S E W P Digest

Science and Engineering Workforce Project | National Bureau of Economic Research

June 2008

Jobs in Nanotech – Creating a Measure of Job Growth

By Richard Freeman and Kavita Shukla

In 2002, the National Science Foundation (NSF) estimated that 2 million workers will be needed to support nanotechnology industries worldwide by 2015 and declared the education and training of a new generation of skilled workers to be a "key challenge" for nanotechnology development. Several universities have since established training centers and degree programs to prepare students for careers in nanotechnology.

At present, there is no comprehensive measure of the number of jobs being generated by the growth of nanotechnology and the level of demand from companies, universities and federal agencies for skilled workers in nanotechnology related fields. While comparisons are drawn between information technology, biotechnology and nanotechnology, there is little empirical evidence contrasting and comparing job growth in these fields.

The Conference Board, a non-profit global business organization supported by business executives that produces Leading Economic Indicators for the United States has published The Help Wanted Advertising Index — a key measure of job offerings in 51 major newspapers across America, each month. Because ad volume has proven to be sensitive to labor market conditions, this measure provides a gauge of change in the local, regional and national supply of jobs. This indicator, however, does not focus on jobs in scientific and technical fields.[1]

A New Measure of Nanotech Job Growth - the Job Board Index

In our study, we sought to observe nanotechnology's creation of jobs in the contemporary economy. We gathered data over a 12 month period from March 2007 to March 2008 from SimplyHired.com, an online job board that aggregates job postings from multiple online job boards and

...[results revealed that] at present, job growth in nanotech is modest

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1 http://www.conference-board.org

National Nanotechnology Initiative (NNI) Budget Overview by Agency

	2007 Actual	2008 Estimate*	2009 Proposed
DOD	450	487	431
NSF	389	389	397
DOE**	236	251	311
DHHS (NIH)	215	226	226
DOC (NIST)	88	89	110
NASA	20	18	19
EPA	8	10	15
DHHS (NIOSH)	7	6	6
USDA (FS)	3	5	5
USDA (CSREES)	4	6	3
DOJ	2	2	2
DHS	2	1	1
DOT (FHWA)	1	1	1
TOTAL	1,425	1,491	1,527

Inside

Featured Publications

Prototypes of emerging metropolitan nanodistricts in the United States and Europe

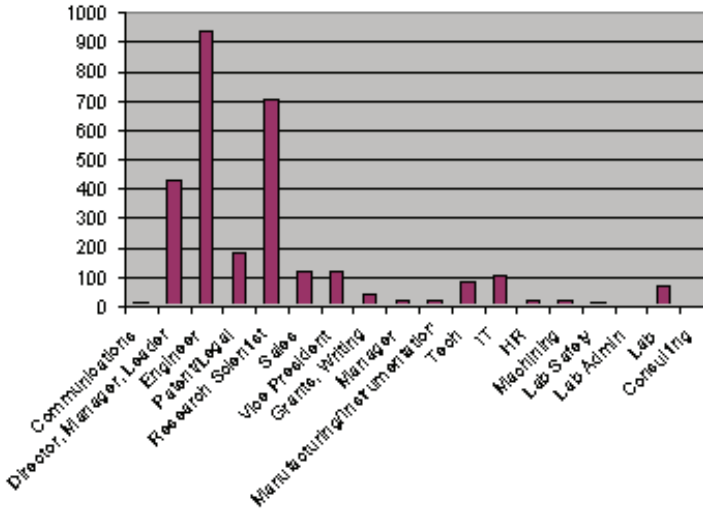
By Philip Shapira, Jan Youtie, and Stephen Carley

Abstract:
In this paper, we probe nanotechnology research and commercialization at a regional level. The study identifies leading US and European prototype "nanodistricts" or metropolitan areas active in nanotechnology research over the 1990-2006 timeframe. We explore the factors underlying the emergence of these metropolitan areas through exploratory cluster analysis. We find that while most of the leading nanodistricts are found in locations that were prominent in previous rounds of emerging technologies, new geographic concentrations of nanotechnology research have also surfaced.

http://wwww.nber.org/confer/2008/Nanos08/shapria.pdf

Continued on Page 2, Col. 2..

Number of Nanotechnology Job Postings



jobs relating to nanotechnology. Our data set contains 5,370 job postings. We collected data regarding salary, education, benefits and experience required for each job listing. In addition, we contacted 80 companies with nanotechnology related job openings to collect information on the length of time required to fill open positions and the qualifications of the individuals selected for various positions. Our preliminary results and our phone interviews with hiring managers revealed that at present, job growth in nanotechnology is modest and that companies are not having any problems filling their hiring needs.

Future Studies

There is considerable discussion regarding whether the new nanotechnology specific degree programs actually result in more skilled nanotech workers. Some firms have voiced concerns regarding whether such degree programs actually create more qualified candidates. The Lux Research Report, "Hiring Nanotech Talent," states that 35% of firms in their study actually considered such degrees as "detractors" in their hiring decisions.[2]

In the next phase of this study, we intend to survey alumni of nanotechnology degree programs to assess how such programs prepare graduates for the workplace. The survey instrument will be modeled on a recent study conducted of alumni of environmental science programs, which tend to be similar to nanotech degree programs in their size and scope.

2 http://www.luxresearchinc.com/press/RELEASE_HiringNanotechTalent.pdf

For sources and readings related to this article or any others in this newsletter contact Kavita Shukla, Research Assistant, NBER and Harvard Law School, Labor and Worklife Program: kshukla@law.harvard.edu

Featured Publications (continued from pg. 1)

Cross-Pollination in Science and Technology: Concept Mobility in the Nanobiotechnology Field

Stine Grodal and Grid Thoma
http://wwww.nber.org/confer/2008/Nanos08/grodal.pdf

Impact of University Scientists on Innovations in Nanotechnology

Jinyoung Kim†, Sangjoon John Lee††, and Gerald Marschke†††
†Korea University,
††Alfred University,
†††University at Albany and NBER
April, 2008

Abstract

Using U.S. patent records in nanotechnology, we study the impact of university research on industry innovations with the premise that knowledge is diffused from universities to industry via personnel with university research experience. Appearing on a patent assigned to a university is evidence that an inventor has been exposed to university research, either directly as a university researcher or through some form of collaboration with university researchers. Over the period 1985-97, we find a steady increase in industry's employment of inventors with university research experience. In the 1990s we find the productivity (in terms of patenting rates and patent quality) of inventors with university backgrounds begins to exceed the productivity of the inventors without such experience. We also find that the share of industry patents in nanotechnology that cite university-assigned patents almost doubles during the period and inventors with university experience cite mostly university patents not invented by them, implying that they are instrumental in transferring general knowledge created throughout the university community.
http://www.nber.org/confer/2008/Nanos08/lee.pdf

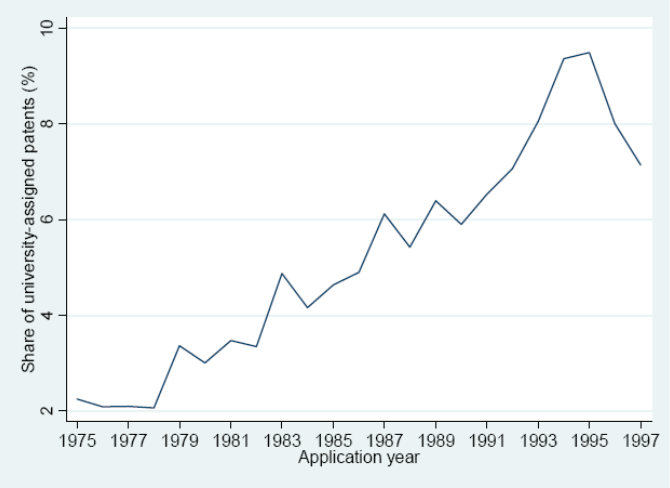
Taking a Proactive Approach Towards Responsibility: Indications of Nano Policy-Making around the World

Kelly Laas, Vivian Weil
Center for the Study of Ethics in the Professions
Illinois Institute of Technology

Abstract:

In this paper, we hypothesize that the development of normative materials dealing with nanotechnology, together with certain governmental initiatives and funding allocations for projects on societal and ethical implica-

Figure 1 Share of University-Assigned Patents in Nanotechnology



tions, could indicate the amount of action being taken in a proactive approach to the responsible development of nanotechnology around the world. We also looked at these indications of action in light of the number of reports, articles, and general agitation about the need to take some sort of proactive steps to see if they have influenced the level of action being taken. While very little in the way of regulation has been passed by national governments in regard to nanotech and its potential environmental, health and safety implications, a small number of government agencies, industrial organizations, and advocacy-oriented NGO's are developing normative materials that represent the first steps taken towards the responsible development of nanotechnologies.
http://wwww.nber.org/confer/2008/Nanos08/laas.pdf

Nanotechnology, risk and the environment: a review

William Hannah and Paul B. Thompson

Nanotechnologies are already interacting with the environment. Scientists and engineers are manipulating matter at the nanoscale, and these nanoscale processes and products are being used by industry in commercially available products. These products are either applied directly to the environment or end up in the environment through indirect pathways. This review examines the state of current environmental risk assessment of nanotechnologies. Nanotechnology is described generally, then both the possible benefits of nanotechnology and the risks are reviewed in a traditional way. Subsequently, a philosophical criticism of the traditional way of looking at risks is offered.

Citation: J. Environ. Monit., 2008, 10, 291 - 300, DOI: 10.1039/b718127m

http://www.ncbi.nlm.nih.gov/pubmed/18392270

Collaboration and Network Indicators in Canadian Nanotechnology

Andrea Schiffauerova and Catherine Beaudry*
École Polytechnique de Montréal

Abstract:

The purpose of this work is to investigate the role of the collaboration and the innovation networks in the efficiency of knowledge diffusion among Canadian nanotechnology inventors. We introduce two sets of indicators which allow tracking the changes in the Canadian nanotechnology collaboration network in the period of 1989-2004. We observe that the Canadian nanotechnology inventors have an increasing tendency to build cooperative ties with higher number of partners, to collaborate with them more intensively and to form larger collaboration teams. They also tend to return for subsequent collaborations to the same partners with whom they have collaborated within the past five years. We identify the prominent researchers in Canadian nanotechnology and propose to take into consideration the patent quality when identifying star scientists. We note that many of the

Nanotech Events

June 1 - 5, 2008: NSTI Nanotechnology Conference and Trade Story

Hynes Convention Center, Boston, MA

Nanotech 2008 is the largest international nanotechnology conference and trade show in the world. It featured 400 exhibitors and more than 4000 attendees, including business executives, venture capitalists, politicians, scientists and researchers from 62 countries.

May 4 - 6, 2008: NanoBusiness 2008 Conference

New York Marriott Marquis, New York City, NY

The NanoBusiness 2008 conference featured presentations by executives from businesses in clean energy and water filtration, advanced materials, next-generation electronics, medical diagnostics and pharmaceuticals and explored a broad range of issues relating to nanotechnology and investing, commercialization, economic development, environmental, and health and safety.

May 3, 2008: Nanobank Research Conference

Le Méridien, Cambridge, MA

Agenda: http://www.cnsi.ucla.edu/news/cnsi/news/download/Nanobank_Research_Conference_Agenda.pdf?live%5frevision=499844

May 1-2, 2008: NBER - Emerging Industries: Nanotechnology and NanoIndicators

Hotel Marlowe, Cambridge, MA

Agenda: http://www.cnsi.ucla.edu/news/cnsi/news/download/Nanobank_Research_Conference_Agenda.pdf?live%5frevision=499844

superior scientists in nanotechnology have not produced any USPTO nanotechnology patent. We also propose indicators which characterize the structural properties of the nanotechnology collaboration network. We observe a fragmentation of the network over time, caused by an increasing specialization of the nanotechnology field.
http://www.nber.org/confer/2008/Nanos08/beaudry.pdf

Nanotechnology field observations: scouting the new industrial west

David Rejeski and Deanna Lekasa
Project on Emerging Nanotechnologies,
Woodrow Wilson International Center for Scholars,
One Woodrow Wilson Plaza, 1300 Pennsylvania Avenue NW, Washington, DC 20004-3027, USA

Abstract:
Public awareness and governmental involvement in overseeing the responsible development of nanotechnologies is lagging far behind the rapid pace of nanotechnology development and commercialization. Numerous products containing nanomaterials are already on the market and many more complex products are sure to follow. This paper highlights some of the recent work conducted by the Project on Emerging Nanotechnologies, a partnership between the Woodrow Wilson International Center for Scholars and The Pew Charitable Trusts. The paper summarizes the Project's research and findings regarding nanotech oversight, public awareness and attitudes, and work to develop a more strategic approach to addressing the potential risks associated with nanotech-based materials and products. We present these observations as a set of field notes from the rapidly changing "nanofrontier."
http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6VFX-4P0VD0P-3&_user=10&_rdoc=1&_fmt=&_orig=search&_sort=d&view=c&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=6c7d5d2a8789e72f88c4ebfc60d06e70

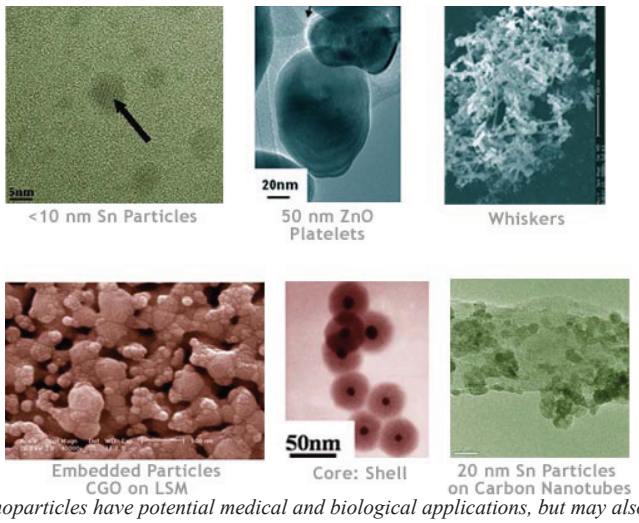
Nanotechnology Safety

"Who's Afraid of Nanotech?"

In a new article for The World Today, Dr Robert Falkner surveys the evidence and latest thinking about the possible risks of nanoparticles.

Dr Falkner, lecturer in International Relations at LSE, suggests that as the scientific debate intensifies, governments around the world will soon have to take tough decisions about whether or not to regulate the emerging technology.

Dr Falkner is co-ordinator of Regulating Nanotechnologies in the EU and US, a transatlantic collaborative research project involving researchers from LSE, Chatham House, Environmental Law Institute and the Project on Emerging Nanotechnologies at the Woodrow Wilson International Center for Scholars.
http://personal.lse.ac.uk/FALKNER/_private/FalknerNanotechWorldTodayJune2008.pdf



Nanoparticles have potential medical and biological applications, but may also pose health risks. Image source: http://www.metamateria.com/particles.php

EU to Pace Nanotechnology Latest Study Fuels Concerns Over Health; Setting a Standard

By Matthew Dalton, The Wall Street Journal
May 29, 2008
http://online.wsj.com/article/SB121201044102027389.html?mod=googlenews_wsj

Safety Studies on Nanoparticles Lag Behind Technology

Sunday, June 1, 2008; N04, The Washington Post
http://www.washingtonpost.com/wp-dyn/content/article/2008/05/29/AR2008052902949_pf.html

Testing the Toxicity of Nanomaterials A fast screening method could help separate the good from the bad.

By Alexandra M. Goho, MIT Technology Review
http://www.technologyreview.com/printer_friendly_article.aspx?id=20861&channel=nanotech&section=

Tool helps small companies conduct nanotech safety and risk management

Small Times
http://www.smalltimes.com/articles/article_display.cfm?Section=ONART&C=Legal&ARTICLE_ID=332305&p=109

Latest Reports

Top 10 Universities for Nanotechnology Research and Education by Category

Small Times, May 2007

The Small Times' university survey included 26 questions about funding, facilities, patenting, company formation, research, publishing, plus micro- and nano-specific courses and degree programs. It also gave respondents the opportunity to write in which of their peer institutions they thought were leaders in small-tech research and commercialization.

This year for the first time we asked respondents to consider institutions across the globe-not just in the United States. Although no non-American institutions received enough write-in votes to make it into the Top 10 lists, several did register. Delft University of Technology, in the Netherlands, is worthy of particular note. It received the most votes of non-American schools, and in fact, garnered recognition in all four peer-ranked categories. Perhaps the following comment, included in a press release issued by Delft in 2005, demonstrates why the institution is so widely regarded: "Nanotechnology has long lost its status as a buzzword. It is now part of our everyday vocabulary." Delft seems to have been ahead of its time.

Following are the results. Note that some universities made the peer rankings, but do not appear at all in the survey rankings; those universities did not respond to the survey or else they provided incomplete information.

Top 10 Universities Engaging in Nanotechnology Research and Education

	RESEARCH	EDUCATION
1	Penn State University	University at Albany-SUNY
2	University of Washington	University of Michigan
3	University of Illinois at Urbana-Champaign	University of Illinois at Urbana-Champaign
4	Cornell University	Penn State University
5	University of Michigan	University of Maryland
6	University at Albany-SUNY	Rice University
7	University of Maryland	North Carolina State University
8	University of Pittsburgh	University of Washington
9	Rice University	Arizona State University
10	University of Minnesota	Cornell University

	FACILITIES	COMMERCIALIZATION
1	University at Albany-SUNY	Arizona State University
2	University of Illinois at Urbana-Champaign	University at Albany-SUNY
3	Arizona State University	North Carolina State University
4	University of Michigan	Penn State University
5	Rutgers University	Cornell University
6	Cornell University	Stanford University
7	University of California Los Angeles	University of Michigan
8	Purdue University	University of Washington
9	Rice University	University of Louisville
10	Rensselaer Polytechnic Institute	Louisiana Tech

Top 10 Universities Engaging in Nanotechnology Research and Education - Peer Rankings

	PEER NANO RESEARCH	PEER MICRO RESEARCH
1	Massachusetts Institute of Technology	University of California at Berkeley
2	Northwestern University	Massachusetts Institute of Technology
3	University of California at Berkeley	Stanford University
4	Cornell University	University of Michigan
5	Harvard University	Cornell University
6	Rice University	Georgia Institute of Technology
7	Stanford University	University of Illinois at Urbana-Champaign
8	University of Illinois	University of California Los Angeles
9	University of California-Santa Barbara	Northwestern University
10	Caltech	University at Albany-SUNY

	PEER NANO COMMERCIALIZATION	PEER MICRO COMMERCIALIZATION
1	Massachusetts Institute of Technology	Massachusetts Institute of Technology
2	University of California at Berkeley	University of California at Berkeley
3	University of Michigan	Stanford University
4	Georgia Institute of Technology	Northwestern University
5	Stanford University	Rice University
6	Cornell University	Cornell University
7	Caltech	Harvard University
8	University at Albany-SUNY	University of Michigan
9	CMU	University of Illinois at Urbana-Champaign
10	Northwestern University	University at Albany-SUNY

Related Links

Sloan West Coast Program on Science and Engineering Workers

http://migration.ucdavis.edu/wcpsew/index.php

The Sloan West Coast Program on Science and Engineering Workers is a network of researchers interested in the science and engineering labor force in the region with a tenth of US workers, a quarter of US science and engineering workers, and many of the leading researchers examining science and engineering work force and education issues. The network hosts seminars on labor and immigration issues affecting science and engineering workers and compiles and distributes information on these issues.

National Nanotechnology Initiative

http://www.nano.gov

The National Nanotechnology Initiative (NNI) is the program established in fiscal year 2001 to coordinate Federal nanotechnology research and development.

The NNI provides a vision of the long-term opportunities and benefits of nanotechnology. By serving as a central locus for communication, cooperation, and collaboration for all Federal agencies that wish to participate, the NNI brings together the expertise needed to guide and support the advancement of this broad and complex field.

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contact:
Kavita Shukla,
National Bureau of Economic Research (NBER) and
Harvard Law School,
Labor & Worklife Program (LWP)
Email: kshukla@law.harvard.edu
Phone: 617-868-3900

Address:
NBER
1050 Massachusetts Avenue
Cambridge, Massachusetts 02138-5398

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Editor:
Kavita Shukla
National Bureau of Economic Research (NBER) and Harvard Law School, Labor and Worklfie Program (LWP)

Design and Layout:
Jason Anastasopoulos
Web and Publications Coordinator, Harvard Law School, Labor and Worklife Program (LWP)

SEWP People

Director

Richard Freeman,
Faculty Director and Professor of Economics,
Harvard University

Network Participants

James Adams,
Rensselaer Polytech

Charles Brown
Univ. of Michigan

Geoff Davis
www.phds.org

Sharon Levin
U. of Missouri, St. Louis

Ronald Oaxaca
University of Arizona

Anne Preston
Haverford College

Paula Stephan
Georgia State University

Staff

Jennifer Amadeo-Holl
Harvard Economics Department

Jason Anastasopoulos
Harvard Law School, LWP

Kavita Shukla
National Bureau of Economic Research (NBER)
Harvard Law School, LWP

John Trumpbour
Harvard Law School, LWP