

University-Industry Knowledge Flows: An Overview



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Outline

- ❑ Background Information on University-Industry Knowledge Flows**
- ❑ Institutions/Mechanisms/Ventures Stimulating University-Industry Knowledge Flows**
- ❑ Partial Review of Academic Literature on University-Industry Knowledge Flows**
- ❑ Lessons Learned For Data Collection From This Literature**
- ❑ Specific Suggestions for Research Evaluation Initiatives**

Background Information on The Rise of University-Industry Knowledge Flows

□ U.S.-1960's, 1970's Decline in Competitiveness

(“Japanese Challenge”, Productivity Slowdown)

⇒ Dramatic Changes in U.S. National Innovation Policy

□ Expansion of Programs to Support Public-Private Partnerships (e.g., R&E Tax Credit, NSF-ERC, IUCRC, Advanced Technology Program-ATP)

□ Relaxation of Antitrust Enforcement to Promote Collaborative Research (e.g., NCRA, NCRPA)

□ Policies Promoting More Rapid Diffusion of Federally-Funded Technologies From Universities and Federal Labs to Firms (e.g., Bayh-Dole, Stevenson-Wydler, SBIR)

Legacy of the Bayh-Dole Act

□ **Bayh-Dole Act of 1980: Universities Own the Rights to Technologies That Arise from Federal Research Grants**

⇒ **Purpose: Accelerate the Rate of Technological Diffusion, Promote Economic Development**

⇒ **Almost All Universities Have Established a Technology Transfer or Licensing Office**

⇒ **Rapid Growth in Commercialization of University Technologies:**

	U.S. Universities	
	<u>1980</u>	<u>2004</u>
University Patents	300	3472
Licensing Agreements	276	3706
Startups	35	354

Institutions/Mechanisms Stimulating University-Industry Knowledge Flows

- ❑ Co-authoring Between Academic and Industry Scientists**
- ❑ Industrial Labs**
- ❑ Strategic Alliances**
- ❑ Research Joint Ventures (RJVs)**
- ❑ Licensing Agreements**
- ❑ Sponsored Research Agreements**
- ❑ Co-operative R&D Agreements (CRADAs)**
- ❑ Industry Consortia (SEMATECH)**

Institutions/Mechanisms Stimulating University-Industry Knowledge Flows (cont.)

- ☐ Property-Based Initiatives (Often Public-Private Partnerships)**
 - ☐ Science Parks**
 - ☐ Incubators**
 - ☐ NSF Industry-University Co-operative Research Centers**
 - ☐ NSF Engineering Research Centers**
 - ☐ “Centers of Excellence” (State-Level)**

Burgeoning Literature on University-Industry Knowledge Flows

- ❑ Interdisciplinary Analysis (Economics, Strategic Management, Public Policy, Sociology, and Finance)**
- ❑ Use of Proprietary Databases, Quantitative and Qualitative Data Collected by Various Authors**
- ❑ Use of A Wide Variety of Performance Indicators**
- ❑ Use of Quantitative and Qualitative Methods (Regression Analysis, Structural Equation Modeling, Case Studies, and Event Studies)**
- ❑ Analysis at Numerous Levels of Aggregation (Scientist, Laboratory, University, Firm)**

Literature on University-Industry Knowledge Flows

(cont.)

Agents

- University Scientists**
- Industry Scientists**
- Entrepreneurs (including academic entrepreneurs)**

Institutions

- Industry-University Cooperative Research Centers**
- University Technology Transfer Offices**
- Science Parks**
- Incubators**
- Firms That Interact With Universities**
- Venture Capital Firms**

Examples of Datasets Used

- ❑ NSF's CORE (COoperative REsearch)**
- ❑ Yale and Carnegie Mellon Surveys of R&D Managers**
- ❑ NCRA-RJV**
- ❑ MERIT-CATI (Maastricht Economic Research Institute on Innovation and Technology-Cooperative Agreements & Technology Indicators)**
- ❑ Proprietary Databases-Securities Data Company, Science Citation Index, Recombinant Capital, Corporate Technology Directory, Venture Economics, Dun and Bradstreet, Compustat, and CRSP**
- ❑ AUTM (Association of University Technology Managers)-U.S. Universities**
- ❑ NUBS/UNICO-U.K. Universities TTOs (Also-new EU Survey)**

Review of Literature (cont.)

Performance/Output Indicators (Private and Social Returns)

Conventional Measures

- Patents (Both Universities and Firms)**
- Short Term Movements in Stock Prices (“Event Studies”)**
- Total Factor Productivity**
- R&D Expenditure**
- R&D Employment**

Review of Literature (cont.)

Additional Proxies

- Citations of Patents and Academic Articles**
- Co-Authoring Between Academic and Firm Scientists**
- Job Mobility of Scientists**
- Invention Disclosures**
- Licensing of Technologies**
- University-Based Startups**
- “Productivity” of Universities in Technology Transfer**
- Firm Retention in an University RJV**
- Hiring of Engineering and Science Graduates**
- Firm Survival**
- New Products Developed and Commercialized**
- Growth in Employment and Sales**

Stylized Facts From Literature (Relevant to Measurement and Analysis of University-Industry Knowledge Flows)

- ❑ Patents Unimportant for Certain Technologies/ Industries**
- ❑ Many University Scientists do not Disclose Inventions**
- ❑ Faculty Involvement/Engagement is Critical For Some Commercialization Outcomes**
- ❑ Universities Have Becoming More Aggressive in Exercising Intellectual Property Rights**
 - ⇒ Raising Concerns Regarding Effects on the University Culture of “Open Science”**
 - ⇒ Also Causing Considerable Tension With Industry**
- ❑ Importance of Public Science in the Industrial Innovation Process**
- ❑ Limited Evidence That Rise of University Technology Transfer Has Had Little Affect Quantity and Quality of Basic Research**

Stylized Facts From Literature

(Relevant to the Measurement and Analysis of University-Industry Knowledge Flows)-cont.)

- ❑ For Universities-Multiple “Outputs” (e.g., Licensing, Startups, Sponsored Research)**
- ❑ Production Function Models Provide a Good Fit**
- ❑ Results Are Fairly Robust to Single or Multiple Outputs, Methods of “Efficiency” Estimation**
- ❑ Incentives Matter (e.g., Royalty Distribution Formula), But So Do Organizational Practices and Other Institutional Policies**
- ❑ Human Resource Management Practices May be Important**
- ❑ Some University-Based Technologies Are Going “Out the Back Door”**

Suggestions for Initiatives to Generate Data to Answer Key Research Questions

- Ask Some Questions Relating to Output and Performance, Especially Concerning Technological Diffusion and the Creation of New Products, Firms, and Industries**
- Work With Organizations Currently Collecting Data on R&D Collaborations (e.g., AUTM, ISI, AURP, NBIA)**
- Facilitate Linkages Between Existing Datasets on R&D Collaborations and Economic Performance (e.g., CES at U.S. Census Bureau)**