



Assessing the level of collaboration in university-industry nanotechnology research centers

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Cooperative Research Center

- An organization that performs research and also has an explicit mission to promote cross-sector collaboration, knowledge and technology transfer, and innovation.

-Boardman and Gray (2010)

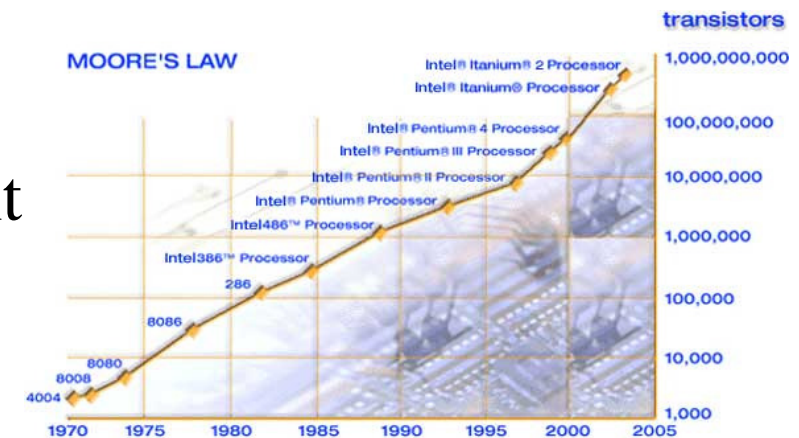


Motivations for CRCs

- Increasing complexity of science
- Multidisciplinary approaches
- Increasing costs of research
- Higher risks
- Shortened time horizon for commercialization

Nanotechnology: a breeding ground for CRCs

- Nanotechnology is science and engineering performed at the nano or atomic scale.
- Nanotechnology is multidisciplinary in research and application.
- Nanotechnology requires highly specialized equipment with high costs and limited availability.
- Field of nanoelectronics is under constant pressure to innovate and commercialize.
- Nanotechnology and CRC policy developed concurrently in the late 1990s.
- Dozens of Nanocenters were established





Bandwagon Jumpers

State and Regional Nanotechnology Initiatives

- Washington Technology Center (2000)
- California Nano-systems Institute (2000)
- Nanotechnology Institute of Southeastern PA (2000)
- NY Center of Excellence in Nanoelectronics (2001)
- Virginia Nanotechnology Initiative (2001)
- Texas Nanotechnology Initiative (2002)
- Biodesign Institute at ASU (2002)
- AtomWorks – Illinois (2002)
- Oklahoma Nanotechnology Initiative (2002)
- New Jersey's Nanotechnology Consortium (2003)
- National Nanotechnology Infrastructure Network (2001)



Research Questions

- Are the nanotechnology centers Collaborative Research Centers?
 - Is support for the centers coming from multiple sectors?
 - What are the collaborative practices at these centers?
 - Has collaboration impacted the transfer of technology?



Methodology

- Identified 28 nanotechnology research centers around the US.
- Collected data on levels of faculty research funding.
- Downloaded publication data from Web of Science to evaluate collaborations through co-authorship.
- Collected Patent data from USPTO to evaluation technology creation and transfer.



NNIN Centers	Non-NNIN Centers
Arizona State University	California Institute of Technology
Cornell University	Louisiana Tech University
Georgia Tech	Massachusetts Institute of Technology
Harvard University	NCSU
Howard University	Northwestern
Penn State	Purdue University
Stanford University	Rice University
University of California SB	Rutgers University
University of Colorado	University at Albany
University of Michigan	University of Arizona
University of Minnesota	University of California LA
UT Austin	University of Illinois at Urbana-Champaign
University of Washington	University of Maryland
Washington University	University of Pittsburgh



Nanotechnology Research Centers: Missions

- NNIN centers are members of the NSF sponsored National Nanotechnology Infrastructure Network. The purpose is to provide access to cutting edge nanoscale facilities to researchers from all sectors.
- Non-NNIN centers were funded by the home universities, local governments, and/or industrial partners.
- Purpose of non-NNIN centers include
 - Improve university prestige
 - Regional economic development
 - Attraction of firm investment.

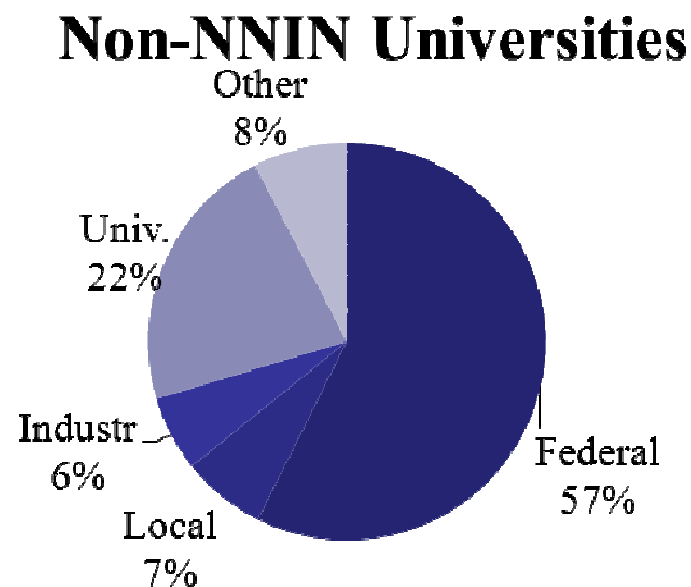
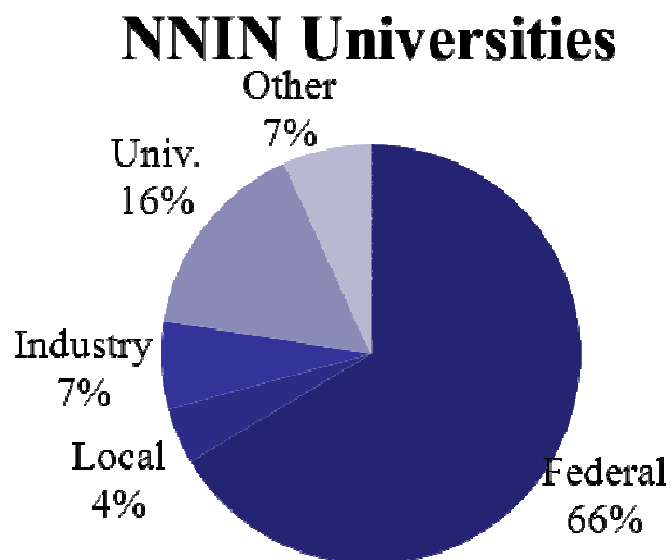
Sources: Small Times Magazine, Center websites, NNIN Annual Reports

Centers were recognized by Small Times magazine for their success in nanotechnology commercialization. (University and Ranking Report 2009)
cnse.albany.edu

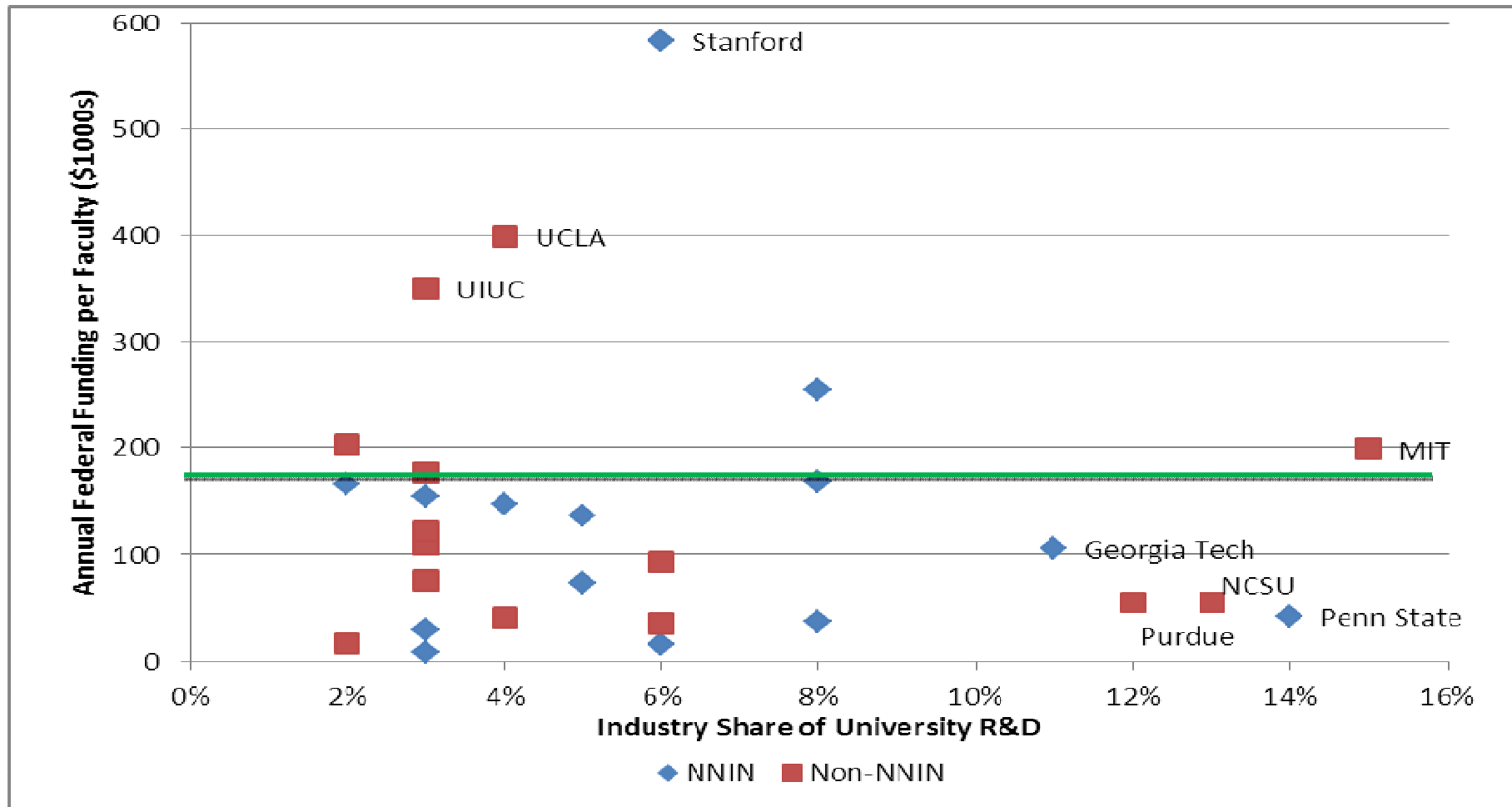


Nanotechnology Research Funding

- Sources of center funding, NSF, Gov't agencies, Local, Industrial Partners, and Universities
- NNIN center faculty received \$144K a year in NSF and NIH funding. Non-NNIN faculty received \$118K a year in funding.
- NNIN Universities receive more federal funding. Non-NNIN rely more heavily on university and local funding.



- Cost faculty nano lab (1 student): \$80,000, 3 Students : \$180,000



Faculty not receiving federal funding are likely supplementary receiving funds from industry or other sources.

Nanotechnology Publications

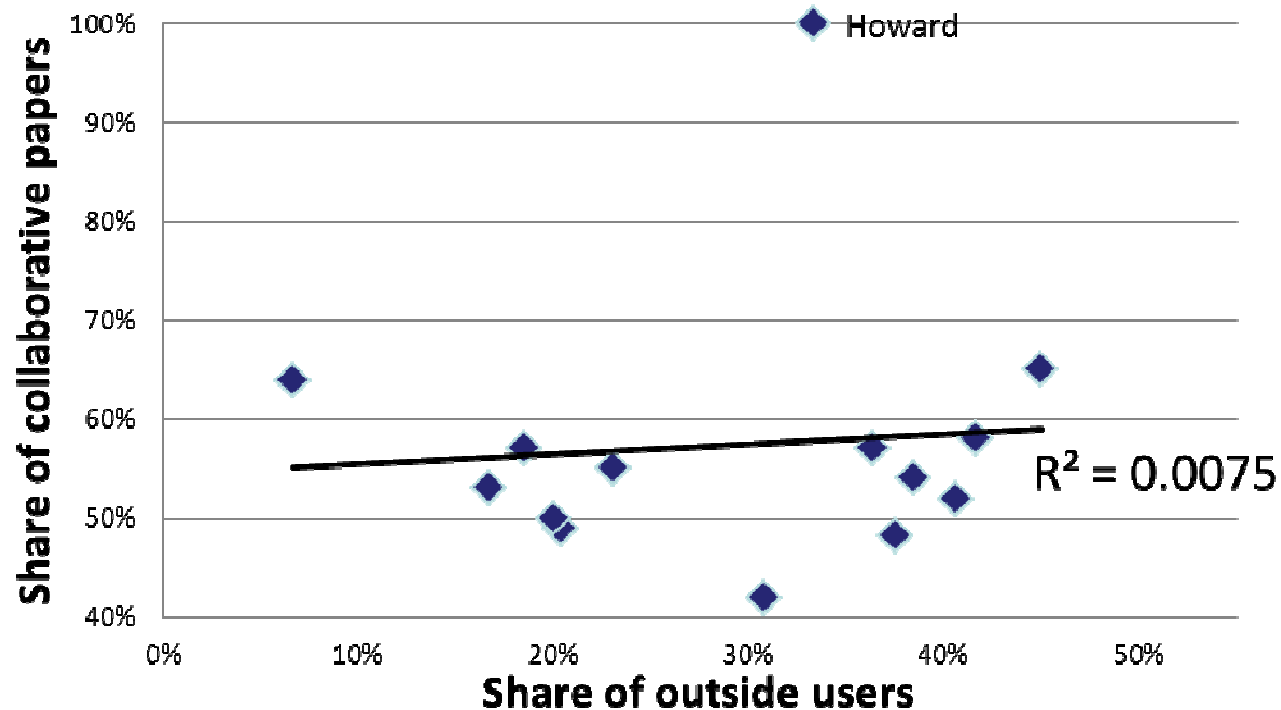
Center	Count	Collabs	Share of total collaborations by type				
			UU	UI	UG	II	UIG
Totals	7789	54%	81%	19%	13%	2%	2%
NNIN	4191	54%	81%	19%	13%	2%	2%
NonNNIN	3877	56%	82%	19%	15%	4%	2%

Source: ISI Web of Science. Nanotechnology-classified publications associated with each university
UU – two different academic institutions, UI – university and industry, UG – university and gov't

- NNIN (5 per faculty member) have higher publishing rates than non-NNIN centers (3 per faculty member)
- Both are equally likely to collaborate and there is no difference in types of collaboration



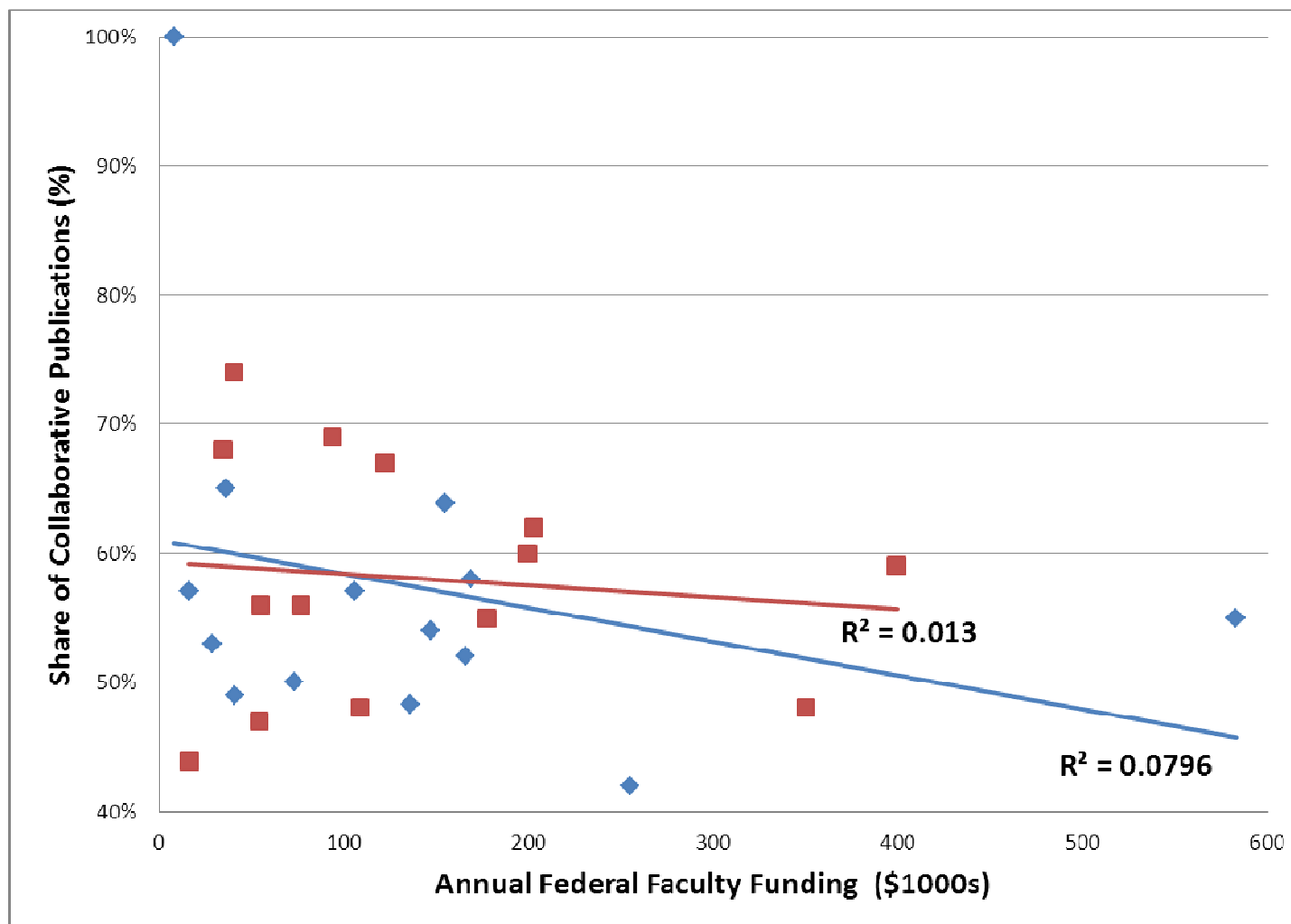
Does co-location foster collaborations?



- The goal of the NNIN is to provide access to users from all sectors.
- NNIN centers publish annual data on users and affiliation
- There is no relationship between the level of outside users and the centers' rate of collaboration.
- The NNIN model is not fostering collaboration among users.

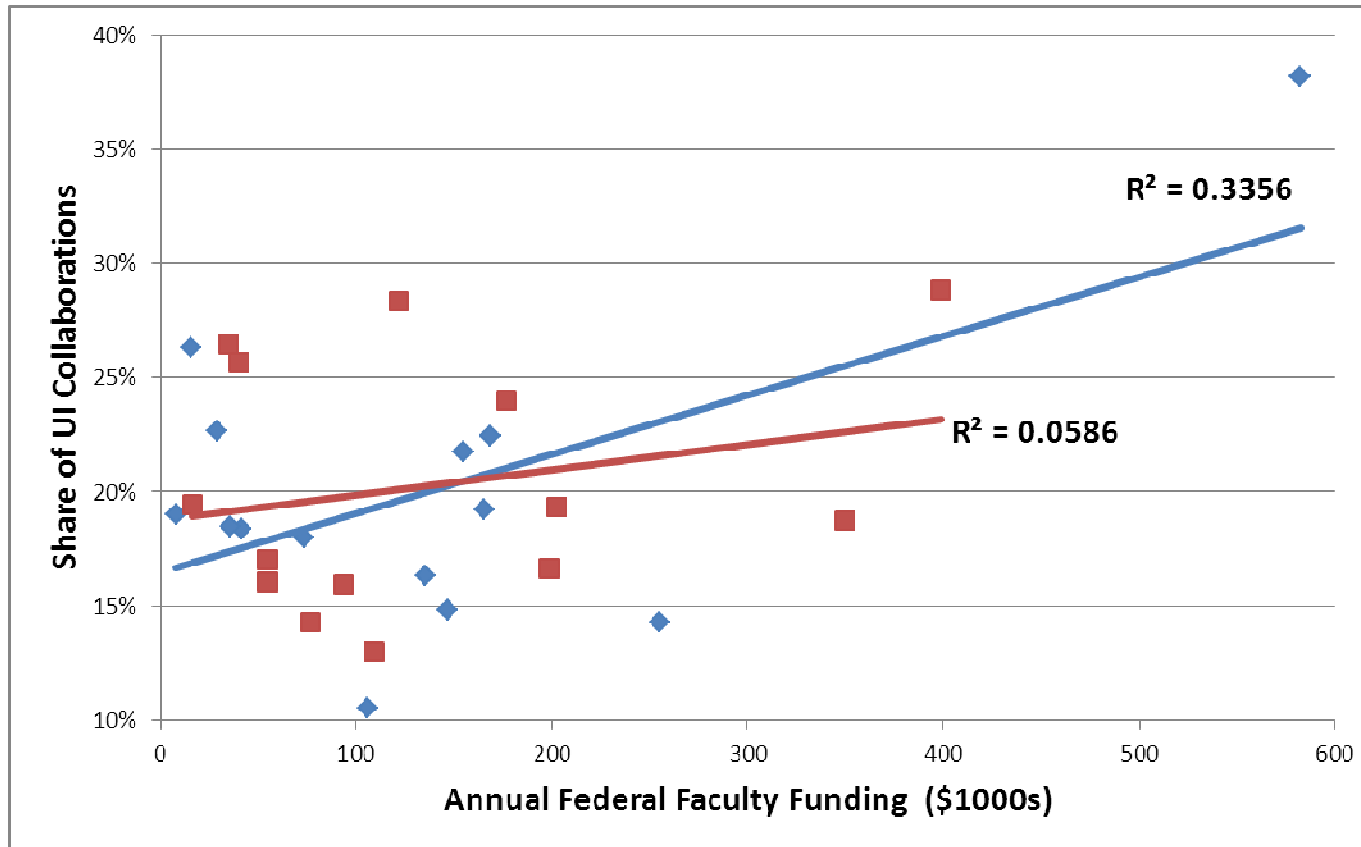


Relationship between Federal Funding and Collaboration



- There is no strong relationship between levels of funding and level of collaboration at nanotechnology centers.

Relationship between Funding and UI Collaboration



- Federal faculty funding at NNINs encourages or enables University-Industry Collaboration.
- Federal funding for non-NNINs has a weak complimentary relationship with industry collaboration.

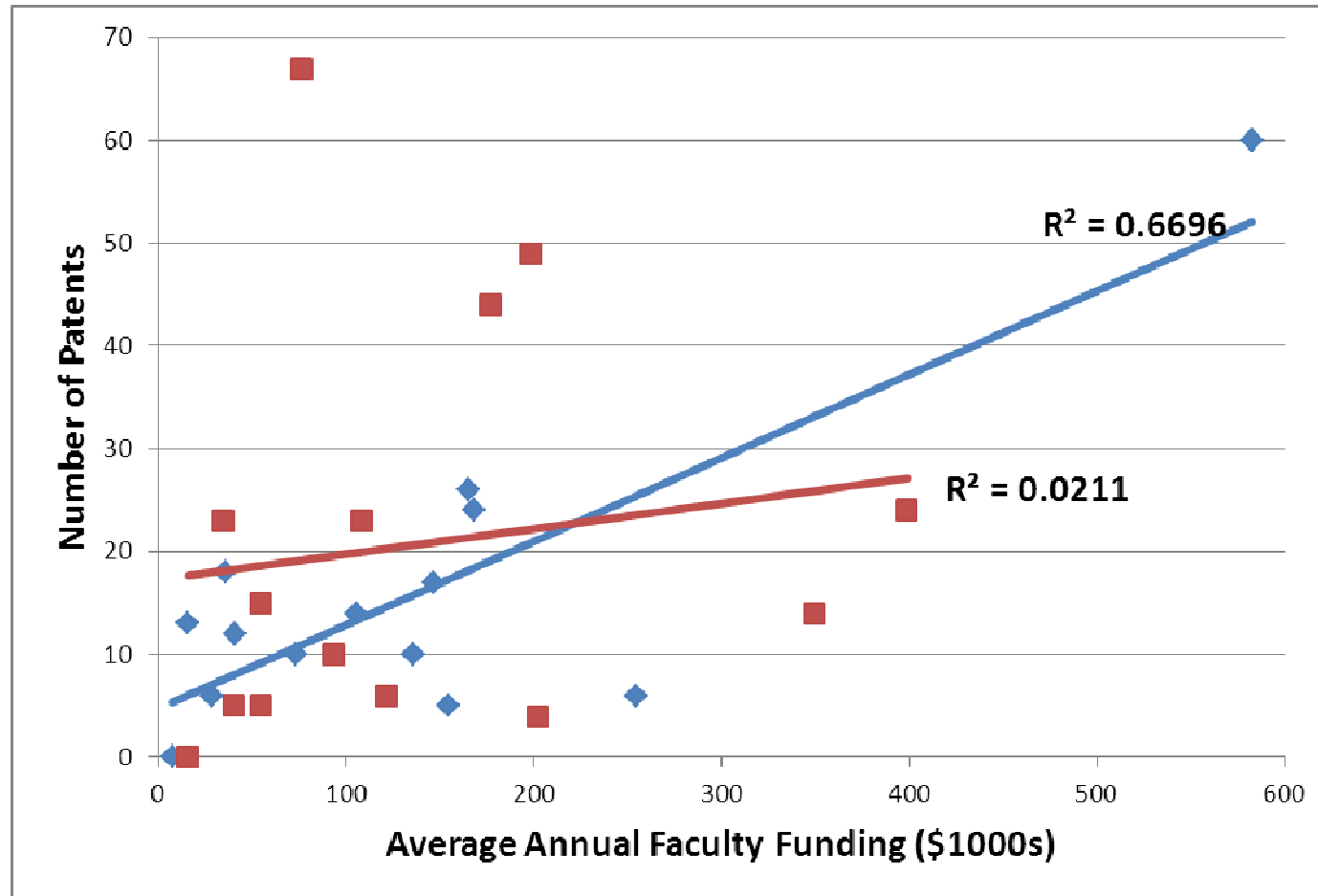


Patent Activity at Research Centers

	Patents	University	Industry	Gov	Inventor
Total	510	73%	28%	1%	3%
NNIN	221	70%	34%	2%	4%
non-NNIN	289	76%	24%	0%	2%

- Non-NNINs generate more patents than NNINs.
- NNIN patents are more likely to be assigned to industry.

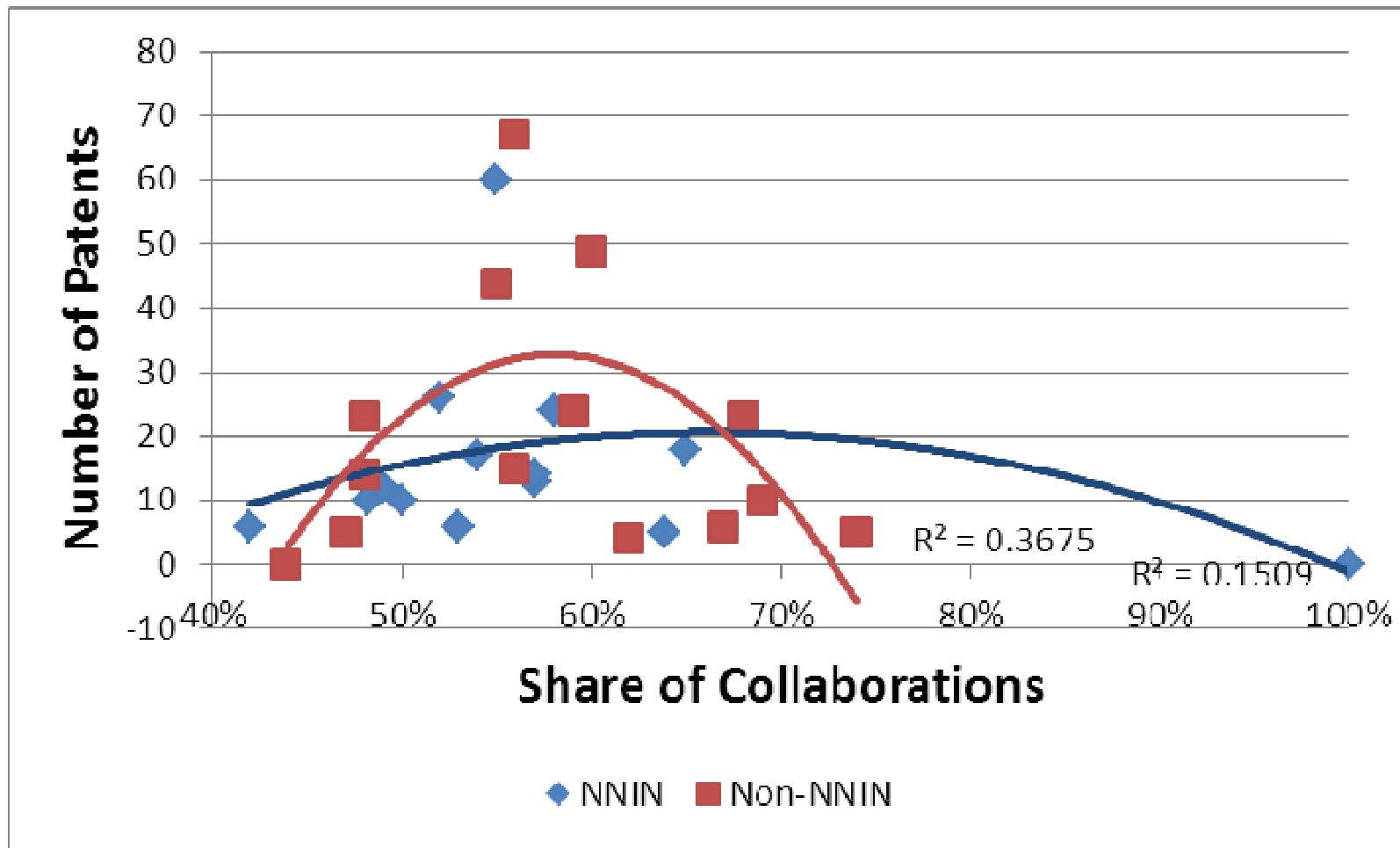
Relationship between Funding and Patenting



- There is a strong relationship between federal funding and patenting at NNIN centers.
- NNINs are attempting to commercialize technologies created by affiliated faculty.

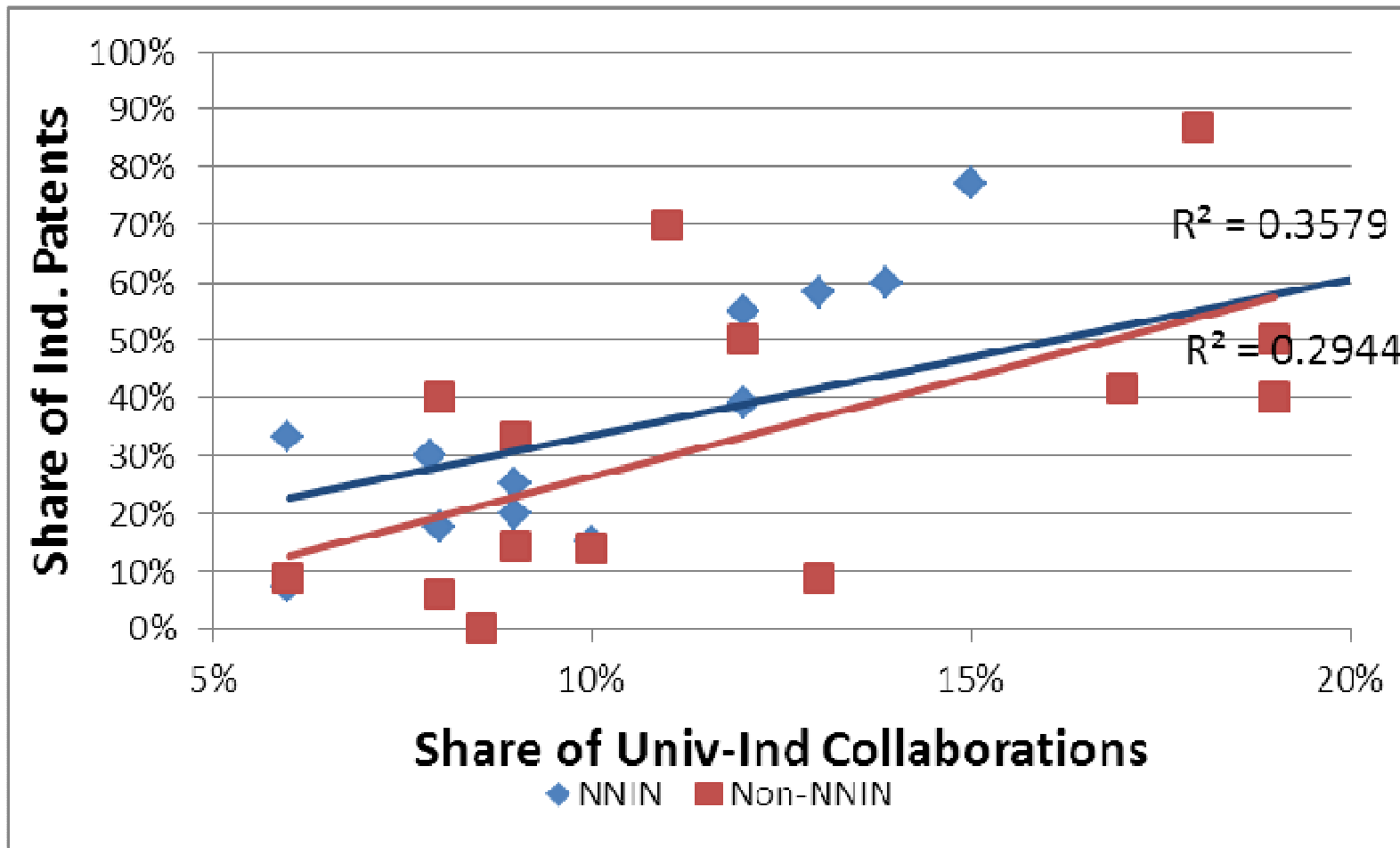
Collaboration and Technology Development

- Does collaboration lead to more commercial technologies?





Do university-industry collaborations lead to more industry patents?





Conclusions

- Faculty must rely on sources beyond the federal government for nanotechnology research funding.
- NNINs provide access to nanofacilities, but co-location does not necessarily encourage collaboration.
- Federal funding does not impact levels of collaboration as a whole, but it may help attract industry collaborators.
- There is a strong relationship between faculty funding and patenting.
- Share of university-industry collaborations is highly correlated with industry patenting at centers.