Barriers and Policies for Private-Sector R&D Success

Insights from 17 R&D Leaders

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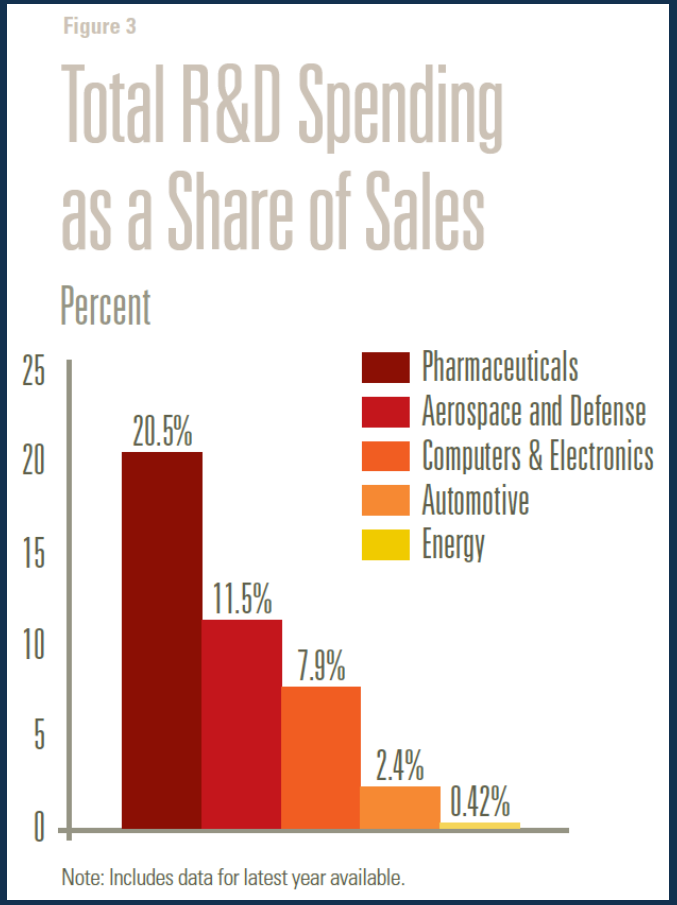
Motivation

- Private sector has been a driver of technological progress in many fields
- Low investment in energy R&D by private sector relative to other industries
- What are the barriers? What can government do to help?



Source: American Energy Innovation Council, Catalyzing Ingenuity, 2011

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Private-Sector R&D Experts

William Banholzer, CTO, Dow Chemical Company
Paul Citron, VP of Technology Policy and Academic Relations, Medtronic (retired)
Fred Coppersmith, Director of R&D, Consolidated Edison
George Craford, Solid State Lighting Fellow, Philips
Paul Delaney, Emerging Technologies Assessments Program Manager for Design and Engineering Services, Southern California Edison
Scott Elrod, VP and Director of Hardware Systems Lab, PARC
Katharine Frase, VP of Industry Solutions and Emerging Business, IBM
Bryan Hannegan, VP of Environment and Renewable Energy, EPRI
Tom Kavassalis, VP of Strategy and Alliances, Xerox Innovation Group
Don Kopczynski, VP of Customer Solutions, Avista
J. Michael McQuade, Senior VP for Science and Technology, UTC
Craig Mundie, Chief Research and Strategy Officer, Microsoft
Raj Nair, Group VP of Global Product Development, Ford Motor Company
William Powers, VP of Research, Ford Motor Company (retired)
John Wall, CTO and VP, Cummins
David Whelan, VP & Chief Scientist, BDS, The Boeing Company
Ellen Williams, Chief Scientist, BP

Overview

- How R&D is Managed in Today's Private Companies 1
- Policies that Effectively Promote R&D Worldwide 2
- Obstacles to Greater R&D Success 3

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Location of R&D

- 14 of 16 companies perform some R&D overseas
- All interviewees who specified a trend indicated greater share of R&D overseas in future

TABLE 2: REASON FOR GLOBAL LOCATION OF R&D

ANSWER	# OF INTERVIEWEES
To work with overseas clients or design products for overseas markets	8
To co-locate with own manufacturing facilities or other operations	4
To have better access to talent	4
To take advantage of foreign government support for R&D	2
To avoid U.S.-specific regulatory hurdles	1
A desire to keep money inside own service area	1

Gating Process & Terminating Projects [1]

- R&D is inherently risky
- Gating procedures are common

TABLE 4: REASONS FOR TERMINATING RESEARCH PROJECTS

ANSWER	# OF INTERVIEWEES
A lack of commercial potential for the innovation	5
Technical issues with the product or the science	5
Poor behavior by another organization in a research partnership	3
Poor internal communication	1
Intellectual property issues	1
A change in business needs	1
Changes in government policy	1
Competition from cheap overseas products	1

Research Partnerships

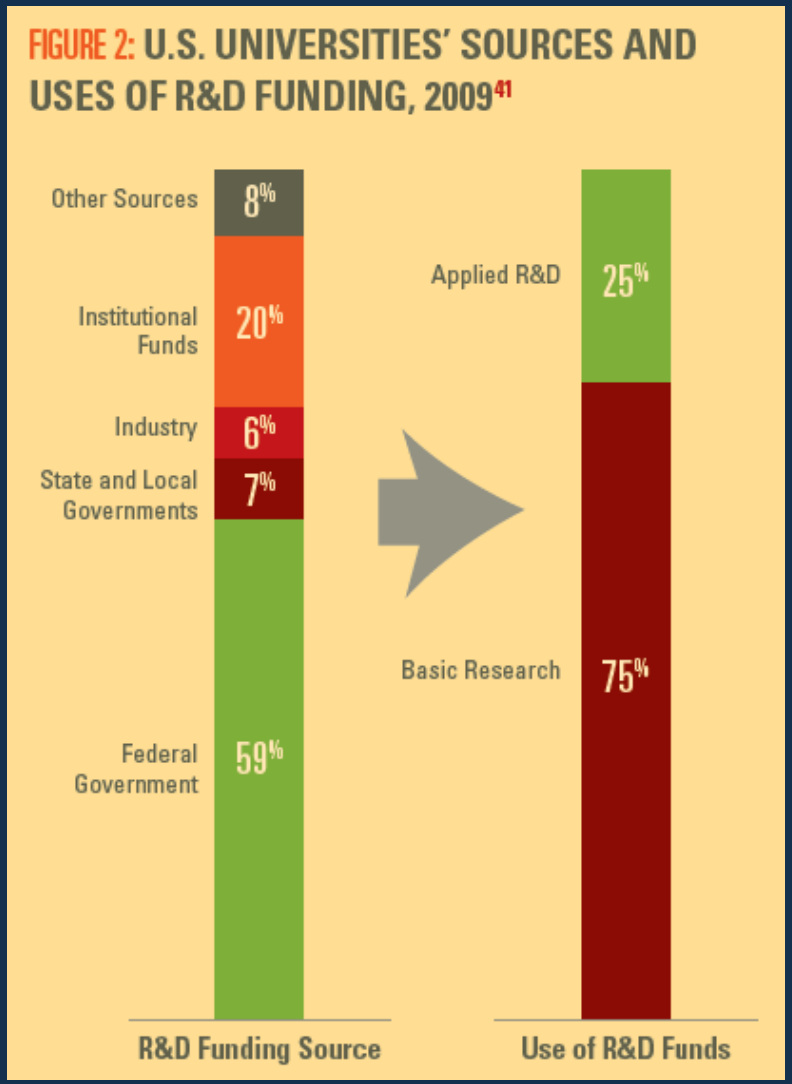
- Universities: unrestricted grants vs directed research
- National labs: paying for specialized skills and eqpt

TABLE 5: RESEARCH PARTNERSHIPS

ANSWER	# OF COMPANIES
Universities	13
National labs (or other government labs, e.g. JPL)	9
Other private companies	8
Government-run coalitions	6
Government Agencies	6
Standards and industry bodies	5
Freelancing individuals	2

Side Note: Universities' R&D

- Universities are not heavily reliant on industry for research funding and remain largely focused on traditional basic science research



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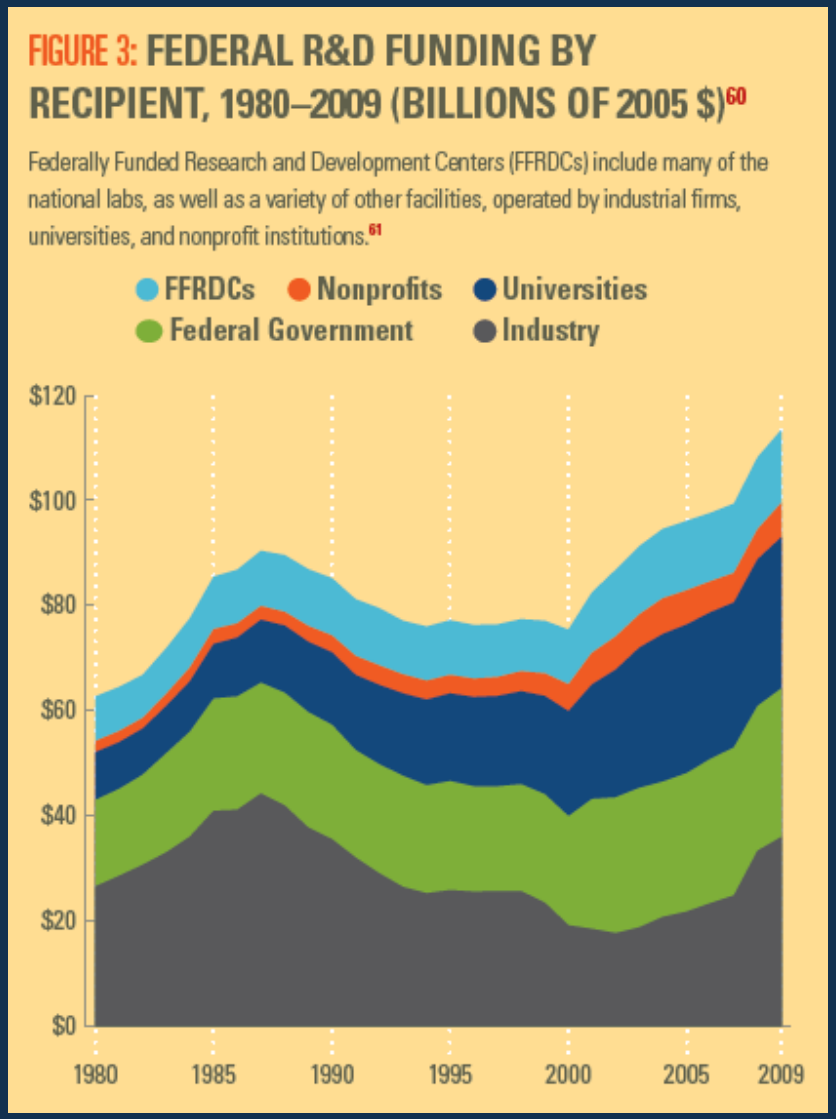
Policies that Effectively Promote R&D Worldwide

- Direct funding is, unsurprisingly, most valued
- Regulations can also be important

TABLE 6: POLICIES THAT EFFECTIVELY PROMOTE R&D

ANSWER	# OF INTERVIEWEES
Grants and contract research	10
Regulations to provide R&D targets and justification to management	4
Foreign economic support	4
Government-funded student research or internships	2
Foreign grants of land, buildings, etc.	2
The U.S. R&D tax credit	2

Grants and Contract Research



- A third of every govt R&D dollar goes to industry

Top Government R&D Funding Agencies (2009)
Dept. of Defense - **$66.3 B**
Natnl Institutes of Health - **$29.6 B**
Dept. of Energy - **$8.1 B**
NASA - **$5.7 B**
Natnl Science Foundation - **$3.9 B**

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Regulations Can Help R&D

- Regulations mentioned include fuel efficiency, safety, and emissions standards
- How?
  - Assist R&D heads in justifying R&D expenditures to corporate management
  - Provide concrete targets/goals for research teams
  - Create new markets (e.g. biofuel blending mandate)
- Firms with R&D comparative advantage gain market share and often very good ROI.

Obstacles to Greater R&D Success

TABLE 7: OBSTACLES TO GREATER R&D SUCCESS

ANSWER	# OF INTERVIEWEES
Lack of access to talent	7
Inconsistent or insufficient tax credits (primarily R&D and PTC)	5
Difficulty with IP licensing from universities	5
Lack of stable policy environment (other than tax credits)	4
Too little direct government funding	3
Regulatory approval requirements or delays	3
Quarterly financial pressures/investor impatience or opposition	3
Pressure on universities to do applied work/prototyping/commercialization	3
Difficulty with IP licensing from national labs	2
Need for government to fund more basic research in universities	2

Access to Talent: Immigration

- Limits on H1-B visas and green cards (65k visa cap, counts family members)
- Backlog is many years long for employer-sponsored green cards (with additional caps for particular countries, like China)
- Difficult process for businesses (MSFT example)
- Bipartisan support for improved access for STEM degree holders: NAS, BRT, CoC, PCJC, PCAST, Obama, Romney

Access to Talent: Schools

- In the OECD (34), the U.S. is 25th in math and 17th in science student performance
  - But U.S. had top scores when comparing low-poverty communities to similarly situated foreign countries
  - Problem stems from many high-poverty communities in the U.S. combined with local funding of school systems (46% state, 37% local)
  - Improving average performance requires policies that target income inequality and poverty (or non-localized funding of school systems)
  - But income inequality and poverty are growing

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Access to Talent: Universities

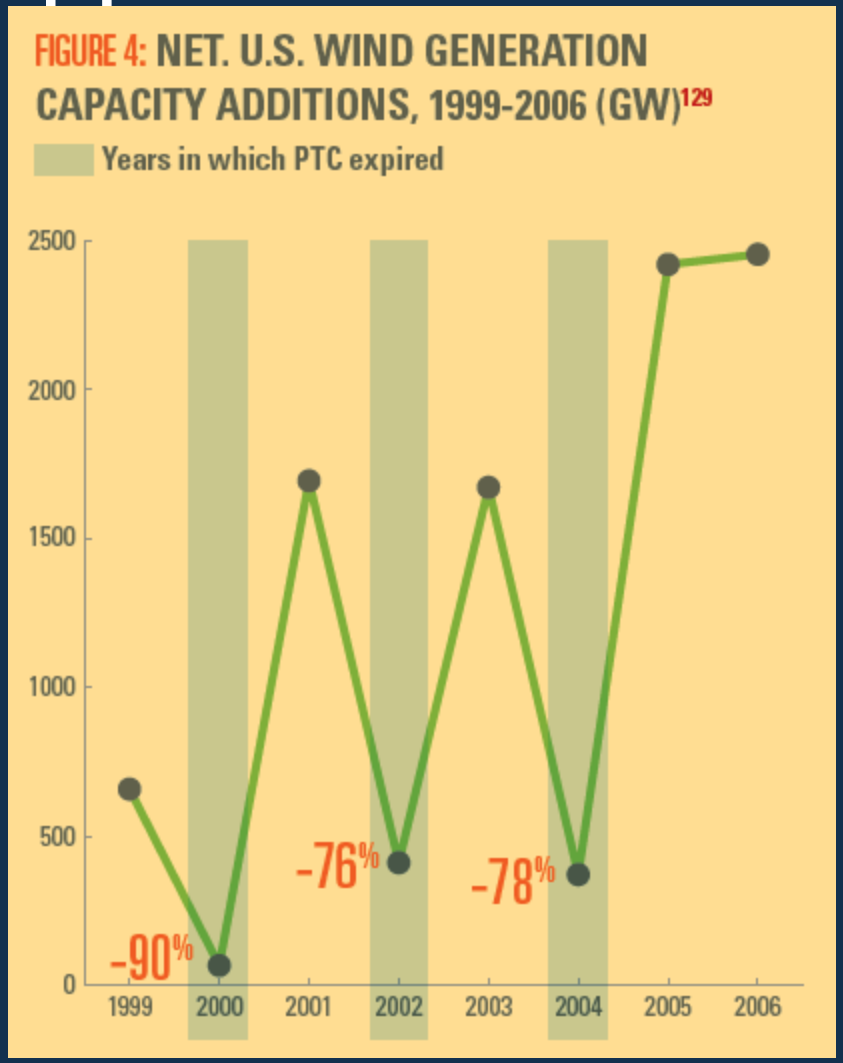
- Growing cost of tuition
- Students less frequently choose STEM fields and education

TABLE 8: PERCENTAGE OF ALL BACHELOR'S DEGREES CONFERRED BY FIELD IN THE U.S.[107]
1981 and 2010 (STEM Fields and Education shown)

FIELD	1981	2010	CHANGE
Biological and biomedical sciences	4.6%	5.2%	+0.6%
Computer and information sciences	1.6%	2.4%	+0.8%
Engineering	6.8%	4.4%	-2.4%
Engineering technologies	1.3%	1.0%	-0.3%
Mathematics and statistics	1.2%	1.0%	-0.2%
Physical sciences and science technologies	2.6%	1.4%	-1.1%
STEM Fields Total	**18.0%**	**15.4%**	**-2.6%**
Education	11.6%	6.1%	-5.4%

Inconsistent / Insufficient Tax Credits

- R&D and PTC tax credits allowed to expire repeatedly
- R&D has long time horizons; certainty of tax credit is important when deciding whether to invest in R&D



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Difficulty Licensing IP from Universities

- Companies typically seek to own or have a perpetual, exclusive license for any IP created through funded research or partnerships
- Companies praised IP models at University of Minnesota (prepay a flat fee for an exclusive, worldwide license to all IP created via a partnership) and Penn State (IP flows back to research sponsor)
- Difficulties with IP arrangements with universities are one driver of increased R&D overseas

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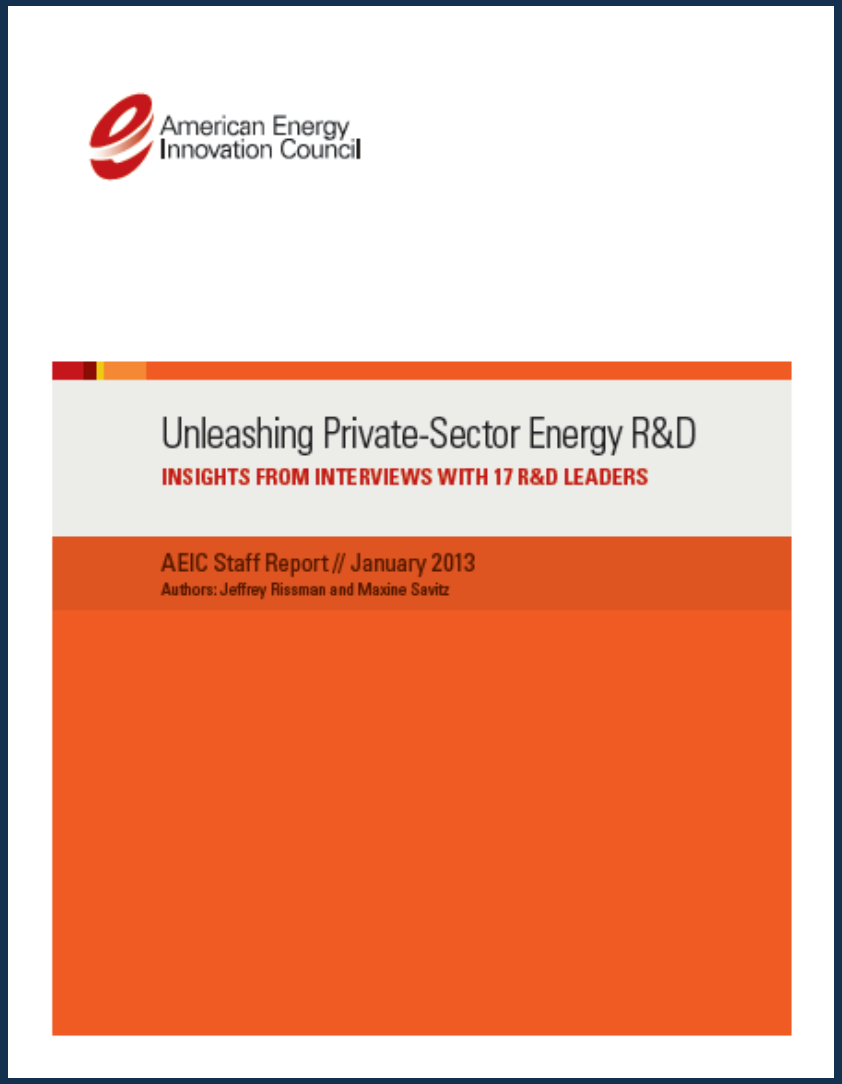

- http://americanenergyinnovation.org/staff-research/unleashing-private-sector-energy-rd-2013/

Short version:

- http://goo.gl/6m2kzy

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