

UMETRICS and STAR METRICS - Measuring the Effects of Research on Innovation, Competitiveness and Science

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CSSIP

Center for the Science of
Science and Innovation Policy

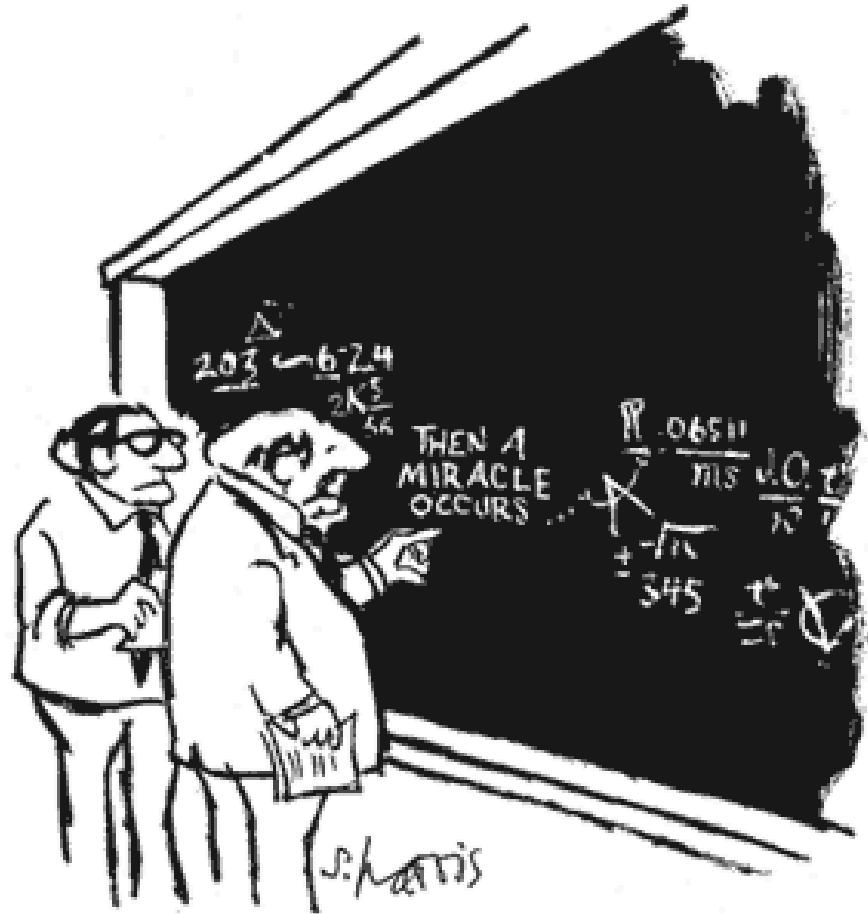
at American Institutes for Research ■

Outline

- Science of science policy approach
- UMETRICS - Developing a new platform
- Initial results
- Building the international community

Motivation

Competing Priorities in the Federal Budget...



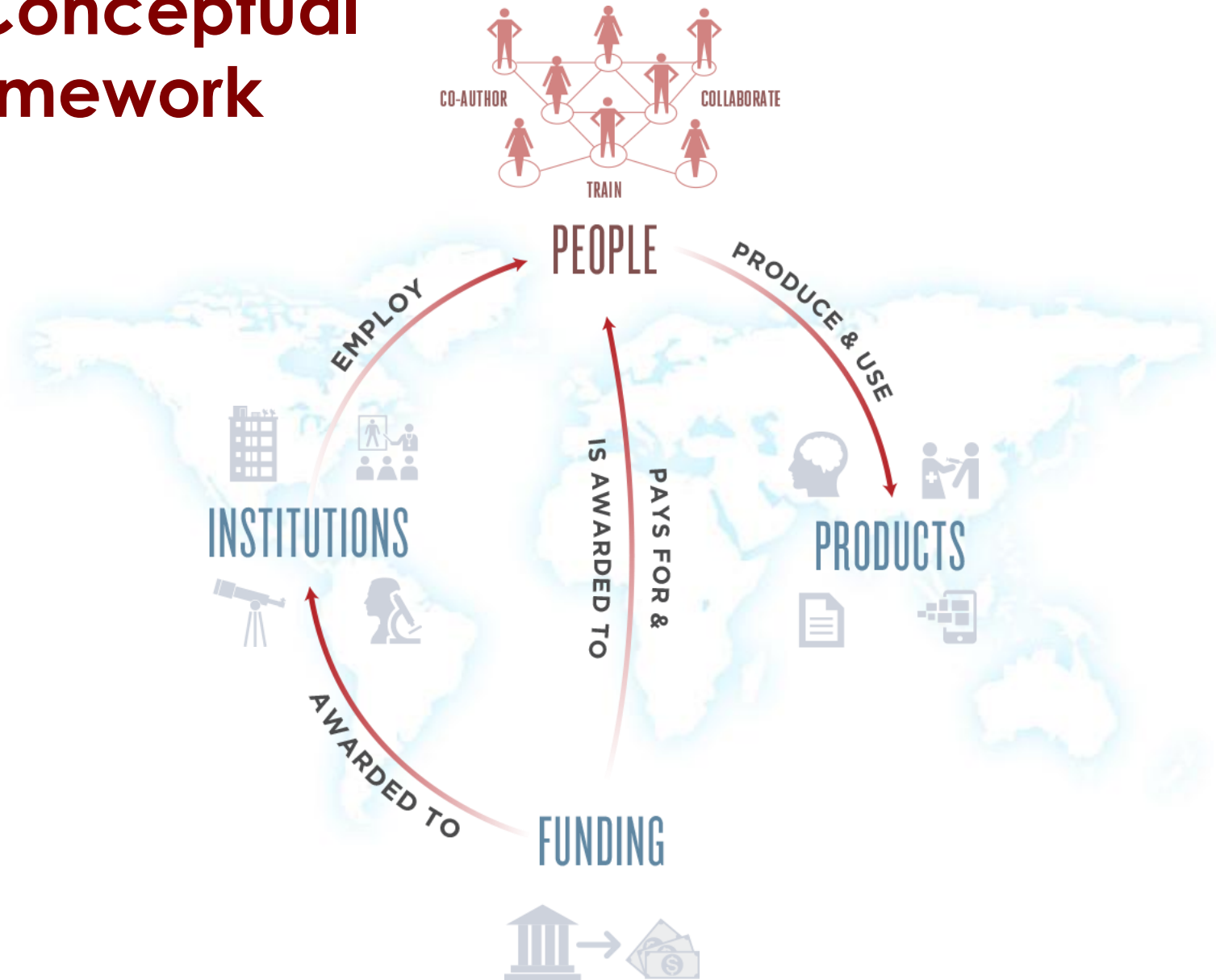
"I THINK YOU SHOULD BE MORE EXPLICIT HERE IN STEP TWO."

Science of Science Policy Approach

Building a feasible, low cost and flexible platform to use **science** to describe science (for policy)

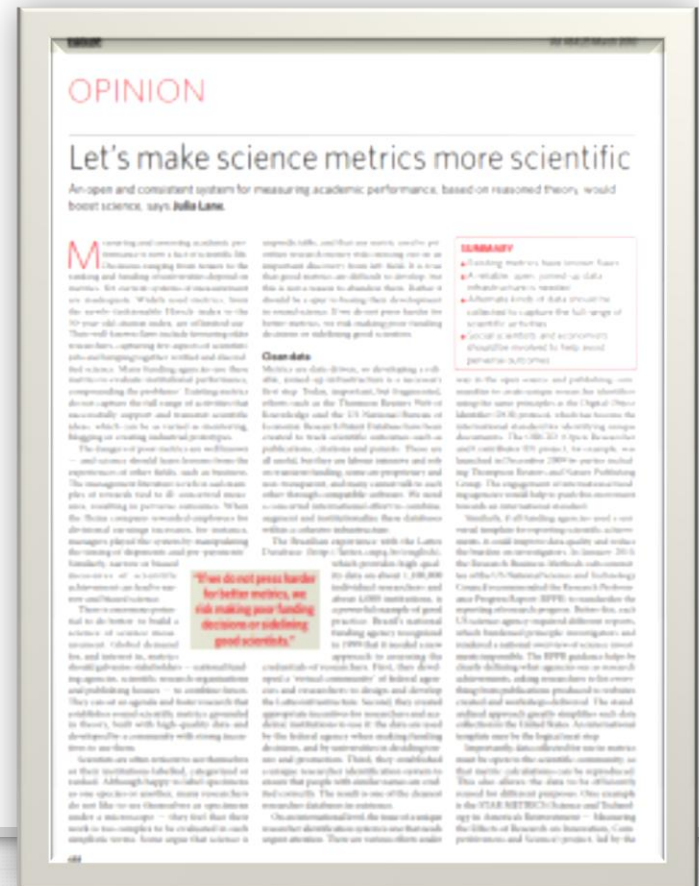
- **Conceptual framework:** Science is done by scientists (not documents), so focus on scientists & networks of scientists
- **Empirical framework:** New ways of collecting data - using new cybertools to capture information automatically
- **Pragmatic Approach:** New ways of presenting information so the public & policymakers can make decisions

A Conceptual Framework



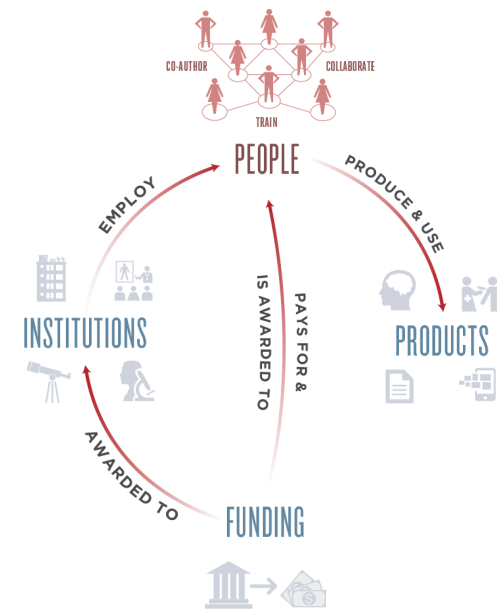
Getting the right framework matters

- What you measure is what you get
 - Poor incentives
 - Falsification
- Effectiveness
 - Research community
- Usefulness
 - Policymakers & Public

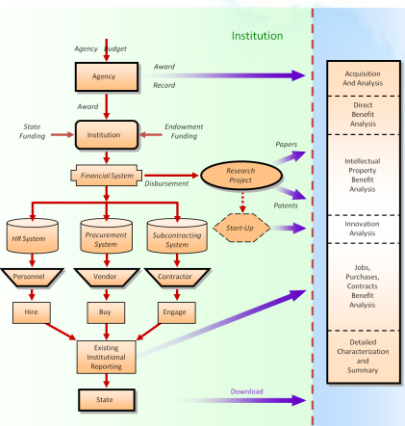
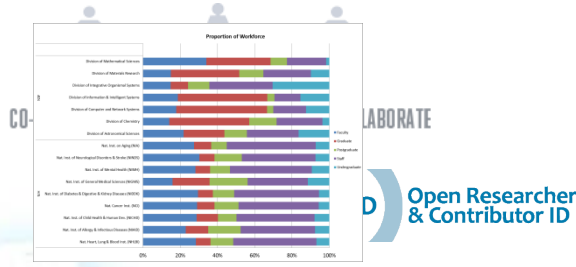


Asking the right questions

- **WHO** is doing the research?
- **WHAT** is the topic of their research?
- **HOW** are the researchers funded?
- **WHERE** do they work?
- With **WHOM** do they work?
- What are their **PRODUCTS**?



Tools to Build an Empirical Framework



Harvard Catalyst Profiles

<http://profiles.catalyst.harvard.edu>

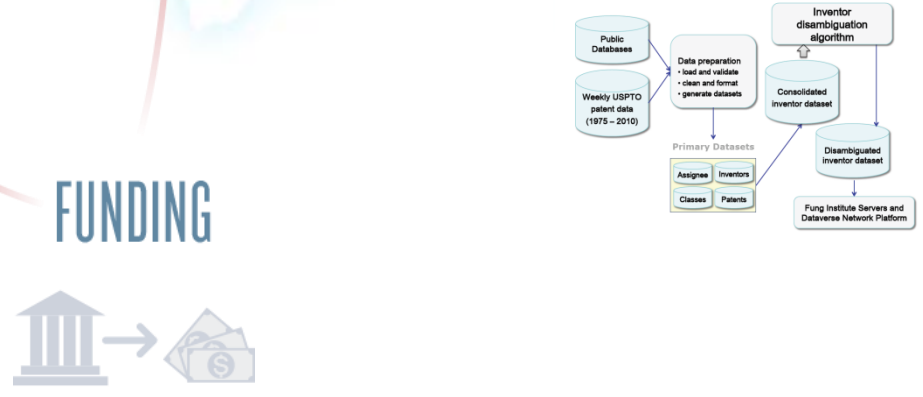
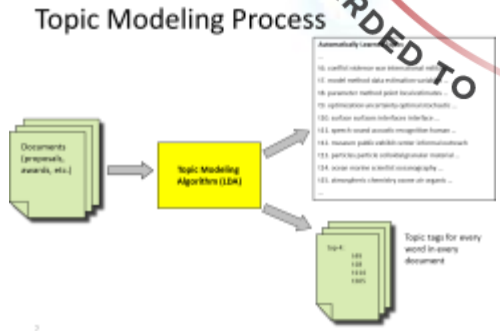
Co-Author Network - Radial Graph

Smaller People Network - Map View

Concept Network - Timelines

Co-Author Network - Cluster Graph

FUNG INSTITUTE
College of Engineering | UC Berkeley



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UMETRICS – A Regional Pilot



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UMETRICS

Universities: Measuring the Impacts of Research on Innovation, Competitiveness, and Science

Universities have a central role in documenting the results of research – from the most fundamental science and humanities to the applied projects of professional schools, research institutes, and affiliated hospitals. The UMETRICS initiative brings Science of Science Policy researchers together with university Vice Presidents for Research from CIC institutions to build a scientific framework that will inform research management, enable evidence-based decision-making, and support credible advocacy.

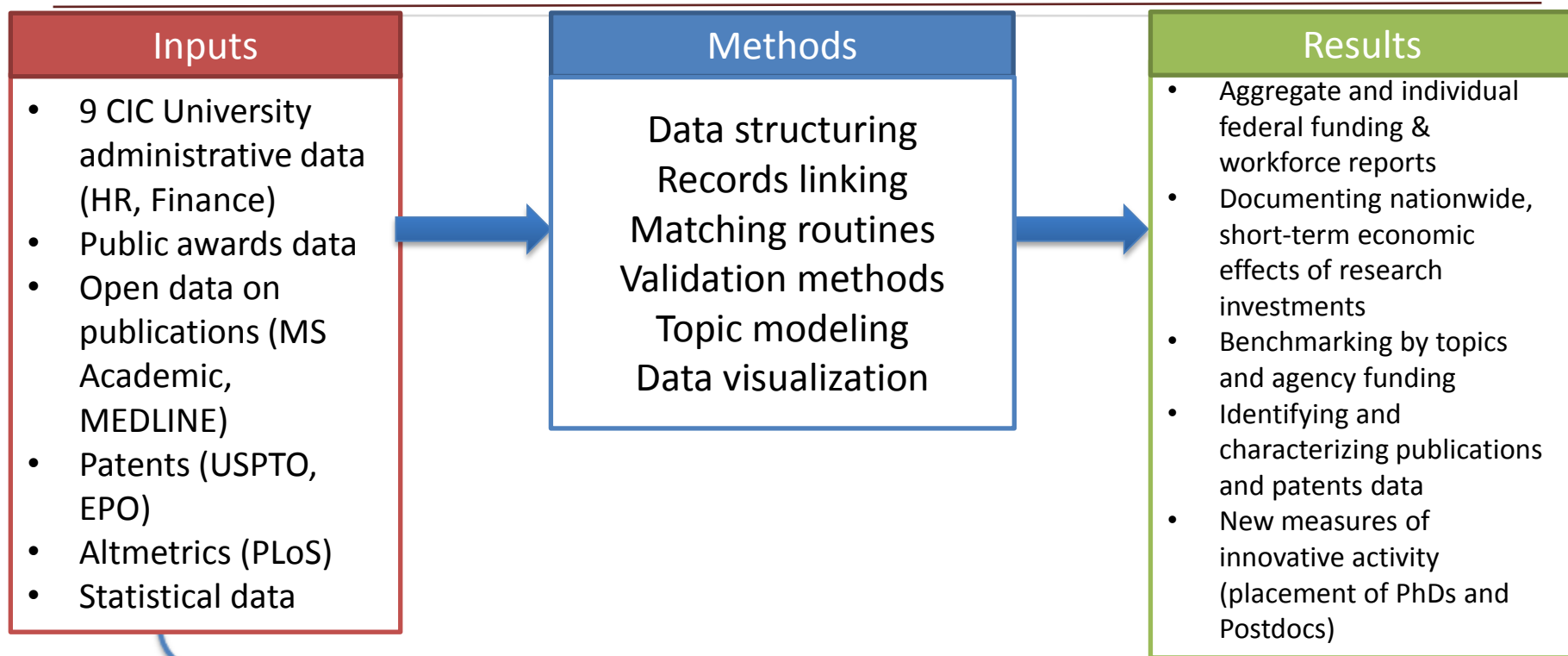
In addition to generating frontier scientific analyses, the goal of UMETRICS is to present results that are readily accessible to the research policy community. Our projects embed research on how universities can influence the policy debate and advance institutional ability to effectively communicate the results of research to donors, policy makers, and other key

UMETRICS RESOURCES

UMETRICS Video (AIR): [Long Story Short: Can We Fix the "Hit or Miss" Approach to Investing in Science?](#)

Governments are investing more in science under the notion that it will lead to more economic growth and scientific knowledge, but are often unsure of how best to invest. In this 90-second video interview, Julia Lane, senior managing economist at the American Institutes for Research (AIR), explains why understanding the scientific process is key to investing wisely in science.

Building the UMETRICS platform



Uses

- Describe and manage science funding portfolios
- Benchmark research portfolios among participating universities
- Track regional and national effects of research dollars
- Automatically identify researcher patenting activity over time
- Provide data and inspiration for new measures of innovative activity

Outline

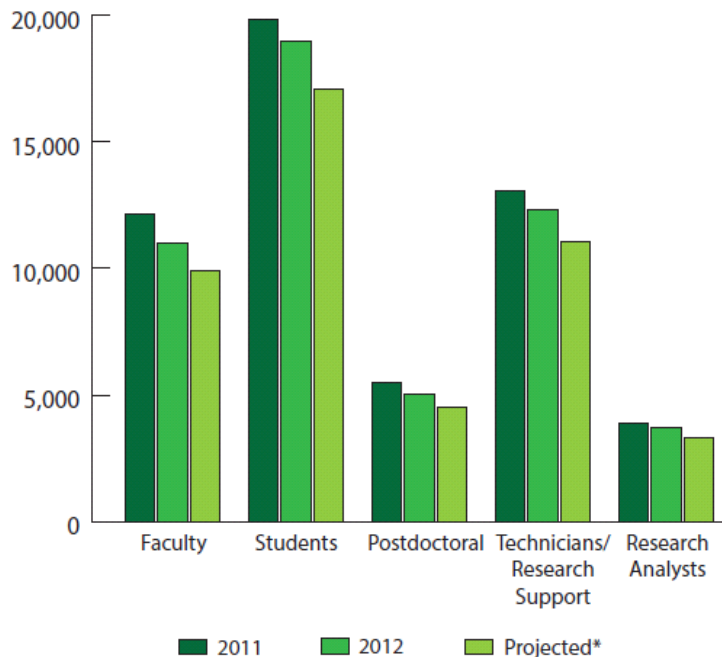
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Initial Results – Research expenditure reports analyzing UMETRICS data

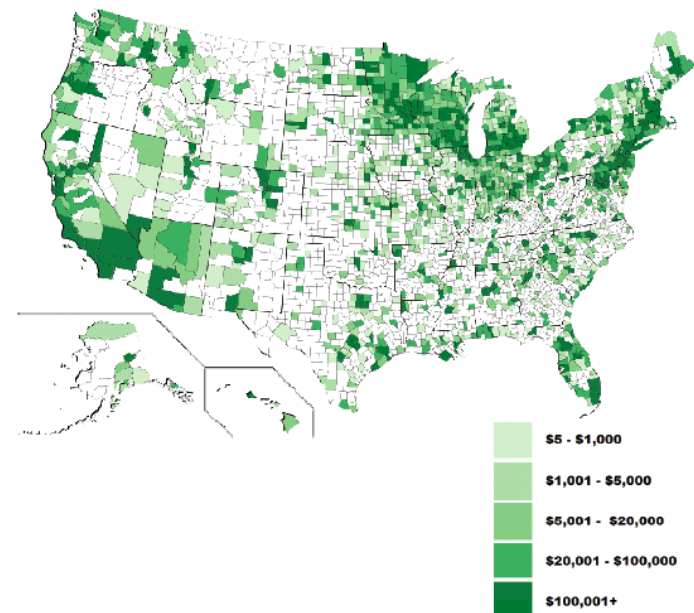
Federal Research Funding: A Detailed Analysis of Expenditures at 8 CIC Universities



Number of Individuals Employed by Federal Research Funding



National Distribution of Expenditures



UMETRICS – Initial Results

POLICYFORUM

RESEARCH FUNDING

Science Funding and Short-Term Economic Activity

Bruce A. Weinberg,^{1,2,3} Jason Owen-Smith,⁴ Rebecca F Rosen,⁴ Lisa Schwarz,⁵ Barbara McFadden Allen,⁶ Ray E. Weiss,⁷ Julia Lane^{1,11,12}

There is considerable interest among policy-makers in documenting short-term effects of science funding. A multiyear scientific journey that leads to long-term fruits of research, such as a moon landing, is more tangible if there is visible near-term activity, such as the presence of astronauts. Yet systematic data on such activities have neither before existed. The only source of information for describing the production of most science is surveys that have been called “a rough estimate, frequently based on unexamined assumptions that originate in years earlier” (1).

But although science is complicated, it is not magic. It is productive work. Scientific endeavors employ people. They use capital inputs. Related economic activity occurs immediately. Data characterizing these activities can be directly captured through the financial and payroll records of research organizations and have been used in other arenas, such as labor policy. Our data provide the first detailed information about initial inputs to the publicly funded scientific enterprise and lay the foundation to trace subsequent results (2).

These new data were initially generated in response to the mandate put in place by the 2009 American Recovery and Reinvestment Act, also known as the stimulus package, which requires that recipients of stimulus funds document the resulting jobs created and retained. In response, almost 100 U.S. universities and five federal agencies, with the support of the Federal Demonstration Partnership, established the STAR METRICS data program. The goal of the program was to document not just short-term, but also longer-term, results of scientific activity and to use

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*Corresponding author: jow@osu.edu

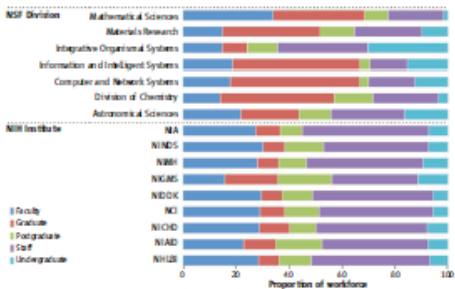
automated approaches to do so (2). The first tranche of rich data are drawn directly from university personnel and financial administrative records that track actual expenditures of all active federal projects. These data provide project-level information about the occupations of the part-time and full-time workforce paid on each funded grant and about the purchases made from vendors who supply scientific researchers. Neither of these types of information have reliably been available before (3, 4).

The results reported in this paper represent an analysis of 2012 expenditure data from nine Committee on Institutional Cooperation (CIC) universities participating in the emerging UMETRICS initiative—Michigan, Wisconsin, Minnesota (Twin Cities), Ohio State, Northwestern, Purdue, Michigan State, Chicago, and Indiana [see supplementary material (SM) for full details on data and analyses]. These universities received about \$7 billion in research and development (R&D) funding from all sources in 2012; 56% of that came from federal government sources (5). In the

Expenditures from grant funds support many different types of workers and vendors across the nation.

aggregate, the 15 institutions that make up the CIC receive 8 to 10% of all federal research dollars. The majority of these institutions are large, Midwestern public universities. Hence, they are not representative of all recipients of federal funds. However, it is unlikely that the type of science that is conducted with those funds is markedly different from that conducted at many other major research universities, and they provide a window into a large portion of federal research activity in the era of tightening federal budgets. Moreover, the 2012 data we analyzed reflect expenditures from federal funds obligated over multiple prior years. These data thus offer a different, and possibly smoother, picture than is apparent in the often volatile annual federal-funding cycle.

Our initial analysis of all expenditures supported by federal funding to these nine CIC institutions—namely, from some 30 agencies—shows that the production of science is complex but eminently traceable. We document reliance on a wide variety of inputs, including a heterogeneous mix of skills



Differences in workforce composition in projects funded by NSF divisions and NIH Institutes. NIA, National Institute on Aging; NINDS, National Institute of Neurological Disorders and Stroke; NIMH, National Institute of Mental Health; NIDDK, National Institute of Diabetes and Digestive and Kidney Diseases; NICHD, Eunice Kennedy Shriver National Institute of Child Health and Human Development; NIAID, National Institutes of Health; NHLBI, National Heart, Lung, and Blood Institute. (See SM.)

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First Milestone Is Claimed on Long Road to Tracking Science's Economic Value - Research - The Chronicle of Higher Education

THE CHRONICLE OF HIGHER EDUCATION Research

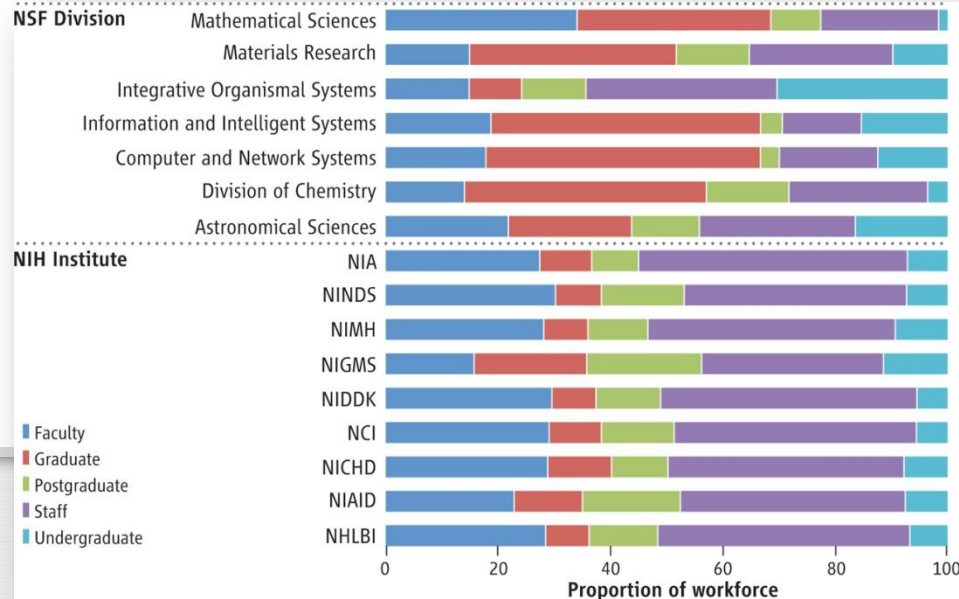
April 3, 2014

First Milestone Is Claimed on Long Road to Tracking Science's Economic Value

By Paul Basken
Washington

Just last week, at a budget hearing on Capitol Hill, a member of Congress cited a well-traveled number: \$2.21.

That figure, said Rep. Ross DeLoe of Connecticut, the top



UMETRICS Research Dashboard



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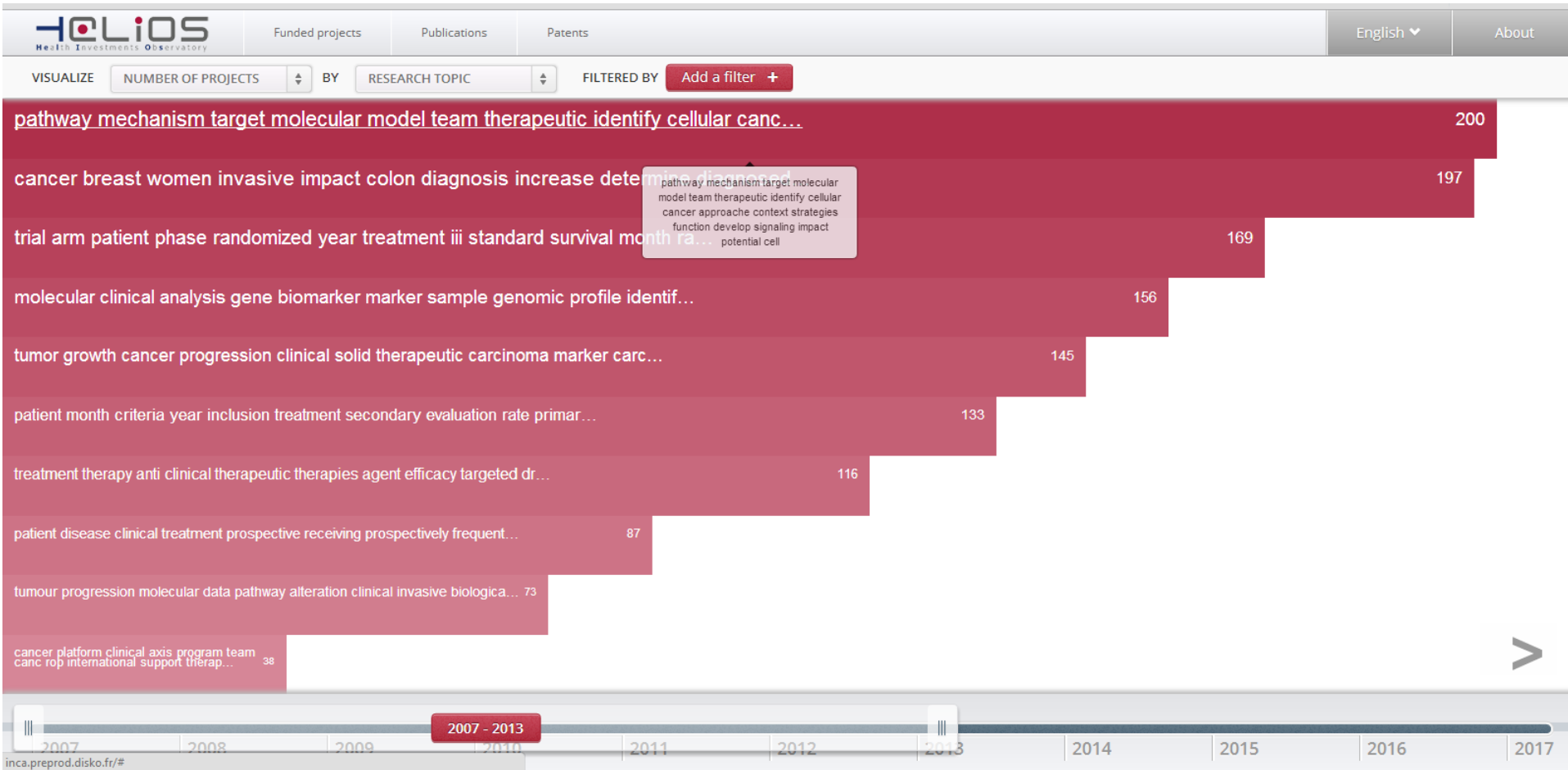
International Approach

- Build internal expertise
 - Big data tools & methods
 - Cut down on expensive, 'one-off' studies
- Work with multiple stakeholders
 - Researchers, universities, Ministry
 - Inform data visualizations
- An empirical platform for policy analyses
 - Focus on infrastructure, not software
 - Extensible, scalable, open

International efforts

- Spain – SOLES
- France – HELIOS
- Australia – ASTRA
- Norway – NORDSJTERNEN
- Strasbourg

Describe a scientific portfolio



Enrich existing taxonomies

The screenshot displays the HeliOS Health Investments Observatory interface. At the top, the logo 'HeliOS Health Investments Observatory' is visible. Below it, navigation tabs include 'Funded projects', 'Publications', and 'Patents'. A search bar contains the text '30 imaging mri mr contrast lesion magnetic_resonanc...'. A filter dropdown is set to 'Prostate Cancer'. The interface shows a map of France on the left with a callout 'Where?'. The main content area displays 'TOTAL OF PROJECTS: 4' and a list of project cards. Each card includes a title, a date, and an institution name. Callouts point to specific elements: 'Cancer Site' points to the 'Prostate Cancer' filter, 'Topic' points to the project titles, and 'Who? What Institution?' points to the institution names.

Where?

Cancer Site

Topic

Who? What Institution?

Where?

Cancer Site

Topic

Who? What Institution?

Identify relationships between investments & outcomes

The screenshot displays the HELIOS Health Investments Observatory interface. At the top, there are navigation tabs for 'Funded projects', 'Publications', and 'Patents', along with language and about options. A filter bar indicates '2 FILTER(S) SELECTED' and provides an 'Add a filter +' button. On the left, a map of Europe shows several blue dots representing data points. The main content area is titled 'TOTAL OF PUBLICATIONS: 729' and includes a search bar and a 'Sort by The most recent' dropdown. Below this, there are six publication cards, each with a title, year, journal name, author, and a 'See more' button. A timeline at the bottom shows years from 2000 to 2011, with a red highlight on the '2008 - 2010' period.

HELIOS Health Investments Observatory

Funded projects Publications Patents English About

2 FILTER(S) SELECTED. Add a filter +

TOTAL OF PUBLICATIONS: 729 Sort by The most recent

Page 1/15 Next

Filter search results

Aspects of an ovarian osteoma on magnetic resonance imaging and computerized tomography

2008, FERTILITY AND STERILITY

DARAI Emile

Objective: To describe the contribution of magnetic resonance imaging

See more

Staging cholangiocarcinoma by imaging studies

2008, HPB

VILGRAIN Valérie

Cholangiocarcinoma (CCA) is an adenocarcinoma that arises from the bil

See more

Subcellular imaging of dynamic protein interactions by bioluminescence resonance energy transfer

2008, BIOPHYSICAL JOURNAL

COULON Vincent

Despite the fact that numerous studies suggest the existence of recept

See more

Measurement of glomerular filtration rate with magnetic resonance imaging: Principles, limitations, and expectations

2008, SEMINARS IN NUCLEAR MEDICINE

GRENIER Nicolas

Factors limiting complete tumor ablation by radiofrequency ablation

2008, CARDIOVASCULAR AND INTERVENTIONAL RADIOLOGY

AUBE Christophe
CALES Paul
LEBIGOT Jérôme

Early quantitative evaluation of a tumor vasculature disruptive agent AVE8062 using dynamic contrast-enhanced ultrasonography

2008, INVESTIGATIVE RADIOLOGY

2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011

Provide an international context

The screenshot shows the HELIOS website interface. At the top, there is a navigation bar with the HELIOS logo (Health Investments Observatory) and menu items: 'Funded projects', 'Publications', 'Patents', 'English', and 'About'. Below the navigation bar, the page title is 'PRALIMAP-INÉS : REDUCTION OF INEQUALITIES IN OVERWEIGHT AND OBESITY CARE MANAGEMENT IN HIGH SCHOOL ADOLESCENT'. A 'Back' button and an 'Export' button are visible. The main content area is split into two columns. The left column features a map of Europe with a red callout box containing the text 'Relative to NIH'. The right column contains the following sections:

- Abstract**

Background: The prevalence of overweight and obesity continues to increase in socially less advantaged populations but is stabilizing even is decreasing in socially more advantaged populations. The PRALIMAP trial (PRomotion de l'Alimentation et de l'Activité Physique) confirmed major social inequalities in overweight and obesity frequency in adolescents in grade 10. The trial highlighted the effectiveness of structured screening and care management in decreasing the prevalence of overweight and ...
- PI**

BRIANCON Serge, Université Henri Poincaré Nancy 1, VANOEUVRE-LES-NANCY
- Researchers**

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Lecomte Edith, Conservatoire National des Arts et Métiers de Nancy,
QUINET Marie-Hélène, CHU Nancy - Hopitaux de Brabois, VANOEUVRE LES NANCY
- HELIOS Research topics**
 - 28 - high low grade rate frequency higher intermediate population time due determine present level data profile range improved defined single
 - 53 - term long short time year follow effect data number part duration period major survivor malaria remain increase longer lasting
 - 65 - health intervention social action inequalities program care local participation prevention context improve practice aim public programme knowledge management healthcare
 - 144 - trial arm patient phase randomized year treatment iii standard survival month rate experimental quality free risk primary randomization multicenter
- NIH Topics**
 - 126 - trial treatment randomized clinical_trial patients months efficacy therapy trials placebo ... [View this topic at NIH](#)
 - 301 - obesity weight physical_activity overweight bmi obese weight_loss children intervention diet ... [View this topic at NIH](#)
 - 447 - intervention screening care settings primary_care effectiveness patients services treatment program ... [View this topic at NIH](#)
 - 532 - adolescents adolescent youth behaviors peer behavior social school relationships adolescence ... [View this topic at NIH](#)

Next steps

- Expand UMETRICS
 - More universities
 - More data on activities, accomplishments and outcomes; partnership with statistical agencies
 - Connect data with frontier researchers (e.g. Ann Arbor workshop
<http://cssip.org/login/june-workshop-ann-arbor>)
- Institutionalize
 - Collaborate with international efforts

Thank you!

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