

It is a pleasure to have the chance to address you today. To give you my background, prior to my current position at Elsevier, I was the Director of Product Development for the SciVal suite of products, and before that I was Director of Research Strategy at Columbia University in New York.

Before I speak about the concept of multidimensional research assessment, which is my main topic for today, I would like to make a brief introduction discussing the data sources used in the research assessment.

Agenda

- **Data Sources: Scopus and SciVal**
- **The Multi-Dimensional Research Assessment Matrix**
 - Examples 1 and 2: Evaluation of an individual researcher
 - Example 3: Evaluation of a department or lab group
 - Examples 4 and 5: Evaluation of an institution



Scopus and SciVal: Solutions for Research Assessment

SCOPUS

- **Scopus is the largest abstract and citation database of research literature and quality web sources**

- Designed to find and evaluate the information that scientists need. Quick, easy and comprehensive, superior support of the literature research process.
- The easiest way to get to relevant content fast. Tools to sort, refine and quickly identify results.
- Over 19,500 peer-reviewed journals from over 5,000 publishers
 - Results from 435 million scientific web pages
 - 23 million patent records from 5 patent offices
 - "Articles-in-Press" from over 3,850 journals
 - Seamless links to full-text articles and other library resources
 - Over 48M records
 - 4.6M conference papers
 - Innovative tools that give an at-a-glance overview of search results



- **The Innovative Solution for Establishing, Evaluating and Executing Research Strategies**

- Top research leaders get insights to evaluate their institution's research output in a single online interface.
- Capturing the unique "research fingerprint" of your university, identifying its distinctive competencies.
- View your position relative to the competition across a multitude of research-driven areas of focus.



Scopus, an abstract and citations database that indexes over 19500 journals from 5000 publishers, is the primary data source for the SciVal suite of research analytics products that Elsevier is currently investing in. In addition to 48M records and 4.6M conference papers, Scopus includes a variety of alternative scientific content, from web pages to patent records and other relevant material.

SciVal is a suite of analytic products that leverage the rich data set embedded in Scopus to perform higher-level analysis on research outputs to assess research performance in a variety of dimensions. These are the two primary data sets that we will use in this presentation.

SciVal Suite—Performance, Planning and Funding Solutions



SciVal Spotlight™

Visualize areas of Research Excellence and Strength across multiple disciplines compared Globally



SciVal Strata™

Benchmark article and citation output from individuals, departments and research against your peers



SciVal Experts™

Identify Researcher Expertise and Enable Collaboration delivered as an Application, Data and Web Services



SciVal Funding™

Integrated Source of Funding Opportunities from over 4,500 sources updated daily



Supporting
Decision
Makers

Supporting
Faculty



These are the four SciVal products. As part of the research assessment framework, I'll be doing some analysis on research outputs primarily using SciVal Spotlight, Strata, and Experts, which are designed to provide decision support to senior research executives and policy makers.

Agenda

- **Data Sources: Scopus and SciVal**
- **The Multi-Dimensional Research Assessment Matrix**
 - **Examples 1 and 2: Evaluation of an individual researcher**
 - **Example 3: Evaluation of a department or lab group**
 - **Examples 4 and 5: Evaluation of an institution**



Research assessment and evaluation is increasingly based on quantitative methods		
Research Program	Sponsor	Description
		<ul style="list-style-type: none"> Assess the quality of research in universities and colleges in the UK Enable funding bodies to determine how to allocate grants across research projects
		<ul style="list-style-type: none"> Detail by institution and by discipline those areas that are internationally competitive Identify emerging areas where there are opportunities for development and further investment
		<ul style="list-style-type: none"> Identify thematic domains for future European support Part of EU's strategy to become "the most dynamic competitive knowledge-based economy in the world"

Governments are actively guiding their national research agenda

SciVal 6 

Why is the topic of research assessment such an important one? One of the most significant new global trends in research planning and performance is the more active role the governments are taking. With initiatives such as ERA in Australia and RAE in the UK, institutions are now required to evaluate research with more quantitative assessments, in addition to the qualitative and subjective measures already in use. Similarly, the Obama administration has placed a new emphasis on financial transparency and tracking of social and economic benefits of fundamental research through the ARRA program and other initiatives such as STAR Metrics, which seeks to quantify the social and economic impacts of government research investments given to university researchers.

In UK this approach has already led to significant changes in how much funding the leading research universities were getting. Some institutions like Birmingham and Aberdeen received more money as a result of these assessments, while others, including such elite institutions as Oxford and Cambridge, received less. These assessments showed that universities that were not considered the most elite institutions, such as Oxbridge and UCL, still had a wide range of focused areas of research excellence, a conclusion also supported by our own analytical tools.

What kind of tools are governments using for this kind of productivity analysis? Primarily they are using abstracting and citation databases like Scopus and its main competitor, Web of Science.

The multi-dimensional research assessment matrix



Dr. Henk Moed, Senior Scientific Advisor,
Elsevier

Dr. Moed is a former professor of research
assessment methodologies – in the Centre
for Science and Technology Studies
(CWTS) at Leiden University.



Research Trends issue 23-may-2011
www.researchtrends.com



When we are asked to measure anything in a rigorous way, it is important to ask two key questions before launching into the process of measuring itself. First, how should the measurement take place, by what methodology and with what metrics? Second, what is the goal of such a measurement, the desired outcome or insights to be gained?

If these questions are not answered up front, it can result in a mismatch between what has been measured and what needs to be measured. This can cause distortion of results or a misuse of metrics. Just to be clear, any single metric used to measure has its limitations. The multidimensional research assessment matrix, as created by Dr. Henk Moed of Elsevier, who is previously an internationally-recognized bibliometrician at the University of Leiden in the Netherlands, gives us a way to help ensure we answer these key questions before beginning to measure and assess research.


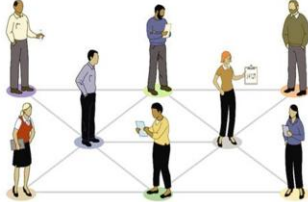

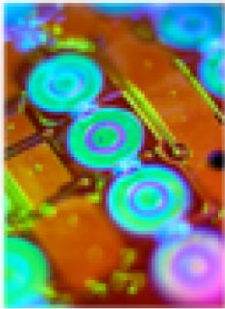
The multi-dimensional research assessment matrix



Unit of assessment	Purpose	Output dimensions	Bibliometric indicators	Other indicators
Individual	Allocate resources	Research productivity	Publications	Peer review
Research group	Improve performance	Quality, scholarly impact	Journal citation impact	Patents, licences, spin offs
Department	Increase regional engagement	Innovation and social benefit	Actual citation impact	Invitations for conferences
Institution	Stimulate international collaboration	Sustainability & Scale	International co-authorship	External research income
Research field	Promotion, hiring	Research infrastructure	Citation 'prestige'	PhD completion rates

Table 1 — The multi-dimensional research assessment matrix.

There are 5 dimensions of the matrix. It is not to be read horizontally, but vertically—that is, any unit of assessment can match up with any purpose or any output dimensions.

Who/What Do We Want to Evaluate?

Unit of assessment	
Individual	
Research group	
Department	
Institution	
Research field	

What or who do we want to evaluate? This is generally a straightforward question to answer. But even here we can see misuse of metrics, as when an impact factor, which is a useful metric to measure journal impact and prestige, is used to evaluate an individual faculty member's papers.

What is the Purpose of the Evaluation?

Purpose

Allocate resources

Improve performance

Increase regional engagement

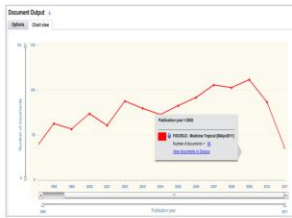
Stimulate international collaboration

Promotion, hiring



Second, the key question of what the goal is of doing this evaluation. This is slightly more complex, and may have multiple answers.

What is the Metric or Impact We Want to Evaluate?



Output dimensions

Research productivity

Quality, scholarly impact

Innovation and social benefit

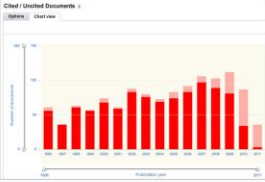





Sustainability & Scale

Research infrastructure



What metric or impact do we wish to evaluate? Again, the choice of these can help to determine the particular methodology that needs to be taken for an assessment.

Which Indicators Should We Use in the Evaluation?

	Bibliometric indicators	Other indicators
	Publications	Peer review
	Journal citation impact	Patents, licences, spin offs
	Actual citation impact	Invitations for conferences
	International co-authorship	External research income
	Citation 'prestige'	PhD completion rates
		
		
		

While bibliometric indicators are certainly an important source for evaluating research outputs, there are other indicators such as peer review, patents, speaking engagements, Ph.D. completion rates, etc. that can be used effectively as part of the assessment. I won't speak of these extensively here, but it's important to note that peer review in particular is part of almost any important assessment of an individual or a laboratory group, and is almost certain to remain so. After all, peer review has proved its worth over hundreds of years. The technology has certainly changed and the methods used have evolved but the basic review process itself has not.

Example 1: Evaluation of a Researcher

Unit of assessment	Purpose	Output dimensions	Bibliometric indicators	Other indicators
Individual		Research productivity	Publications	Peer review
		Quality, scholarly impact	Journal citation impact	
			Actual citation impact	
	Promotion, hiring			



Here is an example of perhaps the simplest case—assessing the research productivity of an individual. In addition to the bibliometric indicators, peer review would also likely be an important part of any assessment. What does the department chair think of the quality and impact of this scholar's work?

Example 1: Evaluation of a Researcher

Brimblecombe, Peter

Research productivity

Personal

Name	Brimblecombe, Peter
Other formats	Brimblecombe, P.
Author ID	7006535630
Affiliation	University of East Anglia, School of Environmental Sciences, Norwich, United Kingdom

Research

Documents	205	Author Evaluator	Add to my list	Set alert	Set feed
References	2186				
Citations	2272	View citation overview	Set alert		
h Index	18	View h-Graph	The h Index considers Scopus articles published after 1		
Co-authors	150 (maximum 150 co-authors can be displayed)				
Web search	2986				
Subject area	Environmental Science Earth and Planetary Sciences Engineering More...	<div style="border: 1px solid gray; padding: 5px; display: inline-block;">Bibliometric indicators</div>			

Find potential author matches

History

Publication range	1966-Present				
Source history	Journal of the Society of Leather Technologies and Chemists Journal of Trace and Microprobe Techniques Precambrian Research More...	View documents	View documents	View documents	

[Show Related Affiliations](#) 1

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This author has published 205 documents in Scopus :
(Showing the 2 most recent)

Grossi, C.M., Brimblecombe, P., Menéndez, B., Benavente, D., Harris, I., Déqué, M.
Climatology of salt transitions and implications for stone weathering
(2011) *Science of the Total Environment*

Song, C.H., Kim, H.S., Von Glasow, R., Brimblecombe, P., Kim, J., Park, R.J., Woo, J.H., Kim, Y.H.
Source identification and budget analysis on elevated levels of formaldehyde within the ship plumes: A ship-plume photochemical/dynamic model analysis
(2010) *Atmospheric Chemistry and Physics*

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This author has been cited 2272 times in Scopus:
(Showing the 2 most recent)

Najafi, M., Mollazadeh, M.
Selective recognition of chloroacetic acids by imprinted polyaniline film
(2011) *Journal of Applied Polymer Science*

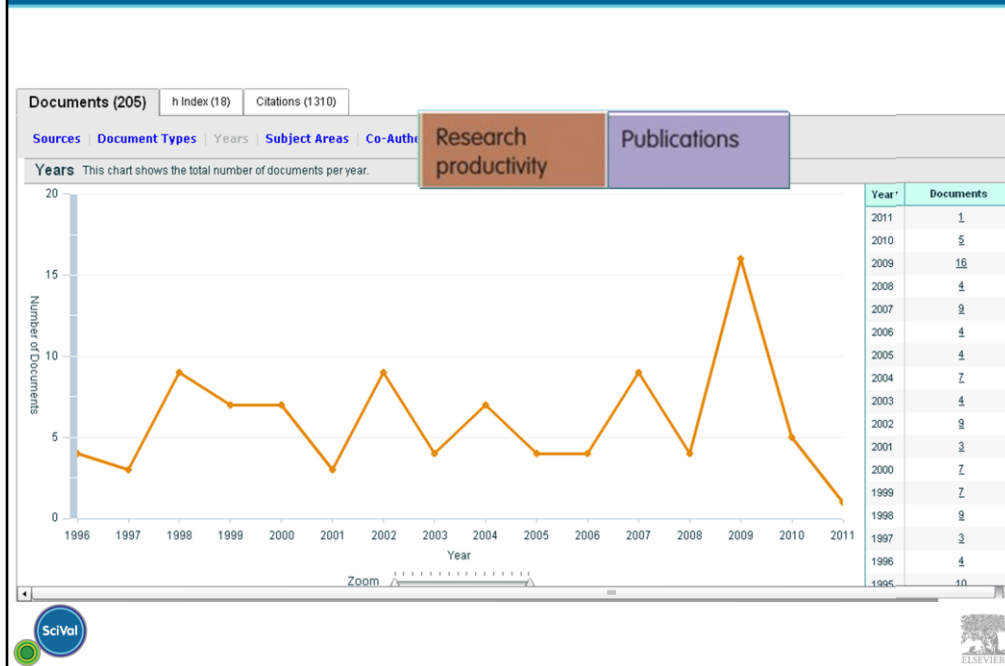
Kamees, S., John, K.
Source apportionment of fine particulate matter measured in an industrialized coastal urban area of South Texas
(2011) *Atmospheric Environment*

[View details of all 2272 citations](#)

Inform me when this author is cited in Scopus:
[Set alert](#)

Looking at Scopus can give needed information about citations and papers published, as well as other commonly-used metrics such as h-index.

Example 1: Evaluation of a Researcher



We can also evaluate a researcher by looking at number of publications over time. This functionality is present in SciVal Strata, which allows for multidimensional analysis on any individual, lab group or department against any control group (e.g. a different lab group at the same institution, or all astronomers in Chile, or all neurologists globally)

Example 1: Evaluation of a Researcher

Citation overview Citations received since 1996

Author: Birmblecombe, Peter

Overview options Hide

Exclude from citation overview: Self citations of selected author Self citations of all authors

Sort documents Date range

Citations descending 2008 to 2011 Update overview

Quality,
scholarly
impact

	205 Cited Documents	Citations							Total
		<2008	2008	2009	2010	2011	Subtotal	>2011	
	Total	2202	237	210	259	134	840	0	3042
1	<input type="checkbox"/> 1998 Thermodynamic model of the syste...	189	27	20	25	11	83		272
2	<input type="checkbox"/> 1994 Stratospheric aerosol growth and...	211	7	4	3	3	17		228
3	<input type="checkbox"/> 1998 Thermodynamic model of the syste...	106	25	21	26	9	81		187
4	<input type="checkbox"/> 1995 A thermodynamic model of the sys...	146	9	10	4	9	32		178
5	<input type="checkbox"/> 1986 Photo-oxidation of dimethylsulph...	113	3	3	5	1	12		125
6	<input type="checkbox"/> 2001 Thermodynamic modelling of aqueo...	69	9	8	17	4	38		107
7	<input type="checkbox"/> 1992 Thermodynamics of multicomponent...	78	6	6	8	9	29		107
8	<input type="checkbox"/> 1995 Application of a multicomponent ...	60	5	2	2	2	11		71
9	<input type="checkbox"/> 1989 Solubility of ammonia in pure aq...	55	3	3	3	1	10		65
10	<input type="checkbox"/> 1988 The solubility and behaviour of ...	53	3	1	5	1	10		63
11	<input type="checkbox"/> 1995 Iron and sulfur in the pre-biolo...	46	3	5	3	3	14		60

Author h index h index = 18

[View h-Graph](#)

Of the 96 documents considered for the h index, 18 have been cited at least 18 times.

Note: The h index considers Scopus documents published after 1995.

[About h-Graph](#)

Actual citation
impact

ELSEVIER

Again, this is taken from Scopus and can easily be sorted to identify papers with the highest citation rates.

Example 2: Analysis of a Researcher's Output and Collaboration Network

The screenshot displays the 'researchprofiles' website for Steve L. Kunkel. The header includes the University of Michigan Medical School logo and the site name. The navigation menu on the left provides access to various sections: Home, Expert Overview, Profile, Publications, Grants, Similar Experts, Journals, Trends, Institutional Network, Coauthor Network, and Research Network. The main content area is organized into several columns. The 'Profile' section lists key concepts such as Cytokines, Tumor Necrosis Factor-alpha, Chemokines, Interleukin-8, Minc, Chemokine CCL2, Neutrophils, Inbred CBA Mice, Messenger RNA, and Interleukin-1. The 'Trends' section features a line graph titled 'Explore the Research Trends'. The 'Research Network' section includes a network diagram titled 'Explore the Expert Network'. The 'Publications' section lists three recent papers, including one by Cavasani et al. (2010) on regulatory T cells and another by Fakhri-Schani et al. (2010) on tumor necrosis factor availability in tuberculosis granulomas. The 'Similar Experts' section lists other researchers like Lukacs, Nicholas W and Chenow, Stephen W. The 'Journals' section lists journals such as Journal of Immunology and The American Journal of Pathology. The page also includes a 'SciVal' logo and a 'Bioscience Resource Project' logo.

On the author's homepage, we see a sample of all the information available to us regarding Dr. Kunkel.

- Top concepts in his profile
- His recent publications
- Similar Experts
- Which journals he has been published in recently
- Which grants he has received recently
-


You can access all of the information in each of these areas by clicking the "More" button or the links on the left-side of the page.

Example 2: Analysis of a Researcher's Output and Collaboration Network



Kunkel, Steve L

Medical School Clinical Sciences, Pathology Department

- Home
- Expert Overview
- Profile
- Publications**
- Grants
- Similar Experts
- Journals
- Trends
- Institutional Network
- Coauthor Network
- Research Network



Kunkel, Steve L



587 Publications

This is a list of publications by this researcher, listed chronologically starting with the most recent first. New publications appear in this list weekly. The source of publications for this application is PubMed, so only PubMed publications are included.

Select All | Export to Endnote sort by year | citation count

- 1.** Cavassani Karen A; Carson William F; Moreira Ana Paula; Wen Haitao; Schaller Matthew A; Ishii Makoto; Lindell Dennis M; Dou Yali; Lukacs Nicholas W; Keshamouri Venkateshwar G; Hogaboam Cory M; Kunkel Steven L
The post sepsis-induced expansion and enhanced function of regulatory T cells create an environment to potentiate tumor growth.
Blood 2010;115(22):4403-11.
- 2.** Fallah-Sichani Mohammad; Schaller Matthew A; Kirschner Denise E; Kunkel Steven L; Linderman Jennifer J
Identification of key processes that control tumor necrosis factor availability in a tuberculosis granuloma.
PLoS computational biology 2010;6(5):e1000778.
- 3.** Seki Masafumi; Kohno Shigeru; Newstead Michael W; Zeng Xianying; Bhan Urvashi; Lukacs Nicholas W; Kunkel Steven L; Standford Theodore J
Critical role of IL-1 receptor-associated kinase-M in regulating chemokine-dependent deleterious inflammation in murine influenza pneumonia.
Journal of immunology (Baltimore, Md. : 1950) 2010;184(3):1410-8.
- 4.** Lyn-Kew Kenneth; Rich Eric; Zeng Xianying; Wen Haitao; Kunkel Steven L; Newstead Michael W; Bhan Urvashi; Standford Theodore J
IRAK-M regulates chromatin remodeling in lung macrophages during experimental sepsis.
PLoS one 2010;5(6):e11146.
- 5.** Ito Toshihiro; Schaller Matthew; Raymond Tracy; Joshi Anrila D; Coelho Ana L; Frantz Fabiani G; Carson William F; Hogaboam Cory M; Lukacs Nicholas W; Standford Theodore J; Phan Sem H; Chensue Stephen W; Kunkel Steven L
Toll-like receptor 9 activation is a key mechanism for the maintenance of chronic lung inflammation.

On the publications page, we see the total # of publications written by Dr. Kunkel. These publications were examined in order to build his profile.

Users can sort the publications by year or citation count. This enables you to easily identify the most significant publications the author has produced.

Example 2: Analysis of a Researcher's Output and Collaboration Network

Kunkel, Steve L
Medical School Clinical Sciences, Pathology Department

Home
Expert Overview
Profile
Publications
Grants
Similar Experts
Journals
Trends
Institutional Network
Coauthor Network
Research Network

Home
Expert Overview
Profile
Publications
Grants
Similar Experts
Journals
Trends
Institutional Network
Coauthor Network
Research Network

Grant Detail
The grant detail shows the name of the PI, active dates of the project, the funding institute and the abstract of the grant. This abstract is what is used to create the fingerprint of the grant within Collexis applications. If any publications referencing this grant are found in the data, they will be listed here as well.

Cytokine Phenotypes After the Host's Response During Chronic Lung Inflammation
Kunkel, Steve L
1 December 2008 - 30 November 2013
NATIONAL HEART, LUNG, AND BLOOD INSTITUTE

Scientific Context
This section shows information that has been computed by using the fingerprint of the grant, including related publications, related experts and related grants - all with fingerprints representing significant amounts of overlap between their fingerprint and this grant. The red dots indicate whether those experts or terms actually appear within this grant, showing potential and actual connections.

Related Topics
● Appears in this Publication

- Pneumonia
- Cytokines
- Chemokines
- Bronchoalveolar Lavage Fluid
- Bacterial Pneumonia
- Neutrophils
- Lung Injury
- Inflammation
- Tumor Necrosis Factor-alpha
- Alveolar Macrophages
- Neutrophil Infiltration

Related Publications

1. Kunkel S L; Strieter R M
1990
Cytokine networking in lung inflammation.
Hospital practice (Office ed.) 1990;25(10):63-6, 69, 73-6.
2. Strieter R M; Lynch J P; Basha M A; Standford T J; Kasahara K; Kunkel S L
1990
Host responses in mediating sepsis and adult respiratory distress syndrome.
Seminars in respiratory infections 1990;5(3):233-47.

Related Grants

1. Kunkel, Steven Lynn
Inflammatory Cells and Lung Injury
1 March 1997 - 31 January 2010
NATIONAL HEART, LUNG, AND BLOOD INSTITUTE
2. Hemmila, Mark Richard
Gram-Negative Pneumonia and Lipopolysaccharide Binding Protein
1 September 2006 - 31 August 2011
NATIONAL INSTITUTE OF

Kunkel, Steve L
Medical School Clinical Sciences
Pathology Department
PubMed H-Index: 106 (?)

SciVal

ELSEVIER

Here we see all the current and past grants awarded to Dr. Kunkel.

We can click on a grant to access the details of the award as well as related topics, publications and grants.

Example 2: Analysis of a Researcher's Output and Collaboration Network

Home

Expert Overview

Profile

Publications

Grants

Similar Experts

Journals

Trends

Institutional Network

Coauthor Network

Research Network

Institutional Network

This view shows the units within the institution with whom this researcher has collaborated, listed with most recent publications first. The first section shows internal organizations, such as other departments, while the second list shows external organizations, such as other universities. Clicking the names of the internal organizations jumps to their profile; internal organizations within the Research Profiles, external organizations to Biomedexperts.com

21 Internal Organizations

- Int Med-Pulm./Critical Care (Medical School Clinical Sciences) 121
- Cancer Center (Centers) 76
- Int Med-Rheumatolog
- Ophthalmology and V
- Cardiovascular Center
- General Surgery Secti
- Int Med-Nephrology
- Vascular Surgery Sect
- Microbiology and Ime
- Thoracic Surgery Sec
- Cardiac Surgery Secti
- Pharmacology Depart
- Int Med-Infectious Di
- Radiology (Medical Sc
- Pediatrics-Pulmonary
- Ctr. For Computations
- Neurosurgery (Medic
- Pediatrics-Intensive C

44 External Organizations

	Shared Pub.
University of Michigan Health System	28
Northwestern University	21
University of Edinburgh	5
University of California, Los Angeles	4
University of Calgary	3
University of Bern	3
Brigham and Women's Hospital	2
St. George's, University of London	2
Kumamoto University	2
University of Alabama at Birmingham	2
University of Pennsylvania	2
Michigan State University	2
Oregon Health and Science University	2
University of Bath	2
Catholic University of Louvain	1
Utrecht University	1
University of Oxford	1
McMaster University	1

Kunkel, Steve L

Medical School Clinical Sciences

Pathology Department

Expert Profiling features three network views:

- The Institutional Network
- The Co-author Network
- The Research Network

These views are all based on the fact that because we know which publications are associated with an expert, and because we know which other experts are associated with those publications, we can build an expert's research network based on those connections.

The Institutional Network gives us a complete list of all the internal and external organizations with which Dr. Kunkel has published.

20

Example 2: Analysis of a Researcher's Output and Collaboration Network

Home

Expert Overview

Profile

Publications

Grants

Similar Experts

Journals

Trends

Institutional Network

Coauthor Network

Research Network

Coauthor Network

This view shows the authors with whom this researcher has collaborated, listed with the most frequent collaborators. The first section shows internal coauthors, while the second list shows external coauthors, including individuals at other universities or institutions. By clicking the [+] next to each researcher, collaborative publications appear. Clicking the names of the experts jumps to their profile; internal experts within the tool, external experts to Biomedexperts.com

77 Internal Coauthors

- Lukacs, Nicholas W
- Chensue, Stephen W
- Hogaboam, Cory M
- Standford, Theodore J
- Ward, Peter A
- Elner, Victor M
- Elner, Susan G
- Phan, Sem H
- Arenberg, Douglas A
- Koch, Alisa E
- Colletti, Lisa M
- Fantone III, Joseph C
- Polverini, Peter J
- Ruth, Jeffrey H
- Toews, Galen B
- Wakefield, Thomas W
- Martinez, Fernando Jose
- Wiggins, Roger C

Shared Pub.

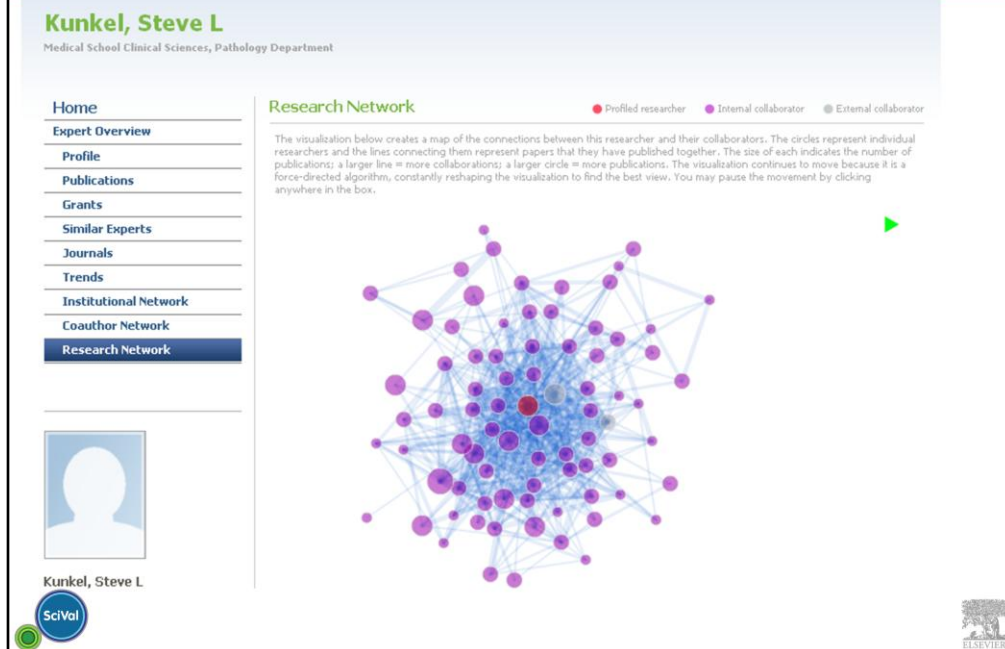
443 External Coauthors

	Shared Pub.
<input type="checkbox"/> Sriefer, Robert M	204
<input type="checkbox"/> Burdick, Marie D	60
<input type="checkbox"/> Evanoff, Holly	29
<input type="checkbox"/> Lincoln, Pamela M	28
<input type="checkbox"/> Warrington, KS	21
<input type="checkbox"/> Lynch, Joseph P	20
<input type="checkbox"/> Jakubick, Claudia	13
<input type="checkbox"/> Steinhauer, ML	13
<input type="checkbox"/> Sleaso, Kate	13
<input type="checkbox"/> Sriefer, RM	13
<input type="checkbox"/> Wilke, Carol A	12
<input type="checkbox"/> Bian, Zong-Mei	12
<input type="checkbox"/> Matsukawa, Akihiro	11
<input type="checkbox"/> Keane, Michael P	10
<input type="checkbox"/> Haines, G Kenneth	10
<input type="checkbox"/> Bone-Larson, Cynthia L	10
<input type="checkbox"/> Weni, Hailao	8
<input type="checkbox"/> Schaller, Matthew A	8
<input type="checkbox"/> Choi, Esther S	7
<input type="checkbox"/> Puri, Raj K	7
<input type="checkbox"/> Simpson, Kenneth J	7
<input type="checkbox"/> Burdick, Marie	7
<input type="checkbox"/> Tra, Seron	5

The Coauthor Network provides us with a comprehensive list of all of Dr. Kunkel's internal and external coauthors. This enables us to compare how much Dr. Kunkel collaborates with other researchers at the University of Michigan versus at other organizations.

21

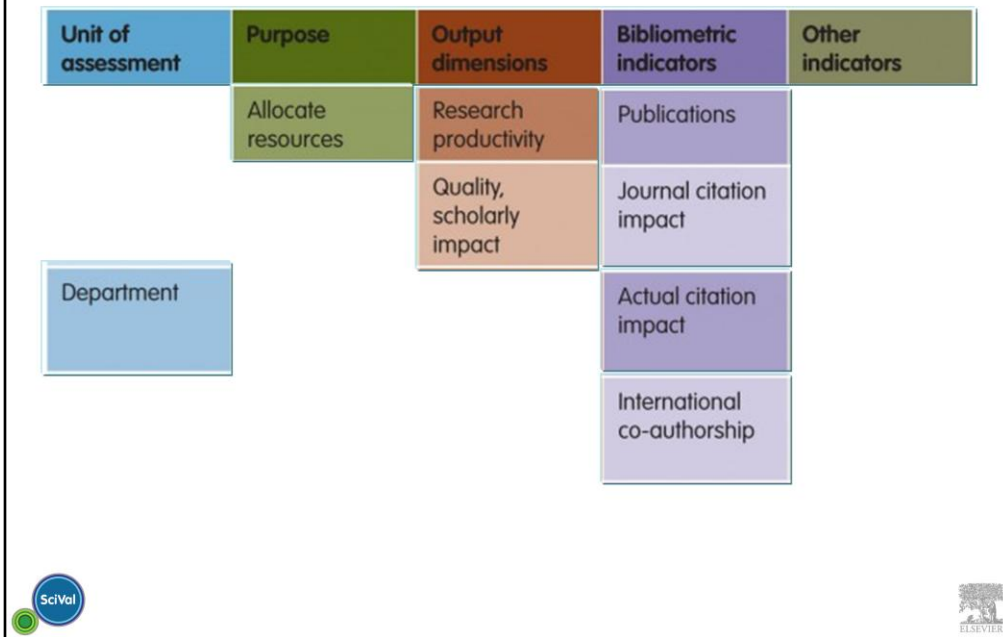
Example 2: Analysis of a Researcher's Output and Collaboration Network



The Research Network view provides us with the researcher's co-author network in an interactive visualization. The visualization allows us to see all of Dr. Kunkel's internal and external co-authors and how they are connected to each other.

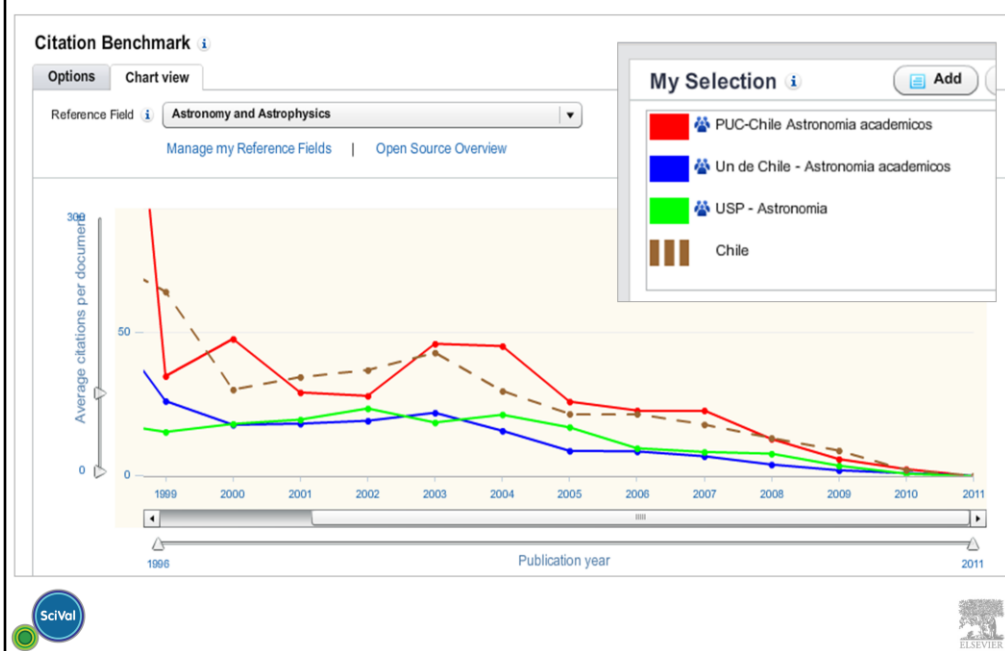
- The red dot is the profiled researcher – in this case, Dr. Kunkel
- The purple dots are internal collaborators
- The grey dots are external collaborators
- The larger the dot, the more publications the expert has produced
- The thicker the line between two dots, the greater number of co-authored publications.

Example 3: Comparative Evaluation of Groups



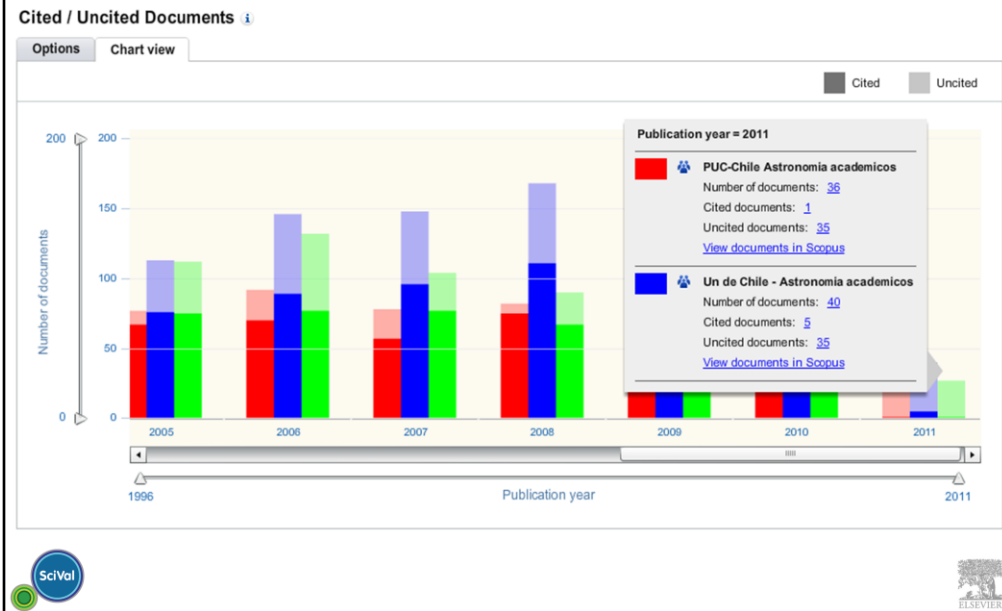
For a department, there is some overlap with bibliometric indicators used with individuals, but also additional elements such as the rate of international co-authorship, which correlates quite strongly with increased number of citations and greater impact and visibility for a paper.

Example 3: Comparative Evaluation of Groups

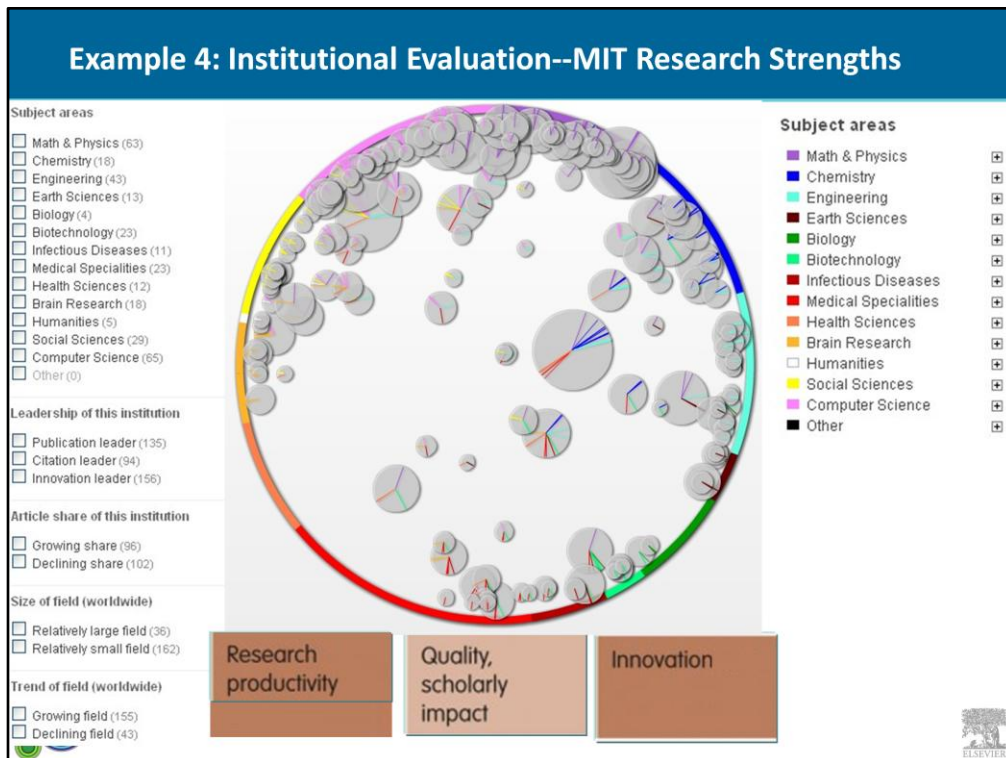


Here you can see that the PUC-Chile group has a higher output over time in average citations per paper than University of Chile, USP, and astronomy and astrophysics within Chile as a whole. This is data again taken from SciVal Strata.

Example 3: Comparative Evaluation of Groups



Another view of a different metric, looking at the rates of cited to uncited documents, which can be a good proxy for consistency of research impacts across time. This is also taken from Strata, and underlines the importance of not over-relying on any single metric.

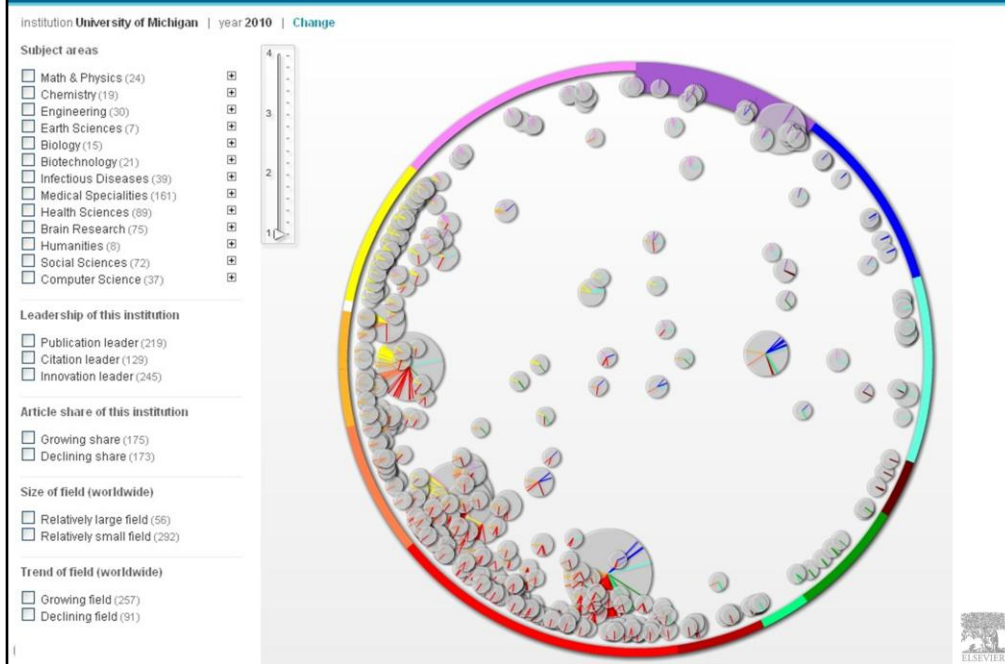


Universities are frequently evaluated on the institutional level. This is a “circle map” taken from SciVal Spotlight, and looks at the institutional impact of the University of Chile from 2006 to 2010. Each circle represents a competency an area of research strength.

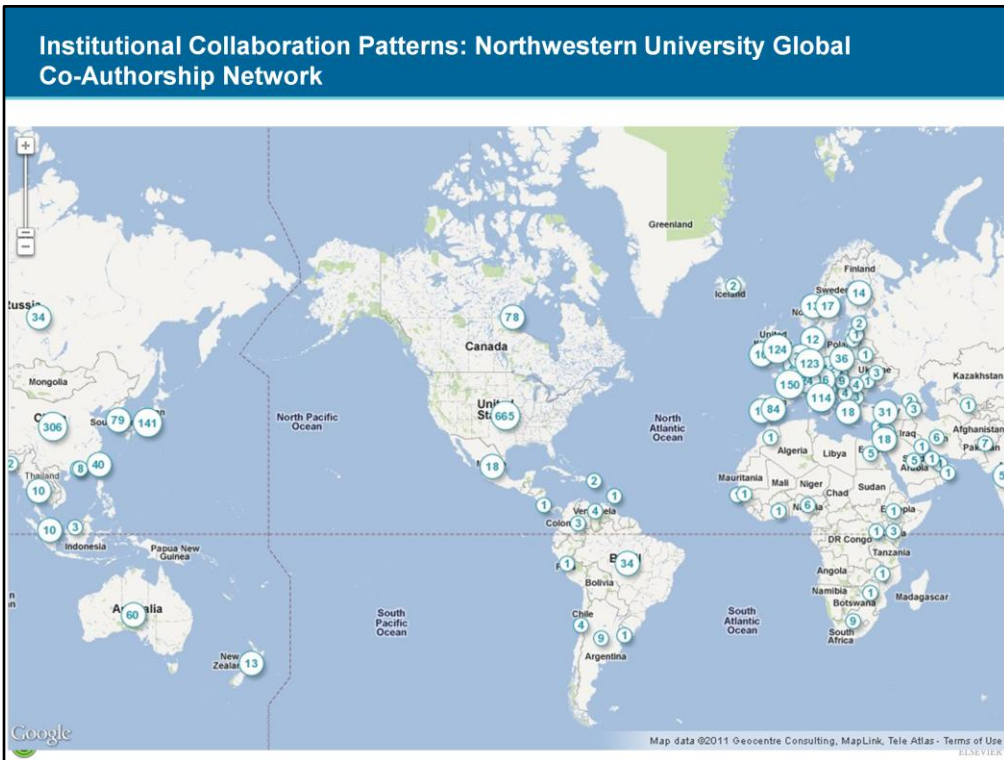
This analysis is done using a sophisticated co-citation algorithm to help determine which interdisciplinary research strengths exist at an institutional or country level. I don’t have time to go over the methodology in full detail, but I will give an analogy. Using traditional methods, a highly-cited biochemistry paper published in the Journal of Biochemistry is assigned as 100% biochemistry based on the journal classification code. These journal classification codes are a fixed, top-down hierarchy that doesn’t often change and cannot adequately capture multidisciplinary research.

In contrast, the co-citation algorithm analyzes the highly-cited paper’s references at an article level. Analyzing at the article level rather than the journal level can change the nature of the analysis. If the same biochemistry paper has 20% computer science references and 25% biotechnology references, the paper is fractionally assigned to those specific subdisciplines. This bottom-up approach does not assume any fixed hierarchy of science but changes dynamically as the underlying science itself changes. Think of genomics in 1999 vs. in 2002, after the human genome was fully sequenced. The underlying science would shift and shift interdisciplinary patterns of co-citation along with it. Use of this method allows research executives to understand their interdisciplinary research activities in a way that traditional methods cannot.

Example 4: Institutional Evaluation--University of Michigan



We also have created maps of over 4500 universities, federal laboratories, and companies. Here's a map of U of M.

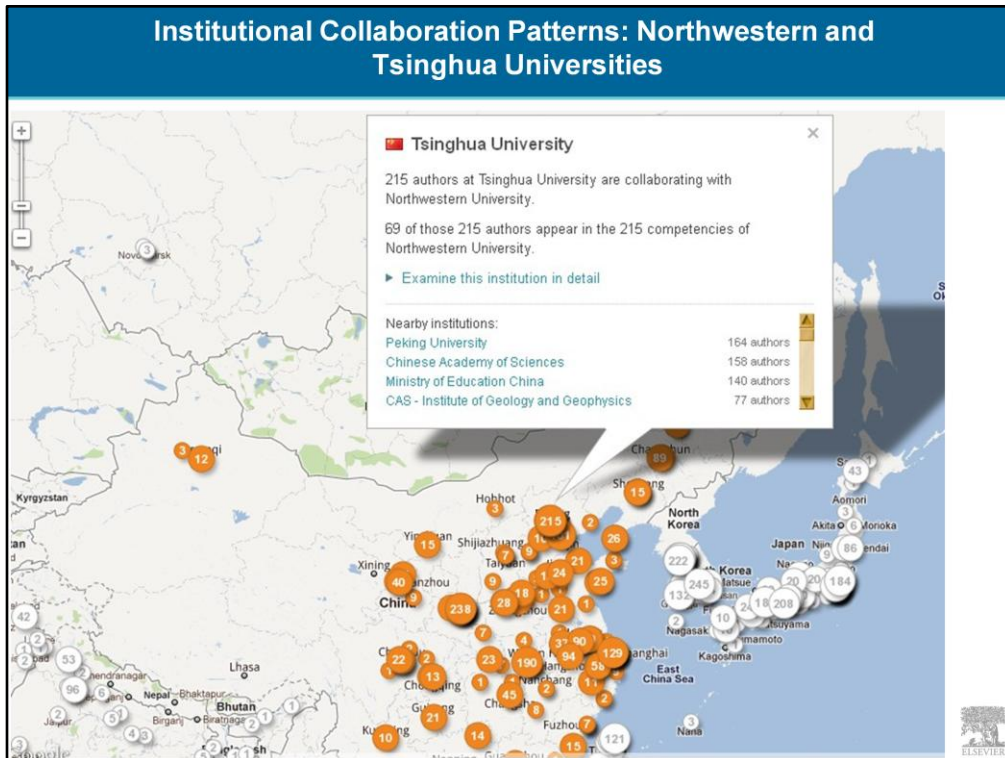


One capability that we have recently developed has allowed us to create collaboration maps for any institution. We currently have these maps for over 4500 universities, research institutes, and government laboratories globally. They allow us to do detailed analyses of collaboration patterns in any major field or subfield of science. This map represents every co-authorship relationship across the globe that the Northwestern faculty have. The white circles indicate the number of institutions in a particular country where there's a co-author relationship.

Institutional Collaboration Patterns: Co-Authorship with Chinese Institutions--Number of Papers

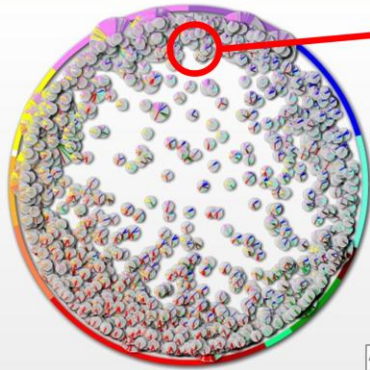


If we zoom into a particular nation on the map, the number of institutes (white circle) becomes the number of individual co-authors that the Northwestern faculty is engaged with. At a glance this can show those institutions that have the highest total number of collaborations.



When we drill down into an individual circle, it can be seen that 215 authors at Tsinghua University are currently collaborating with Northwestern. It is possible of course to drill down further to the individual co-author names at Tsinghua and individual papers, and thus one can telescope easily from the global view to an institutional one to an individual author and paper view. Again, these maps exist for over 4500 institutions globally, and give a good basis for comparative analysis.

Example 5: National/Global Context: The United States National Map of Research Strengths



2010 Circle of Science Map
for The United States



Competency: DC #305 X

Articles published in this country:
1376

Authors in this country: Capasso F.;
Canedy C.L.; Vurgafman I.

Keywords: cascade lasers; cascade
laser; quantum cascade

Disciplines:
Semiconducting Materials 68.8%
Applied Optics 28.6%
Combustion 1.3%

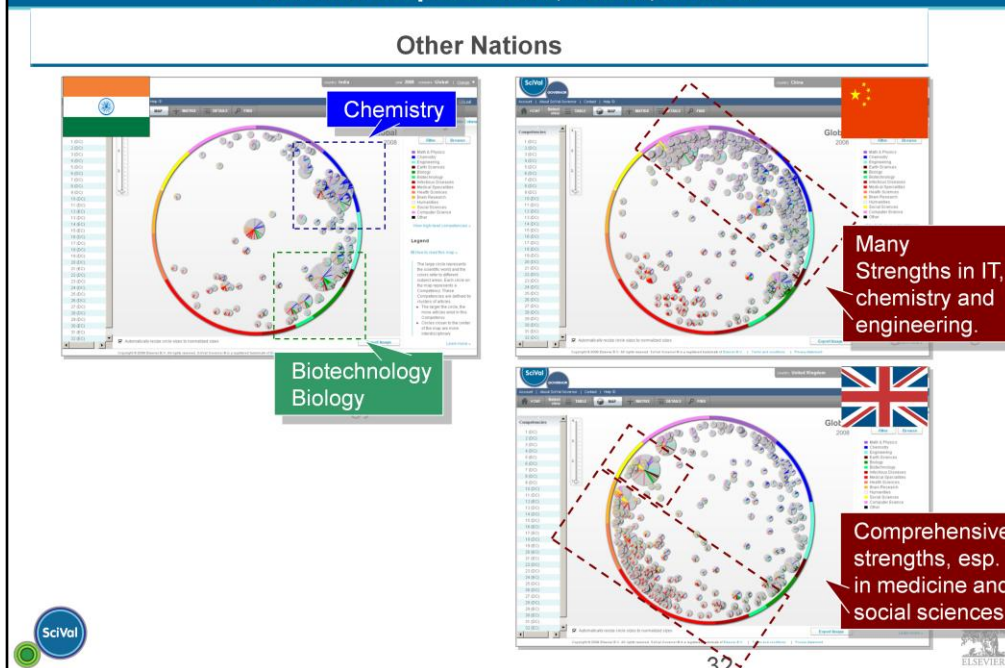
[More details »](#)

Top institutions in this Competency

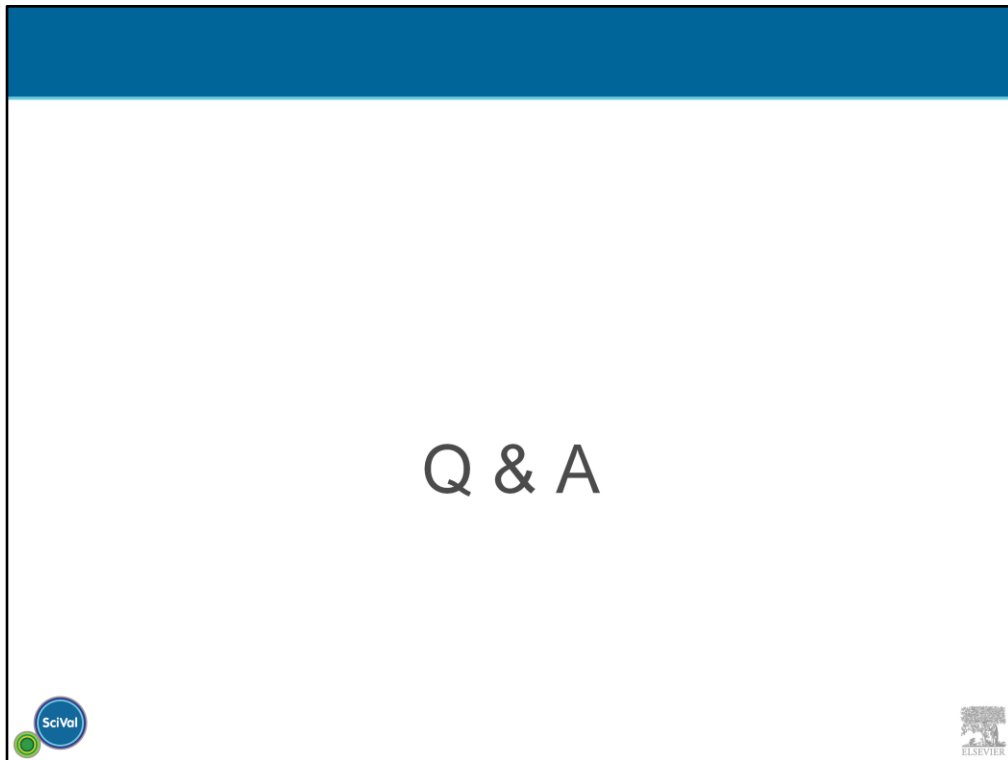
All institutions						
Institution (Country)		Fractionalized articles	Total articles	RRS	SoTA	Citation count
1. Princeton University	USA	100.2	122	0.25	8.98	215.4
2. Northwestern University	USA	89.1	98	0.90	9.63	791.5
3. Naval Research Laboratory	USA	79.7	90	0.91	-15.60	385.5
4. Harvard University	USA	79.7	103	1.10	7.71	741.6
5. ETH Zurich	CHE	64.0	81	0.45	-21.68	535.5
6. Vienna University of Technology	AUT	63.1	84	0.33	8.98	132.3
7. University of New Mexico	USA	52.2	65	0.32	8.40	183.9
8. Rice University	USA	51.0	61	0.33	-71.21	299.0
9. Jet Propulsion Laboratory, Calif...	USA	50.3	58	0.45	-32.48	146.6
10. Universite Montpellier II	FRA	46.2	60	0.28	9.62	220.1

This is the US circle map, with over 1800 research competencies. This map highlights the research strengths of the United States, with top authors and top institutions for every competency. Northwestern has some bragging rights here because even though they published fewer papers than Princeton, they have a lot more citations than Princeton does on this one.

Example 5: National/Global Context: National Maps of India, China, and UK



Similarly, you can see maps of India, China, and the UK here.



I am happy to respond to any comments or questions that you may have. Muchas gracias por sus atenciones!

Thank you!

d.calto@elsevier.com
+1-212-633-3663 (office)
+1-917-455-4788 (cell)

