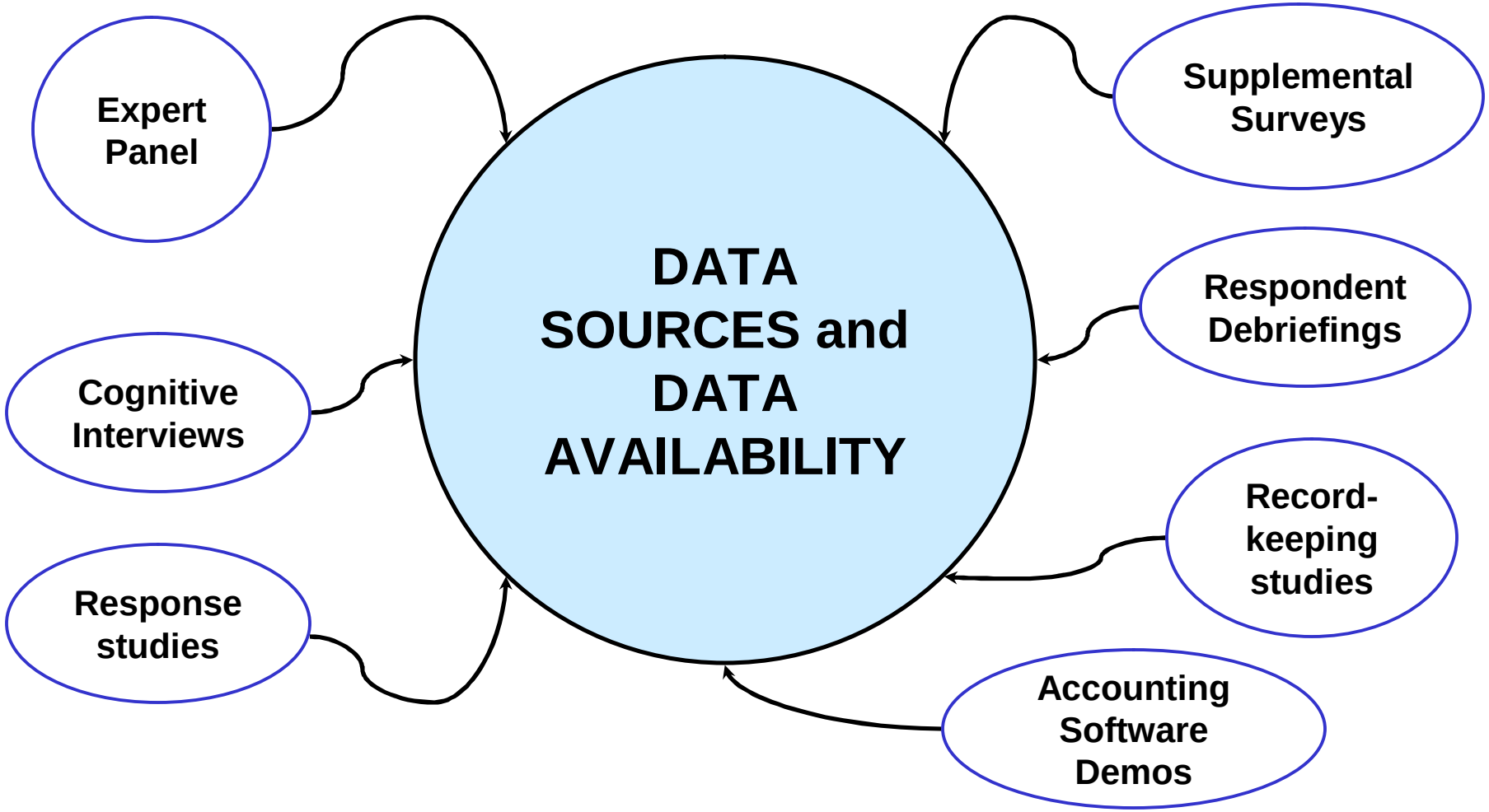
2000s

- Government still largest source; relative decline in state funds; large growth in institution cost-sharing
- Computer & IT assisted research
- Increase in multi- and interdisciplinary research
- Increase in collaborative research
- Growth in centers
- Interest in commercialization (Bayh-Dole Act; patents; IP; technology transfer)

Content: Identify Data and Information Needs



Content: Identify Data Sources and Availability



Present Industry R&D Survey

- Annual collection of industrial (manufacturing and services) R&D expenditure data since 1953
  - Data collection and tabulation by Census since 1957
- Includes all for-profit R&D-performing companies
  - 5 or more employees
- Surveyed at company (firm, enterprise) level
  - Not at establishment level
- Sample = approx. 32,000
  - Overall unit response rate (2006) = 77.5%;
    top 500 R&D performers = 89.2%
- Uses two survey forms: RD-1 and RD-1A (short form)
- 5 mandatory items
  - Total & Federal R&D, sales, employment, R&D by state
  - All items mandatory in Economic Census years

Extensive company contacts: What data do companies have and how to get it?

- Recordkeeping/environmental scanning interviews (~25)
- 5 rounds of cognitive interviews (~100 companies)
  - One round per topic
    - The "right people" are:
      - **Accountants** for financial sections
      - **HR reps** for employment section
      - **R&D managers** for technical aspects
      - **Legal experts** for IP and technology transfer
    - Combination of new companies and re-contacts from recordkeeping interviews and previous rounds
  - One overall round for entire survey (Summer 2008)
- Usability testing
  - Paper
  - Web

Lessons learned and challenges

- Different types of data are stored in different parts of the company
- No one person has direct access to all the data we need
- Not all the data policymakers and researchers want are knowable
- Questionnaire development requires
  - Contact with a variety of companies
  - Input from a variety of subject matter experts
- Getting the survey to the correct (most knowledgeable) respondent in the company for specific topic is crucial

<u>Right person = Right data</u>

What have we done with what we've learned?

- Survey content covers range of topical areas and requires data from multiple parts of the company

- Survey structured into separate sections:
  - Financial measures of R&D activities (R&D expense in accounting terms)
  - Financial measures of R&D funded by others (not classified as R&D in accounting definitions; but is R&D performance)
  - Nature and technical aspects of R&D
  - R&D employment data
  - Intellectual property (IP) and technology transfer

Business R&D Survey content (1)

- **Initial check-off questions on innovative activities** (NEW)
  - Introduction of new or significantly improved products (good and services)
  - Introduction of new or significantly improved processes
  - Own, receive, or apply for utility patents
  - License intellectual property to others

- **Financial measures of R&D activity:**
  - Detail on domestic U.S. R&D and on worldwide R&D activity (NEW)
  - Company R&D expense
    - Includes social science R&D (NEW)
    - by "business segment" (i.e., below the company level) (NEW)
    - by U.S. state location and country location (NEW)
    - by type of expense (wages, materials, etc.) (EXPANDED)
    - outsourced R&D by sector (universities, other companies, etc.)
  - Detail on domestic U.S. and worldwide sales and revenue (NEW)
  - Capital expenditures for R&D (buildings, software, equipment) (NEW)
  - Projected R&D expense

Business R&D Survey content (2)

- **Measures of company R&D activity funded by others**:
  - Funds for global R&D activity as well as domestic U.S. activity (NEW)
  - R&D funded by others
    - by "business segment" (i.e., below the company level) (NEW)
    - by U.S. state location (NEW)
    - by type of expense (wages, materials, etc.) (EXPANDED)
    - associated with single largest R&D project (NEW)
  - R&D performed for others under grants, contracts, or other agreements (NEW)
    - by type of organization (other companies, federal government, state and local governments, others)
    - by foreign vs. domestic organization
    - for clinical trials and the production and testing of prototypes

Business R&D Survey content (3)

- **Measures related to R&D management and strategy**
  - Share of R&D
    - devoted to new business areas for the company (NEW)
    - involving science or technology new to the company (NEW)
    - on science or technology that is new to the market (NEW)
    - spent on research versus development
    - devoted to specific application areas (health, defense, energy, etc.) (NEW)
    - devoted to specific technology areas (EXPANDED)
  - Counts of R&D projects (NEW)
    - number active and number started
    - number moved from R&D into production or marketing
  - R&D partnerships (EXPANDED)
    - by sector (universities, companies, government)
    - by type of organization (customer, vendor, competitor)

Business R&D Survey content (4)

- **Measures related to R&D employment**
  - US R&D headcount and worldwide R&D headcount (NEW)
    - by occupation (scientists, engineers, technicians, support) (NEW)
    - gender, and level of education (NEW)
  - US R&D employees working under a visa (H-1B, L-1, etc.) (NEW)
  - R&D Full-Time Equivalent counts

- **Measures related to intellectual property and technology transfer** (NEW)
  - Patent data (counts, external sources, foreign filings) (NEW)
  - Licensing to outside parties (NEW)
  - Importance of types of intellectual property protection (NEW)
  - Participation in specific technology transfer activities (NEW)

Business R&D Survey Timeline

Feb 2008 – Jan 2009	Collect 2007 data & continue redesign efforts
Jul 2008	Submit package for redesigned survey to OMB (Survey to be all mandatory)
Jan 2009	Launch full-scale pilot of redesigned survey (collect 2008 data for ~40K cases)
Feb 2009 – Dec 2009	Evaluate survey operations and pilot data
Jan 2010	Launch BRDS (collect 2009 data)
Mar 2010	Delivery of limited aggregate 2008 data from pilot
Dec 14, 2010:	**Delivery of 2009 BRDS data** in time for *Science and Engineering Indicators: 2012*

Future plans

- Add innovation and other topical questions to BRDS
- Consideration of new/rotating modules—e.g., innovation, specific modules for key industries
- Develop pilot survey of firms with 1-4 employees to identify innovative activities
- Continuously review and update survey content, methodology, and processing
- Maintain data quality and reduce (maintain) burden
- Continue program of company visits and consultation with industry experts

Present Academic R&D Survey (1)

- Currently a census of all R&D-performing universities and colleges (n = ~680)
- Conducted annually since Fiscal Year (FY) 1972
- Web-based survey used by 99% of respondents
- Voluntary survey (response rates regularly ~ 95%)
- Requests expenditures for all separately budgeted R&D performed at institutions during previous fiscal year
- Survey data published at the institution level

Present Academic R&D Survey (2)

Collects R&D expenditures by

- Source of funds (federal, state/local, industry, institution, other)
- Character of work (what percent is basic research?)
- Field of Science & Engineering (S&E)
- Federal agency sponsor and S&E field
- Amount expended on research equipment, by S&E field
- Amount passed through to subrecipients or received as a subrecipient
- Non-S&E field

Academic R&D Survey Redesign Project: Data Users Workshop

Top data needs mentioned:

- Data on academic technology transfer activities
- Data on academic/industry collaboration
- Data on interdisciplinary or multi-disciplinary research

Academic R&D Survey Redesign Project: Expert Panel (1)

Major recommendations:

- Capture the entire research enterprise
- Raise threshold for survey inclusion and/or use a long form/short form approach
- Include non-S&E R&D in the totals for institution rankings
- Collect data separately for medical schools
- Capture all sources of funding by field
- Collect data on interdisciplinary R&D and emerging fields

Academic R&D Survey Redesign Project: Expert Panel (2)

Major recommendations (cont.):

- If feasible for institutions, consider collecting data on the following:
  - Foreign sources of funding
  - R&D collaboration
  - Proposals and awards
  - Technology transfer activities
  - R&D personnel

Academic R&D Survey Redesign Project
Proposed Content Changes (1)

Based on Findings from 15 Institutional visits

- Ø Add “Nonprofits” as source of funding category
- Ø Request total amount of foreign funding as overlay question for source of funding
- Ø Include non-S&E R&D in totals reported for institutions
- Ø Include clinical trials and research training grants as R&D
- Ø Request all sources of funding to be reported by field of R&D

Academic R&D Survey Redesign Project
Proposed Content Changes (2)

Based on Findings from 15 Institutional visits (cont.)

- Update fields of R&D and add question on interdisciplinary R&D
- Request minimal data on R&D faculty/personnel
- Request minimal data on R&D proposal submissions
- Add small module on technology transfer activities
- Request total R&D expenditures by cost categories (salaries, indirect costs, equipment, supplies, etc.)

Higher Education R&D Survey Timeline

Jun 2008 – Jan 2010	Normal data collection & continue redesign efforts
August 2008	Draft of new survey items presented to expert panel
Fall 2008	Notice to academic respondents of proposed changes
Fall/Winter 2008	Cognitive testing of revised questionnaire
Summer 2009	Web survey development and usability testing
Fall 2009	Pilot of redesigned HERD survey (collect FY 2009 data for ~40 institutions)
Spring 2009	Evaluate survey results
Fall 2010:	Launch redesigned survey (collect FY 2010 data)