Measuring Returns to Research in the Public Sector

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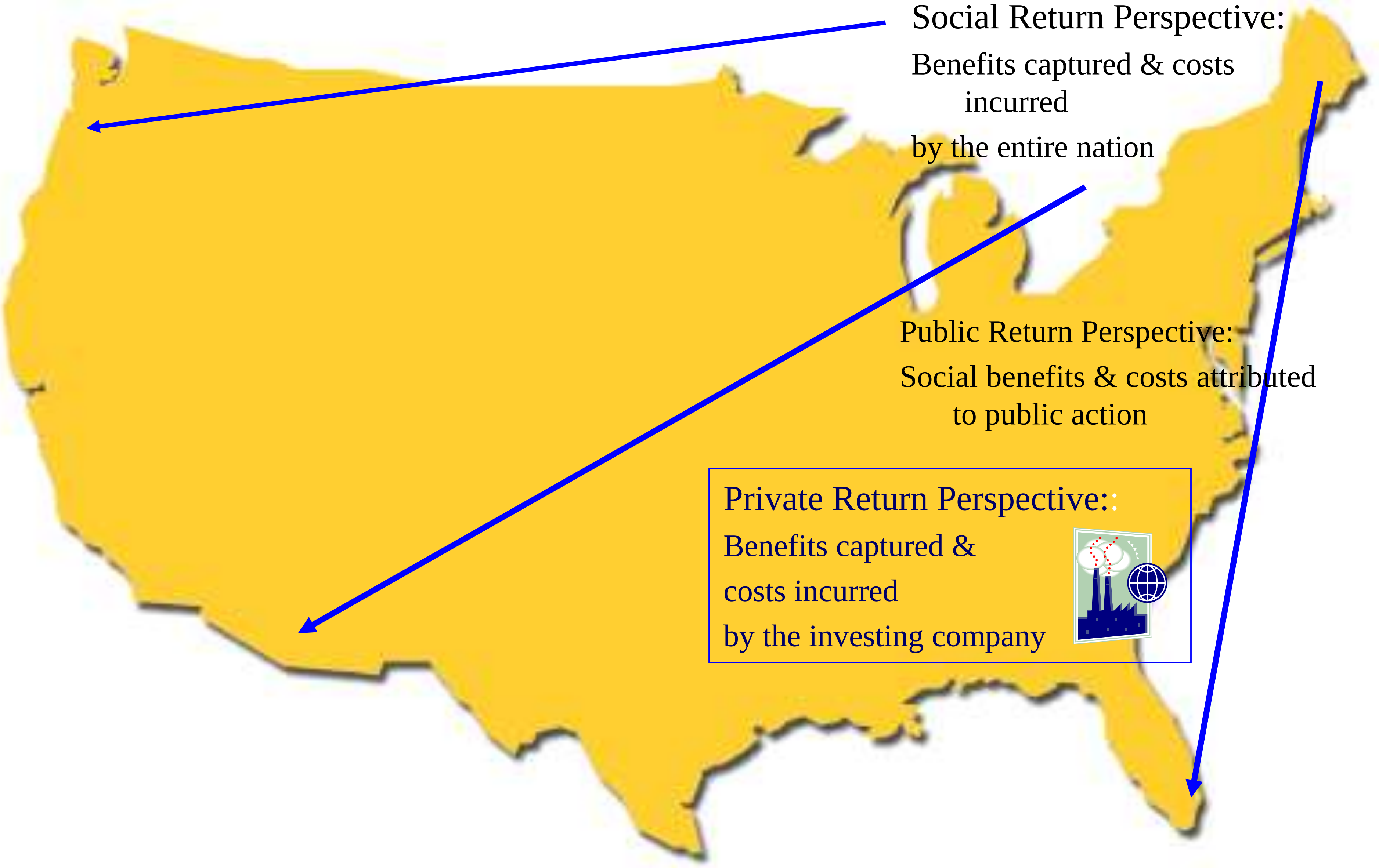
Outline

- Social vs. private returns to research
- Methods for assessing returns to public research
- Illustrations
- Conclusions

Different Perspectives: Returns to Research in the Public vs. Private Sector



Social Return Perspective:

Benefits captured & costs incurred

by the entire nation

Public Return Perspective:

Social benefits & costs attributed to public action

Private Return Perspective::

Benefits captured &

costs incurred

by the investing company

Social Rates of Return Encompass Private Returns

Net Social Benefits =

(private benefits + spillover benefits)

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(all private and public research, development, and other costs, including all negative externalities)

Privately Funded Research Also Can Generate Spillover Benefits

- Median social rate of return on national US sample of privately-funded inventions: 55% (Mansfield)
- Raises the bar for government funding of research

Public Support of Research Tends to Favor:

- **Research Tax Credits**

  (in recognition of spillover effects from private sector research)

- **Basic and high-risk applied research**

  (funding gap)

- **Enabling and infrastructural technologies**

  (high spillovers)

- **Mission-oriented technologies**

  (assigned government responsibility)

- **“Critical technologies”**

  (public policy strategies)

Methods for Assessing Returns to Public Research

- Expert Judgment
- Survey
- Descriptive case study
- Bibliometrics – counts, citation analysis, data mining
- Historical tracing
- Sociometric and network analysis
- Indicator metrics
- Economic case study (NPV, B/C, IRR, AIRR)
- Econometric studies
- Portfolio approaches
- Other

Main Reasons for Assessing Performance of Government Research Investments

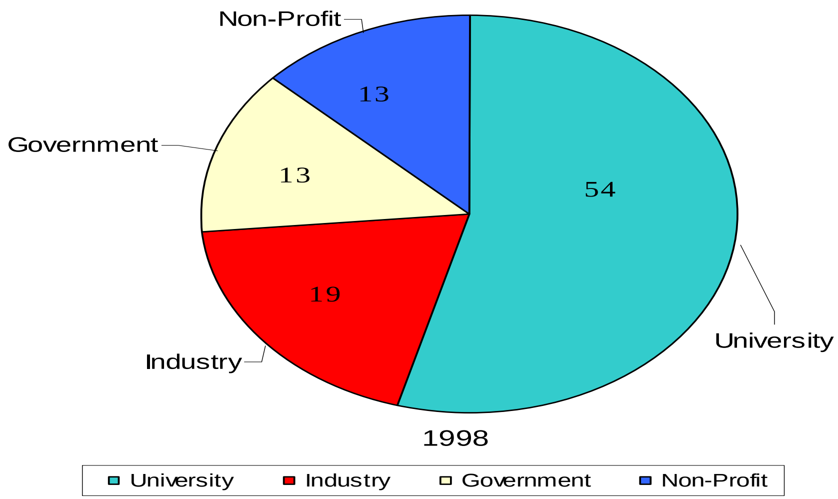
- Management
- Accountability

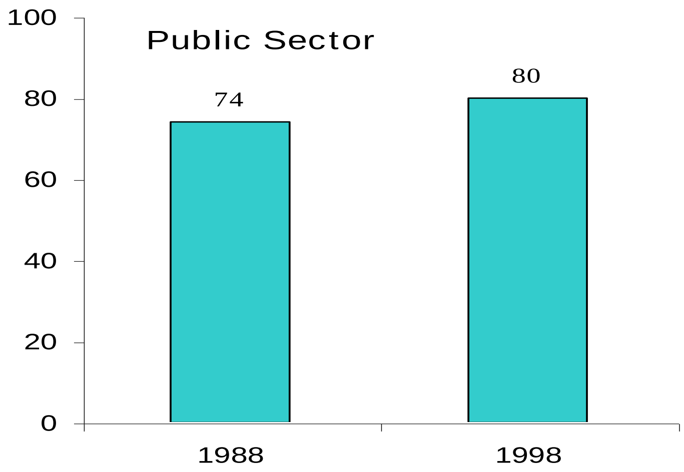
Assessing Returns to Public Research: Examples

- Assessing returns to basic research:
  - Citation analysis examples
- Assessing returns to a public-private partnership program:
  - Economic case study examples
  - Portfolio assessment example

Using Citation Analysis to Show Impact

Public Sector Science is Valuable for U.S.-Invented Technology





% of references on U.S. patents to U.S. scientific literature

Source: NSF Science & Engineering Indicators

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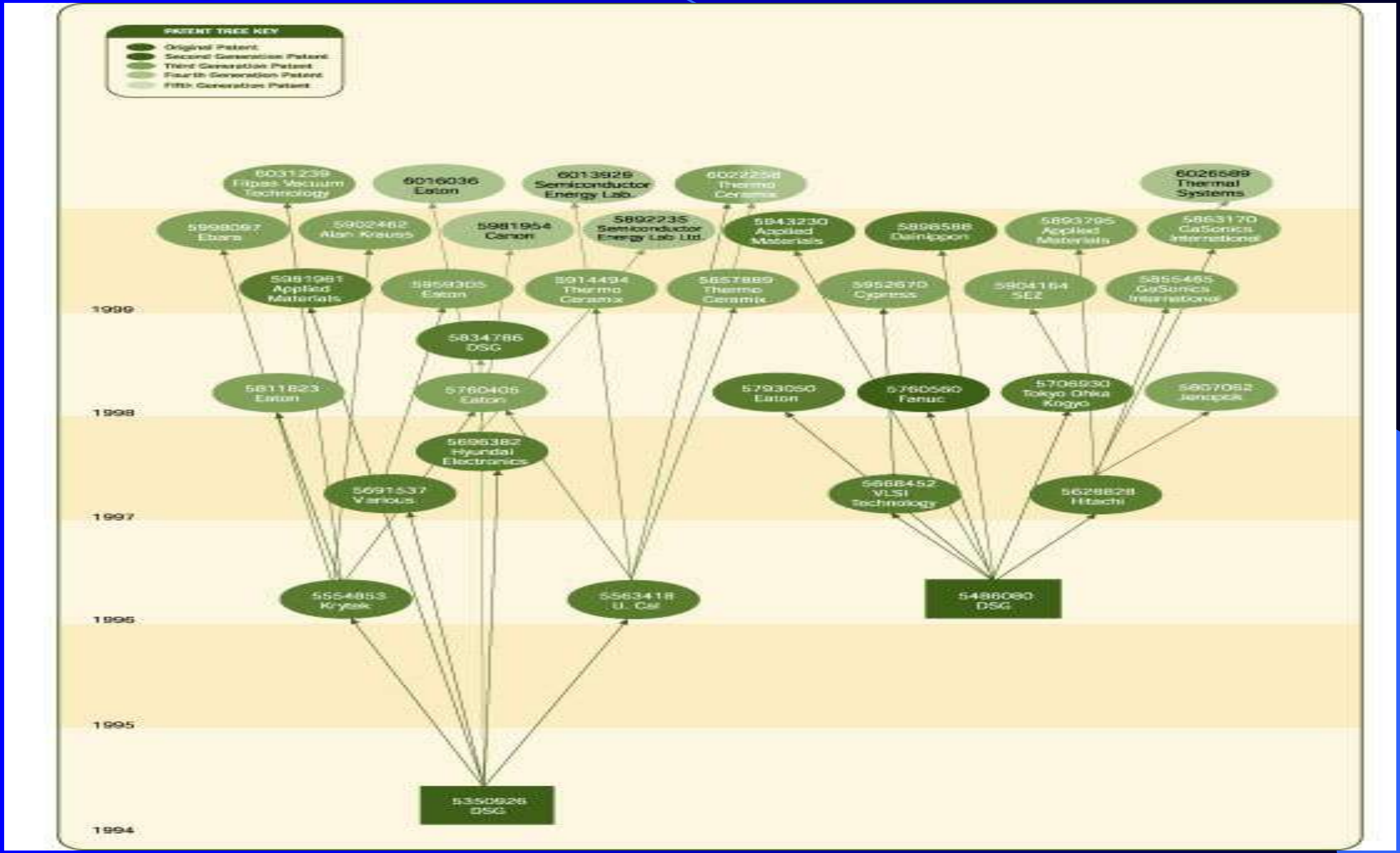
Source: Presentation by D. Hicks, CHI Research, Benchmarking Workshop, Embassy of Finland, 2002.

"Publicly Financed Science—a Pillar of Industry"

- The institutional origins of research cited on patents were found to lie heavily in the public sector.
- In 1988, 74 percent of the papers cited in U.S. industry patents were authored in universities, government laboratories and other publicly supported organizations. By 1998, this figure had risen to 80%.
- Patents cite papers published in the most prestigious scientific journals.
- Examining the funding acknowledgements on the papers cited in patents established that they were overwhelmingly supported by leading federal agencies such as NSF and NIH.
- As the New York Times reported, this study found that "Publicly Financed Science Is a Pillar of Industry" (Tuesday, May 13, 1997, p. C10). The data make it clear that public science plays an overwhelming role in the science base of U.S. industry.

Citation Analysis Used by the Advanced Technology Program to Show Knowledge Spillovers



Source: Ruegg and Feller, A Toolkit for Evaluating Public R&D Investment, NIST GCR 02-842, 2003; patent tree from vol. 2, ATP Status Reports.

Assessment of 7 Tissue Engineering Projects Cost-shared by ATP and Private Companies

Stem Cell Expansion Systems

Biopolymers for Tissue Repair

Living Implantable Microreactors

Proliferated Human Islets

Clinical Prostheses from Biomaterials

Gene Therapy

Universal Donor Organs

Source: RTI Research, Framework for Estimating National Economic Benefits of ATP Funding of Medical Technologies, NIST GCR 97-737, 1998.

Estimated Impact of ATP on Project Outcomes

Acceleration of benefits

- 2 to 10 years

Benefits comprised of

- healthcare cost savings
- quality of life improvements

Source: RTI, Framework for Estimating National Economic Benefits of ATP Funding of Medical Technologies, NIST GCR 97-737, 1998.

Composite Private Returns: ATP Projects in Tissue Engineering for a Single Preliminary Application

	NPV	**IRR**
	(1996 $ millions Project)	(%)
Project returns	1,564	12
Increment attributable to ATP	$914	

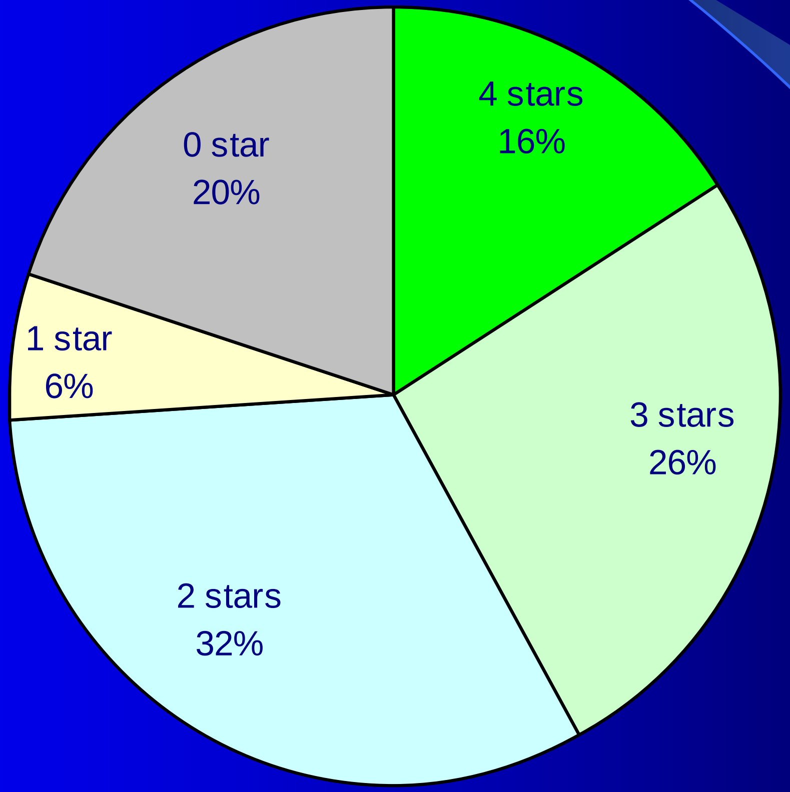
Source: RTI, *A Framework for Estimating the National Economic Benefits of ATP Funding of Medical Technologies*, 1998, p. 1-24.

Social and Public Returns to Research

Project	Social NPV (1996$ millions)	SRR (%)	Public NPV (1996$ millions)	Public IRR (%)
Composite of 7 tissue engineering projects	109,229	115	34,258	116

Source: RTI Research, Framework for Estimating National Economic Benefits of ATP Funding of Medical Technologies, NIST GCR 97-737, 1998.

Assessing Interim Performance of a Public Research Portfolio using a Composite Performance Rating System based on Indicator Data



Source: Ruegg, Bridging from Project Case Study to Portfolio Analysis in a Public R&D Program, NIST GCR, 2003

Conclusions

- Assessment of public research tends to be more complicated than assessment of private research.
- Financial performance measures are more feasible for close-to-market research; other methods for more basic research.
- Assessment of public-private partnership research tends to be more complex than assessment of mission-driven government lab research.
  - **Additionality concept**
  - **Defender technology concept**
- Differences in the assessments of private and public research are reflected in public support of research.