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Mapping the Social Sciences Landscape: A Way Forward

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Mapping the Social Sciences Landscape: A Way Forward

May 27, 2014

David A. Pendlebury
Scientific & Scholarly Research
IP & Science, Thomson Reuters

Derek J. de Solla Price: Physicist, Historian of Science, and Visionary of Science Mapping



“There is some type of natural order in science crying out to be recognized and diagnosed. Our method of indexing papers by descriptors or other terms is almost certainly at variance with this natural order. If we can successfully define the natural order, we will have created a sort of giant atlas of the corpus of scientific papers that can be maintained in real time for classifying and monitoring developments as they occur.”

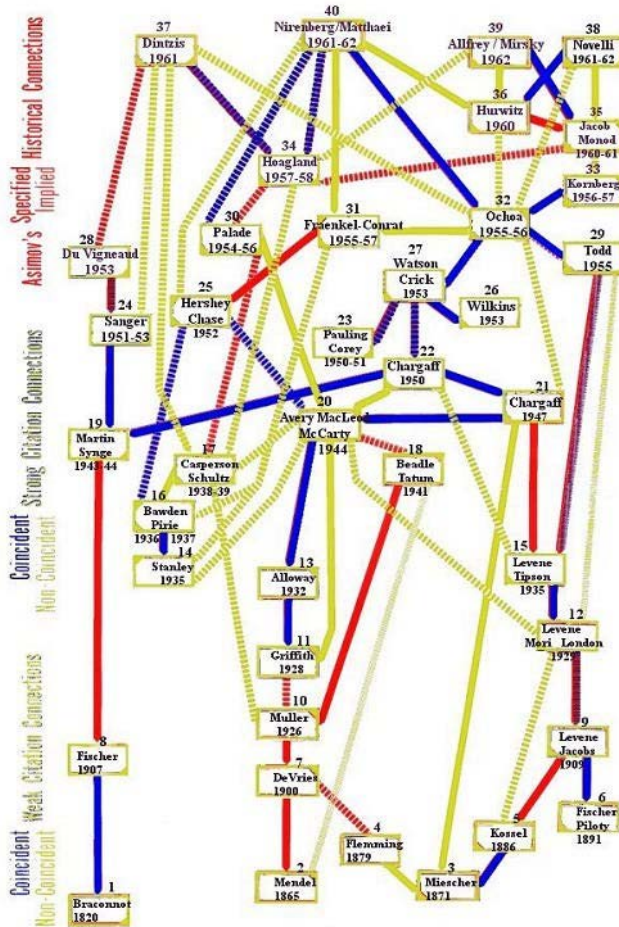
Foreword to Eugene Garfield, *Essays of an Information Scientist*, Vol. 3, 1977-1978, Philadelphia, 1980, page vii.

Eugene Garfield: Information Scientist, Inventor of the *Science Citation Index*, and Founder of ISI

- Eugene Garfield, “Citation Indexes for Science: A New Dimension in Documentation through Association of Ideas,” *Science*, 122 (3159): 108-111, 1955
- 2014 is the 50th anniversary of the *Science Citation Index*, which became commercially available in 1964
- Even then Garfield understood that this tool for information retrieval contained a network of scientific communication (citing papers and cited references) with a structure that had meaning



First Historiograph (1964): Structure of DNA Citation Linkages to Reveal Key Papers, People



“Eugene Garfield published ‘The Use of Citation Data in Writing the History of Science’ in 1964. Forty years later, his HistCite™ tool automatically generates chronological tables and historiographs of topical paper collections. It assists researchers, librarians, and others in the following areas: identifying core papers on a topic in question; understanding the impact of specific authors, papers, and journals; and making sense of the history of old and new research topics.”

http://scimaps.org/maps/map/histcite_visualizati_52/

Co-Citation: Henry Small's Description of 1973

“A new form of document coupling called co-citation is defined as the frequency with which two documents are cited together.... Networks of co-cited papers can be generated for specific scientific specialties.... Co-citation patterns are found to differ significantly from bibliographic coupling patterns, but to agree generally with patterns of direct citation. Clusters of co-cited papers provide a new way to study the specialty structure of science.”

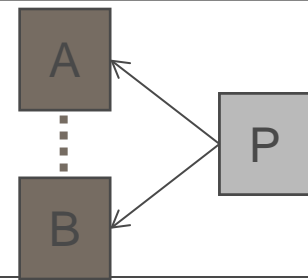
Henry Small, “Co-Citation in the Scientific Literature: A New Measure of the Relationship Between Two Documents,” *Journal of the American Society for Information Science*, 24(4): 265-69, July/August 1973



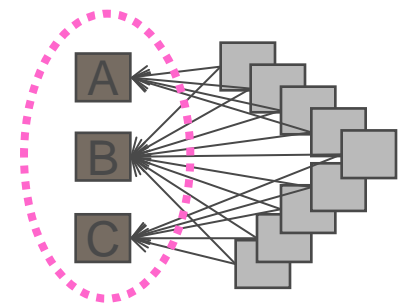
Co-Citation Analysis and Clustering: How Does It Work?

Counting the number of times that a given pair of documents (or authors or journals) are co-cited. The more papers that co-cite the pair, the stronger the relationship. This relationship is *dynamic* (*new papers may be published which cite the pair*) and *forward looking*.

1. When paper A and B are “co-cited” by paper P, A and B are likely to have topical similarity.

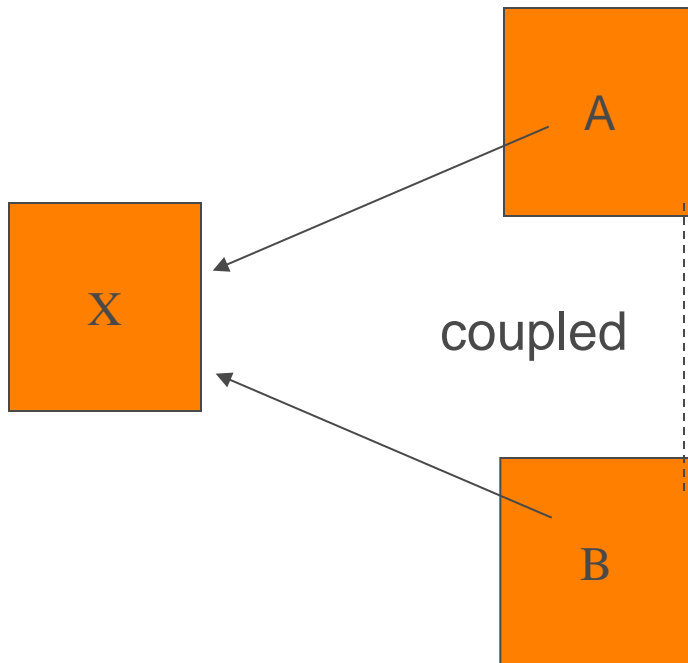


2. When co-citation is frequent, it forms a group of papers that are topically associated to one another.



Bibliographic Coupling (Kessler, 1963): How it relates to but is different from Co-Citation

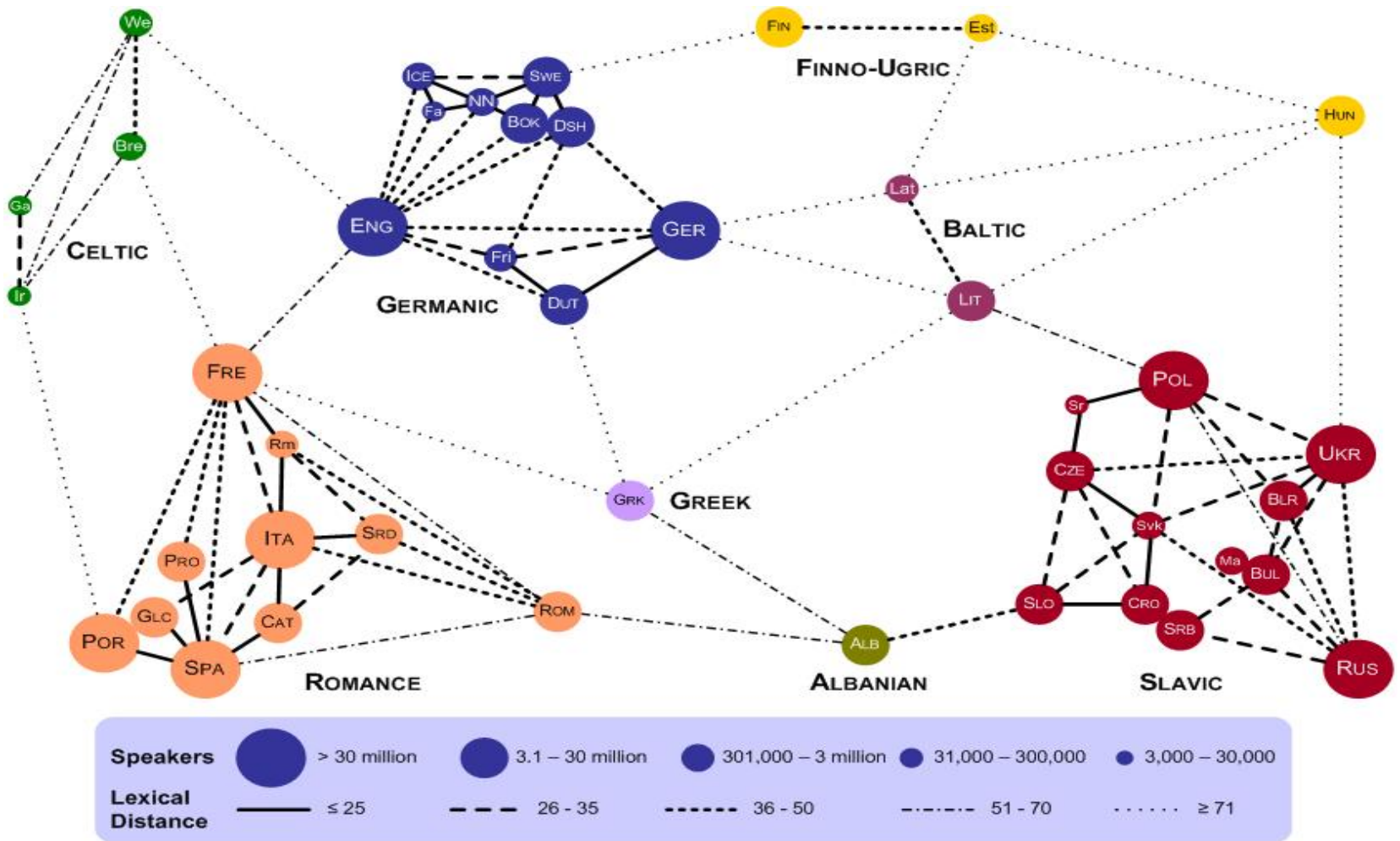
Counting the number of references that a given pair of documents have in common. The relationship between documents is stronger if they have more cited references in common. This relationship is *static over time and retrospective*.



Papers A and B
are related
because they
both cite paper X

M. M. Kessler, "Bibliographic Coupling
Between Scientific Papers," *American
Documentation*, 14 (1): 10-25, 1963

Multi-Dimensional Example from Linguistics: Mapping Lexical Similarity, Links, Number of Speakers



Henry Small and Belver Griffith (1974): The Beginning of the Modern Age of Science Maps

“In 1974, Small and Belver C. Griffith of Drexel University in Philadelphia published a pair of landmark articles that laid the foundation for defining specialties using co-citation analysis and mapping them according to their similarity...In the second of their two papers, Small and Griffith showed that individual research fronts could be measured for their similarity with one another. Since co-citation defined core papers forming the nucleus of a specialty based on their similarity, co-citation could also define research fronts with close relationships to others. In their mapping of research fronts, Small and Griffith used multidimensional scaling and plotted similarity as proximity in two dimensions.” – *Research Fronts 2013*, p. 28

Henry Small and Belver C. Griffith, “The Structure of Scientific Literatures I: Identifying and Graphing Specialties,” *Science Studies*, 4 (1):17-40, 1974.

Belver C. Griffith, Henry G. Small, Judith A. Stonehill, and Sandra Dey, “The Structure of Scientific Literatures II: Toward a Macro- and Microstructure for Science,” *Science Studies*, 4 (4): 339-365, 1974.

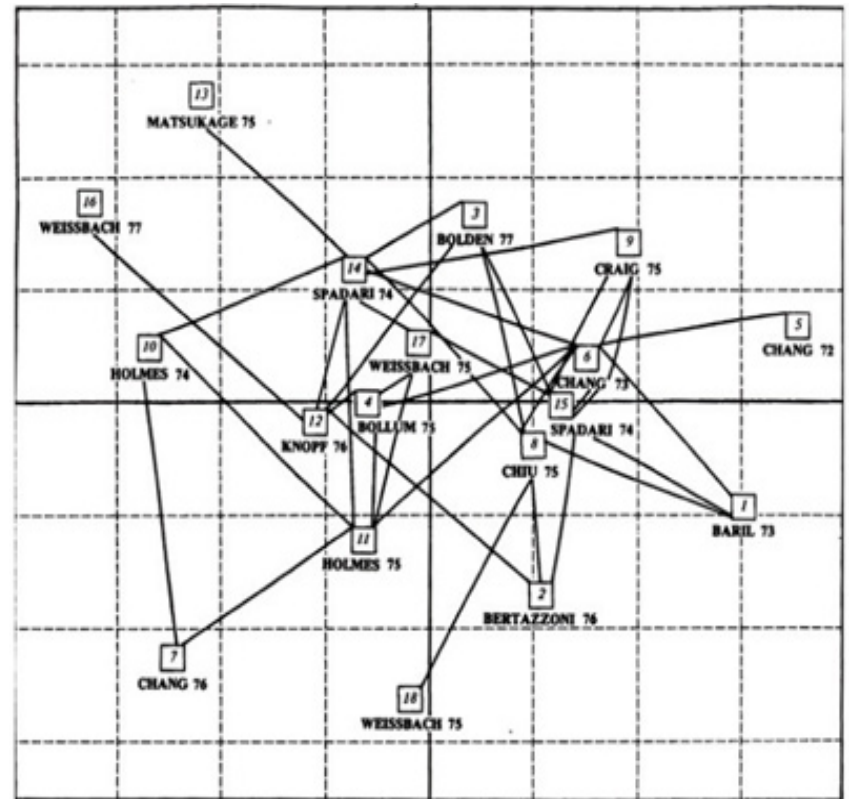


ISI Atlas of Science: Biochemistry and Molecular Biology (1981)

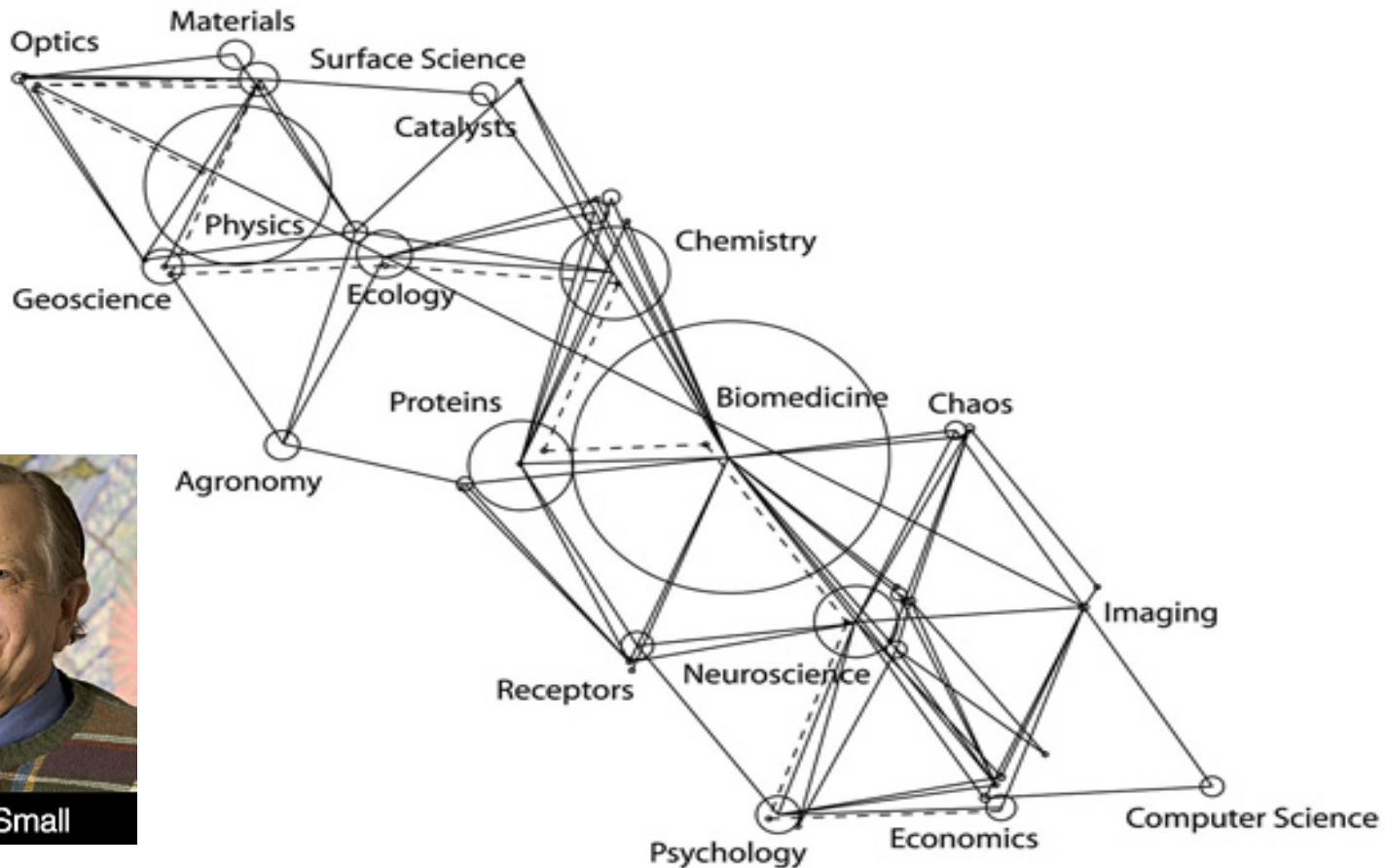
“The work by Small and Griffith was the last theoretical rivet needed to get our flying machine off the ground.”

– Eugene Garfield

Eugene Garfield, *ISI Atlas of Science: Biochemistry and Molecular Biology 1979-1980*, ISI: Philadelphia, 1981.

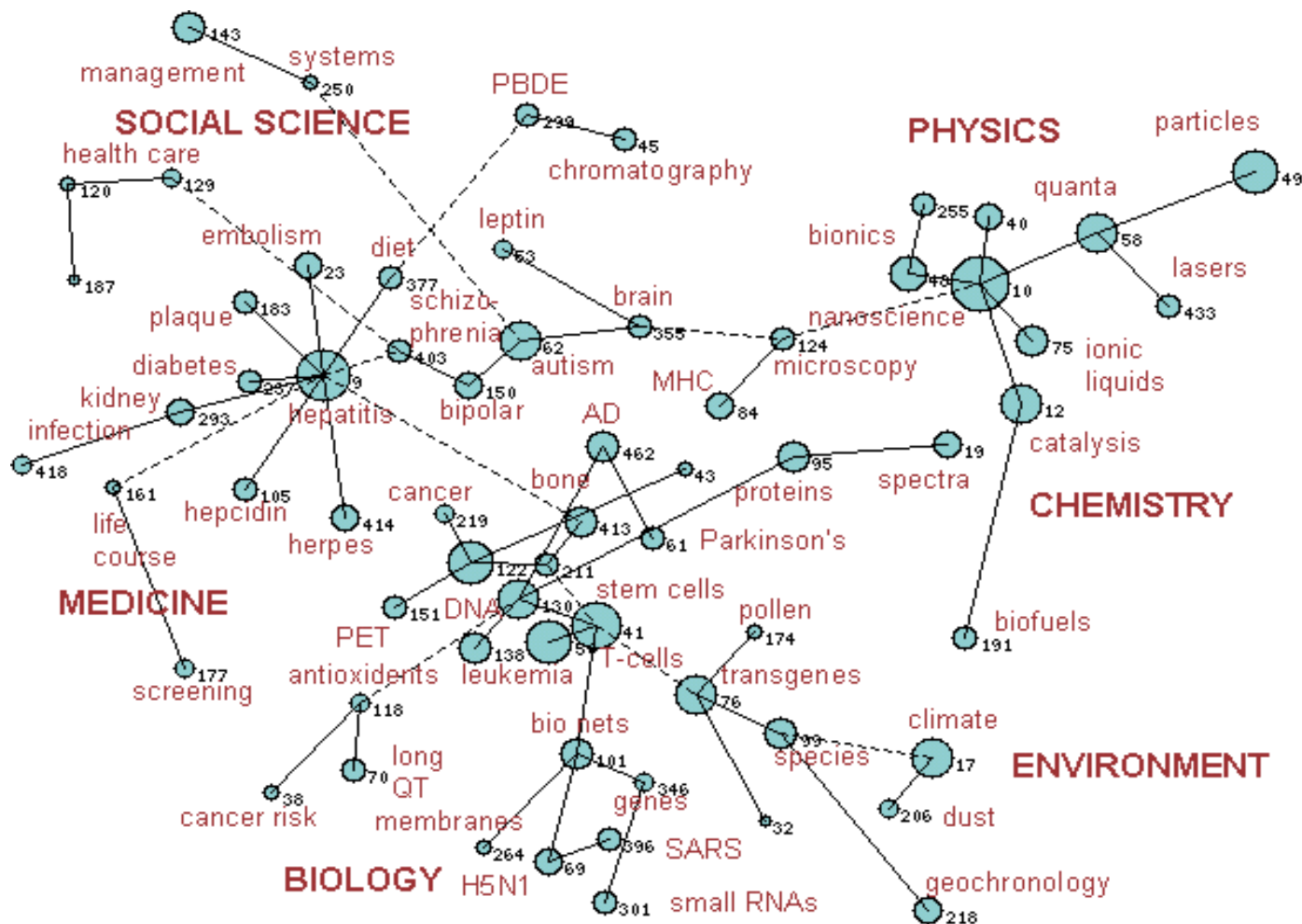


Small's Global Map of Science (1996)



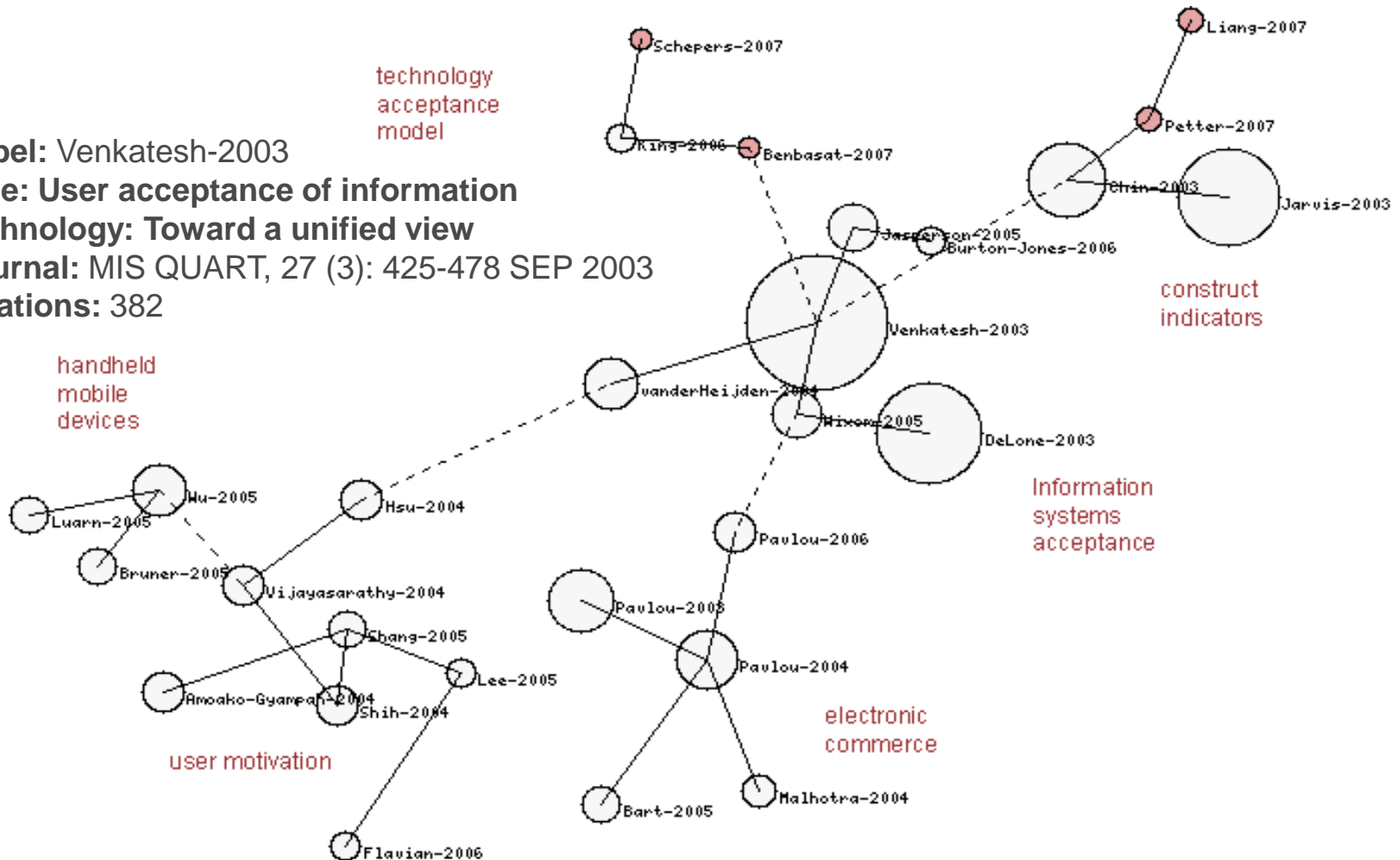
Henry Small, "Visualizing Science by Citation Mapping." *Journal of the American Society for Information Science* 50 (9): 799-813, 1999

Map of the Structure of Global Science (May 2010)

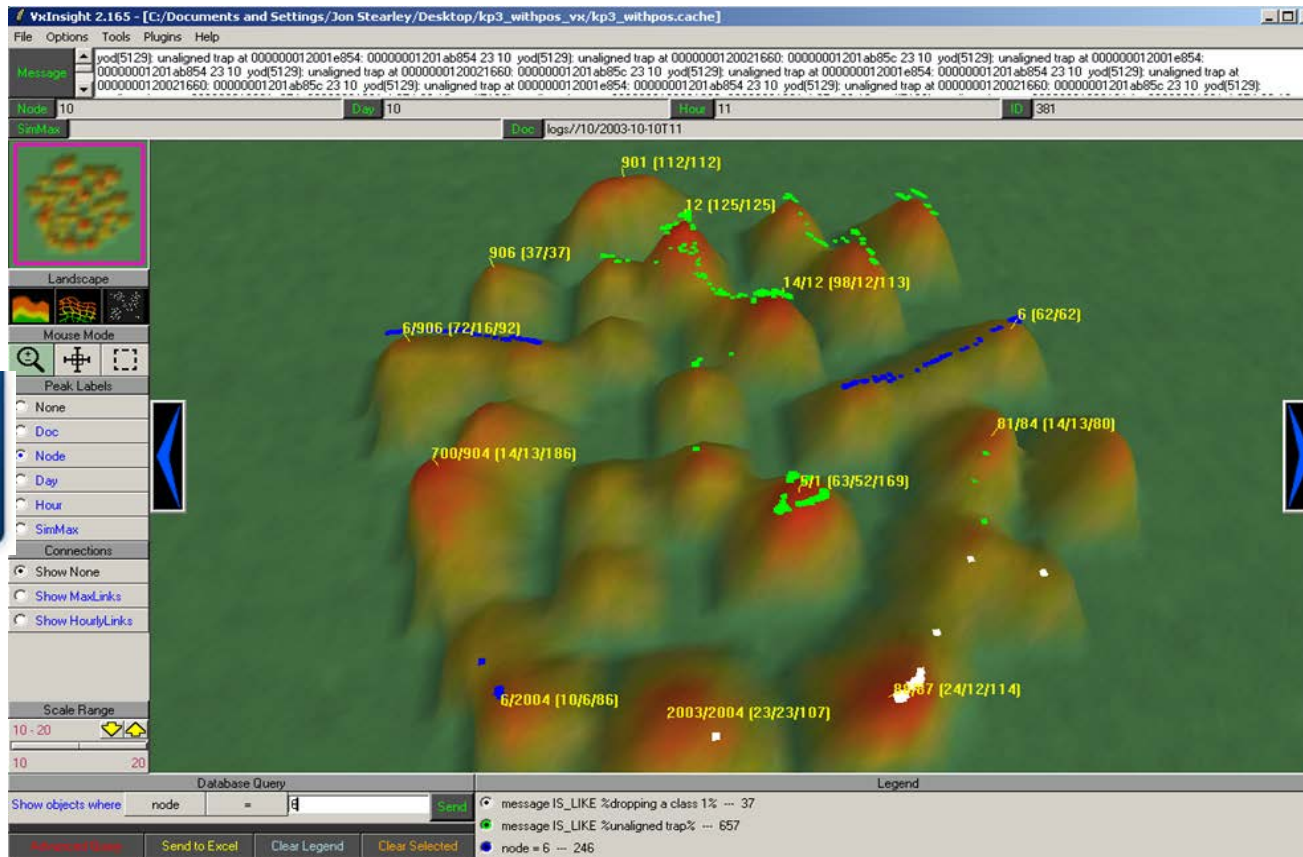


Mapping a Research Front in the Social Sciences: Technology Acceptance

Label: Venkatesh-2003
Title: User acceptance of information technology: Toward a unified view
Journal: MIS QUART, 27 (3): 425-478 SEP 2003
Citations: 382

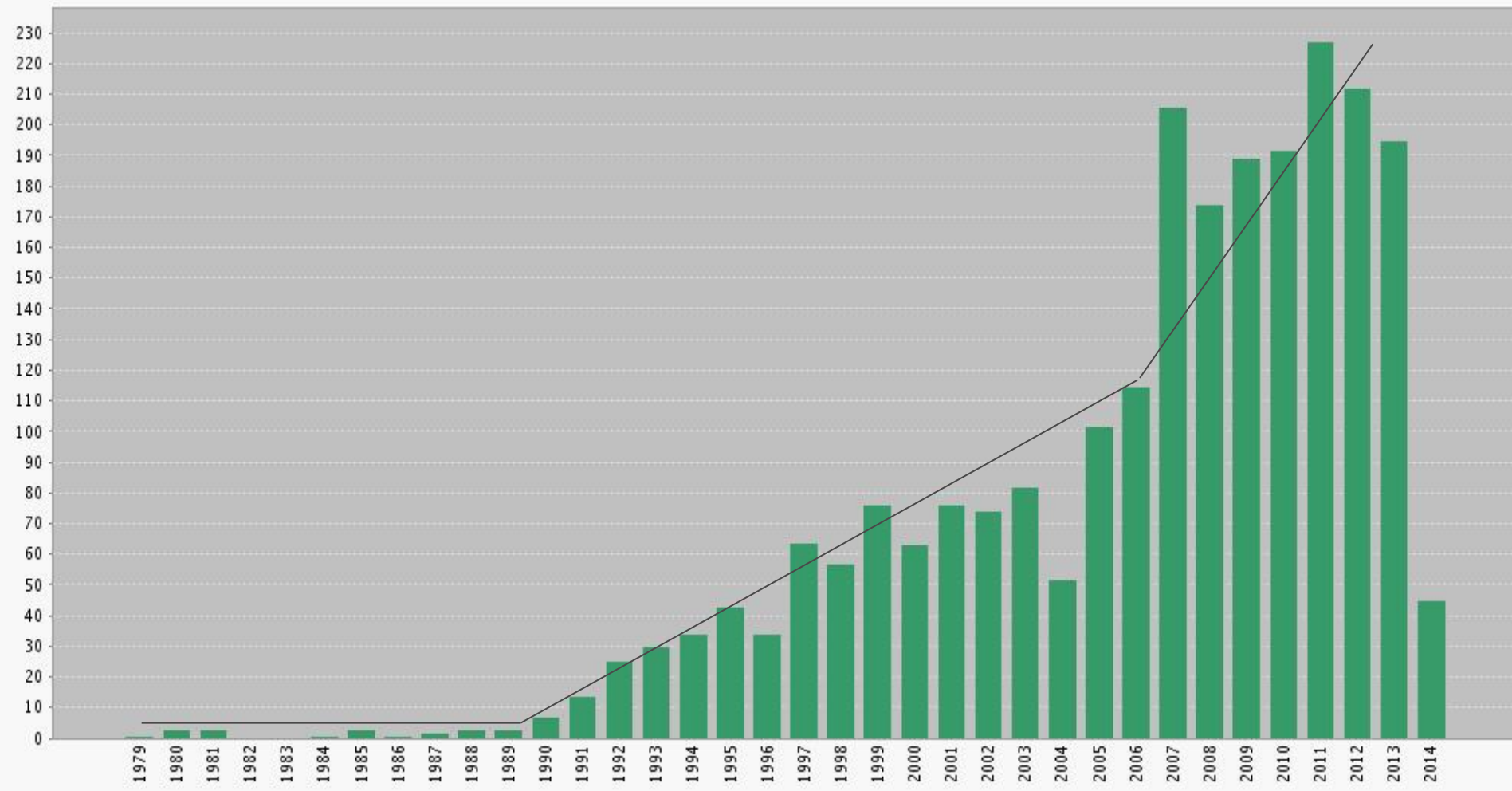


VxInsight, A Knowledge Management Tool: Sandia National Lab and ISI/Thomson (1998)



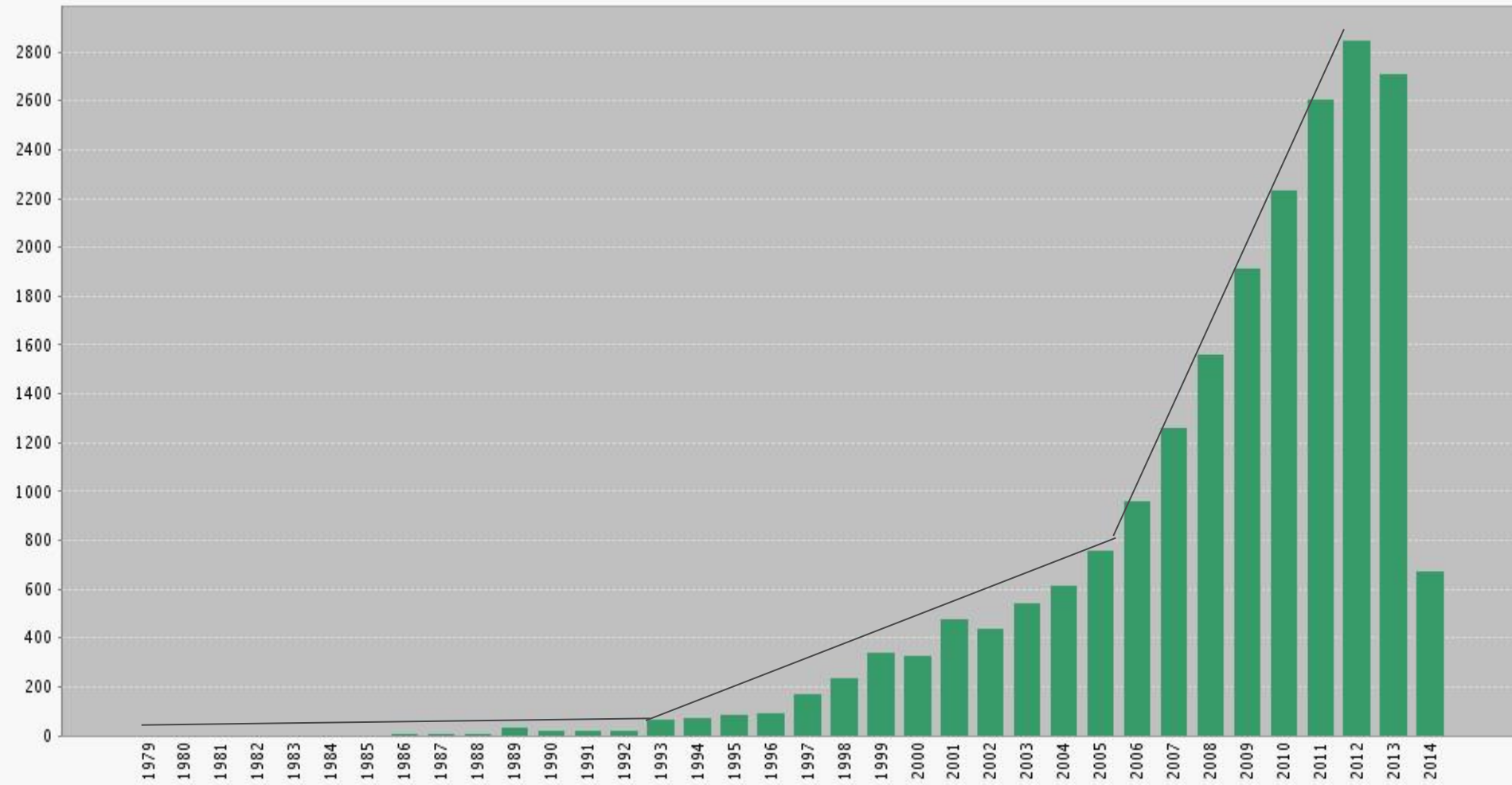
<http://www.cs.sandia.gov/projects/VxInsight/snapshot.html>

Web of Science *Publication* Counts Reveal a Revolution in Mapping Science Structure, Dynamics



Source: Web of Science, "scien* OR research*" and "map* OR visual*" in information and library science

Web of Science *Citation* Counts Reveal a Revolution in Mapping Science Structure, Dynamics



The First Two Decades of Science Mapping: Premature Discovery or Delayed Recognition?

Possible Impediments:

- Lack of availability of large datasets
- Inadequate computer processing speed and storage
- Little software for clustering, ordination, visualization
- Skepticism about 'accuracy' of maps
- Academic opposition to bibliometric analysis for performance evaluation (and everything else)
- Lack of demand from governments, universities, and science-oriented firms

Researchers and Research Groups: Some Key Players and Tools for Science Mapping

Researchers	Institutions	Tools
Masatsura Igami, Ayaka Saka	NISTEP (Tokyo, Japan)	Custom
Kevin Boyack, Richard Klavans	SciTech Strategies (Berwyn, PA USA and Albuquerque, NM USA)	Custom
Chaomei Chen	Drexel Univ. (Philadelphia, PA USA)	CiteSpace II
Katy Börner	Indiana Univ. (Bloomington, IN USA)	Science of Science (Sci ²)
Ed Noyons, Nees Jan van Eck, and Ludo Waltman	Univ. of Leiden, CWTS (Leiden, Netherlands)	VOSviewer, CitNetExplorer
Loet Leydesdorff, Ismael Rafols, Alan Porter, and Lutz Bornmann	Univ. Amsterdam (Netherlands), SPRU, Univ. Sussex (Brighton, UK), Georgia Inst. Technol. (Atlanta, GA USA), Max Planck Inst. (Munich, Germany)	Leydesdorff toolset
Félix de Moya Anegón, Benjamín Vargas Quesada	CSIC (Madrid, Spain), Univ. Granada (Granada, Spain)	Custom

Software for Science Mapping (Mostly Freeware): Important Review Published in 2011

Science Mapping Software Tools: Review, Analysis, and Cooperative Study Among Tools

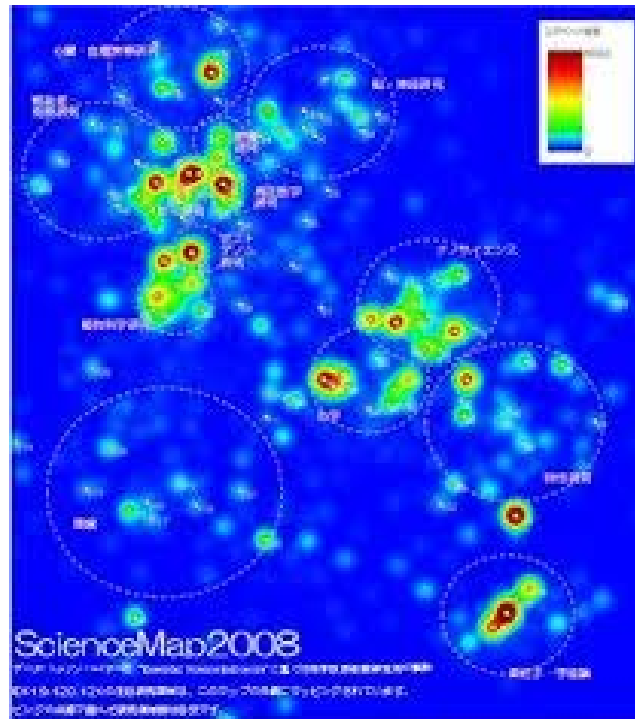
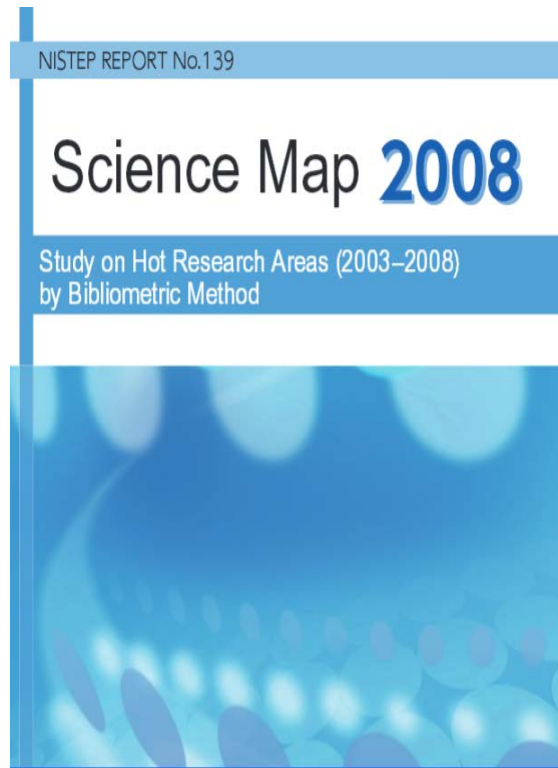
M.J. Cobo, A.G. López-Herrera, E. Herrera-Viedma, and F. Herrera

Department of Computer Science and Artificial Intelligence, CITIC-UGR (Research Center on Information and Communications Technology), University of Granada, E-18071 Granada, Spain. E-mail: {mjcobero, lopez-herrera, viedma, herrera}@decsai.ugr.es

Science mapping aims to build bibliometric maps that describe how specific disciplines, scientific domains, or research fields are conceptually, intellectually, and socially structured. Different techniques and software tools have been proposed to carry out science mapping analysis. The aim of this article is to review, analyze, and compare some of these software tools, taking into account aspects such as the bibliometric techniques available and the different kinds of analysis.

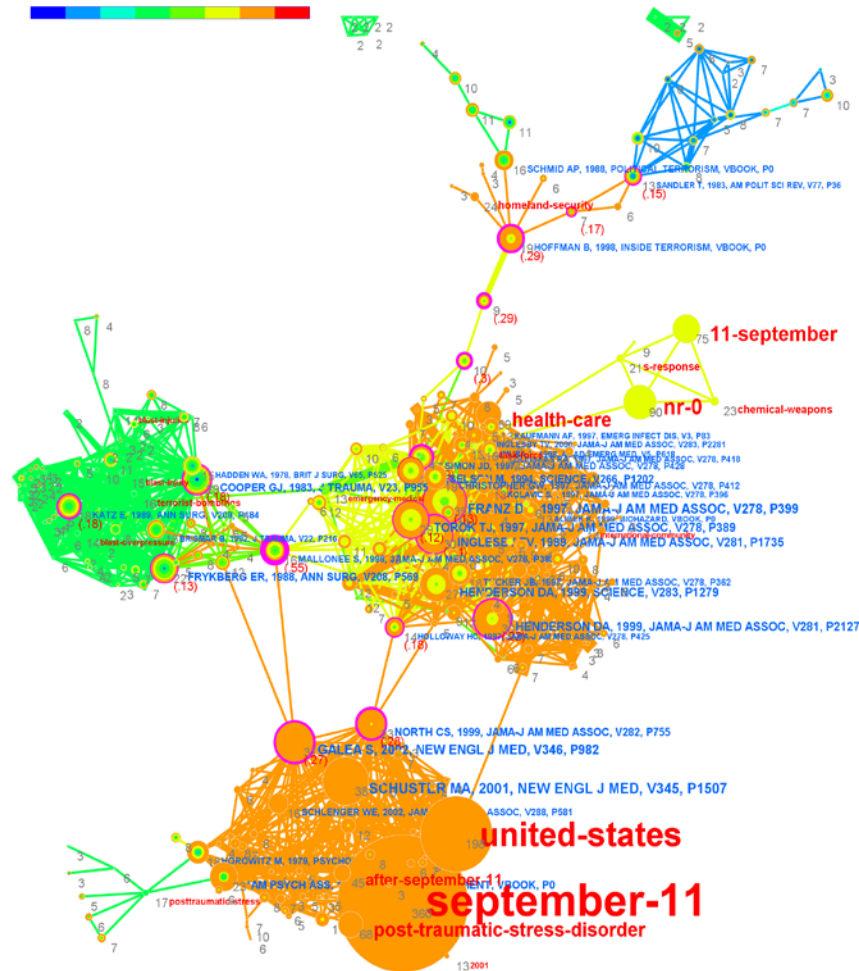
Different approaches have been developed to extract networks using the selected units of analysis (authors, documents, journals, and terms). *Co-word* analysis (Callon, Courtial, Turner, & Bauin, 1983) uses the most important words or keywords of the documents to study the conceptual structure of a research field. *Co-author* analyzes the authors and their affiliations to study the social structure and collaboration networks (Gänzel, 2001; Peters & van Raan, 1991). Finally, the cited references are used to ana-

Japan's National Institute of Science and Technology Policy Science Maps: (2002-2008)

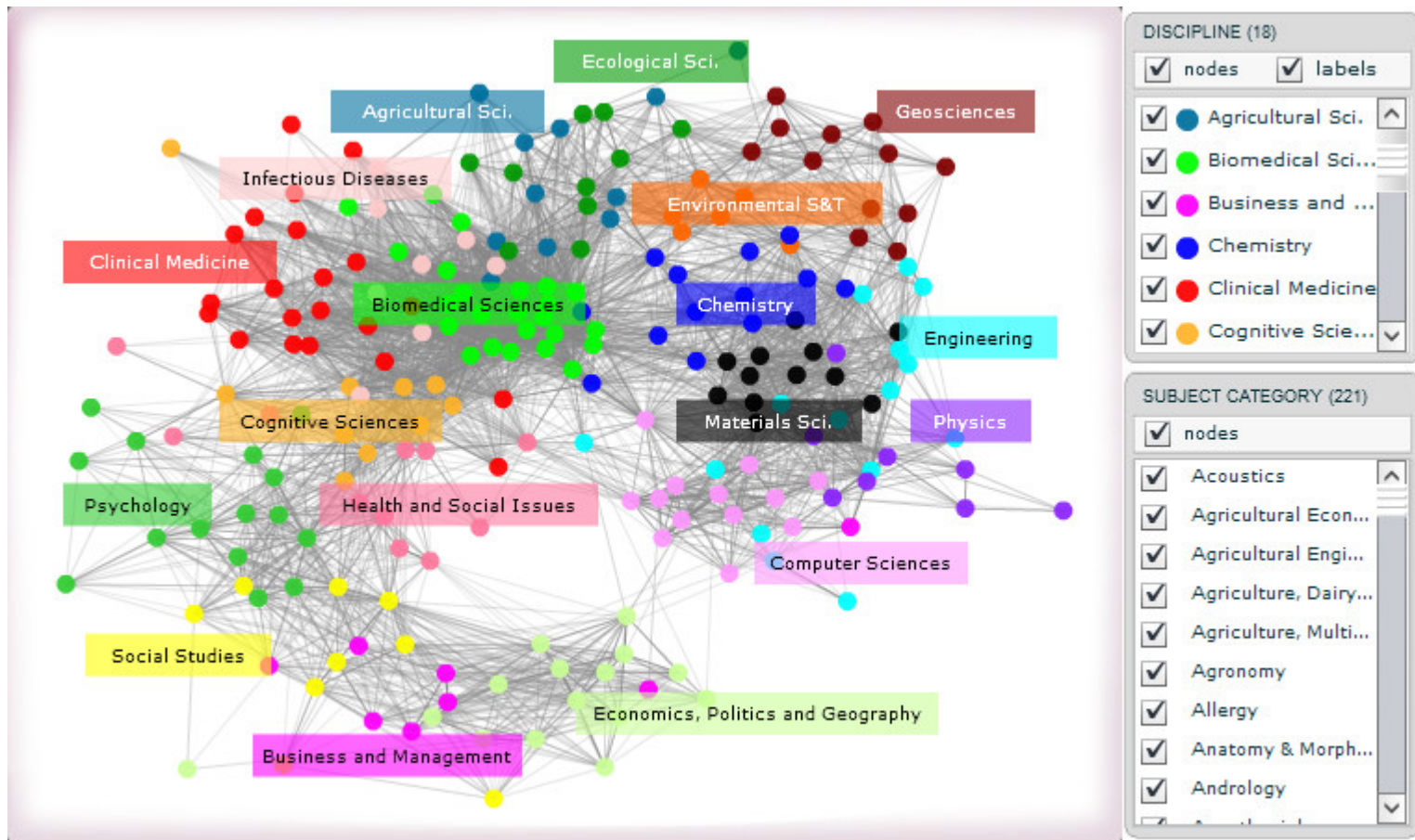


<http://www.nistep.go.jp/achiev/ftx/jpn/rep139j/pdf/rep139j.pdf>

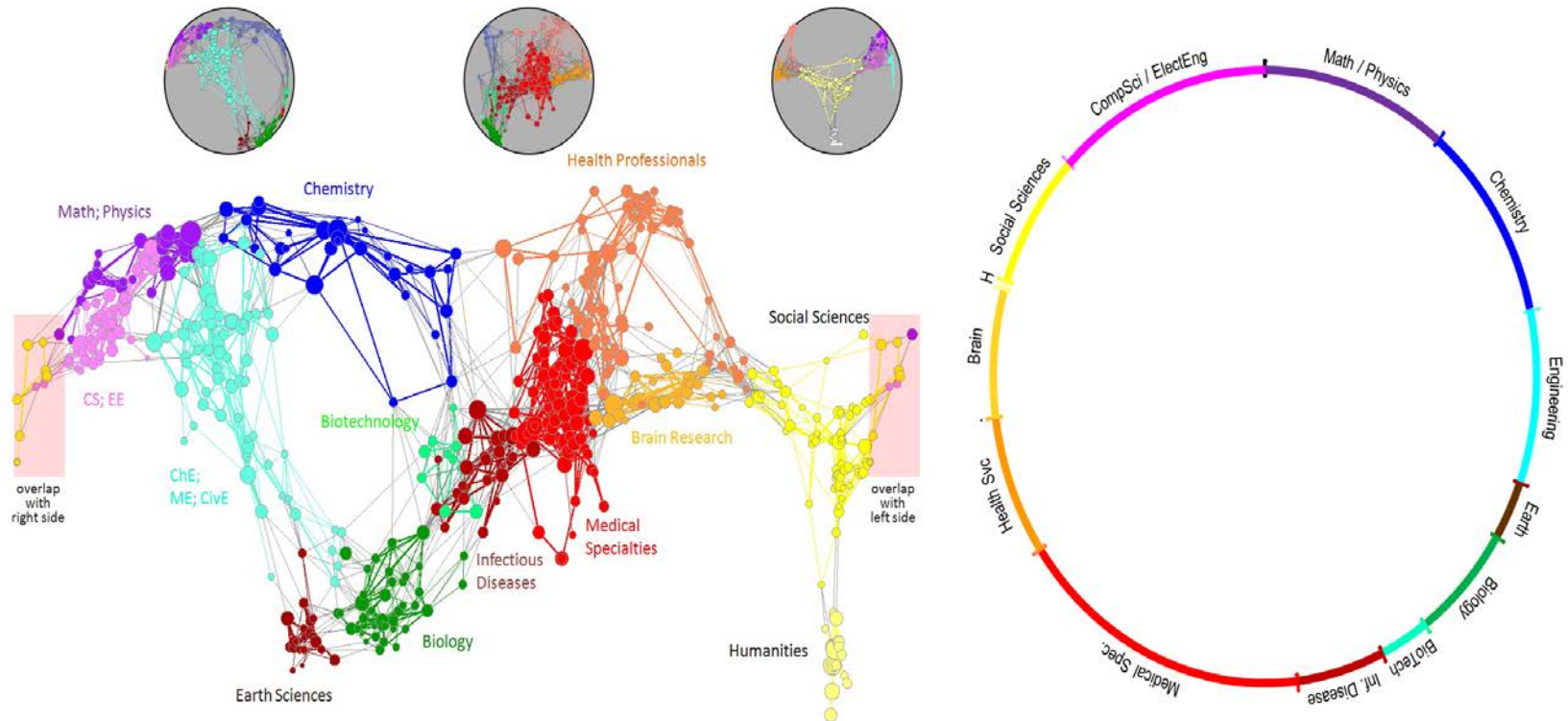
Drexel University: Chaomei Chen's CiteSpace II (2006)



Global Map of Science (2007) Using Citations between Web of Science Journal Categories for Clustering



Global Map of Science (2005-2010) Using Paper-Level Clustering of Citation Links and Keywords



Börner K, Klavans R, Patek M, Zoss AM, et al., "Design and Update of a Classification System: The UCSD Map of Science," *PLoS ONE*, 7 (7): e39464, 2012

University of Leiden, Centre for Science and Technology Studies (CWTS): VOSviewer software (2009)

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Welcome to the VOSviewer web site

Users of VOSviewer may also be interested in the recently released CitNetExplorer tool. This tool can be used for visualizing and analyzing citation networks of scientific publications. More information is available on the [CitNetExplorer website](#).

VOSviewer is a freely available computer program that can be used for the following purposes:

- VOSviewer can be used to create maps based on network data. Maps are created using the VOS mapping technique and the VOS clustering technique.
- VOSviewer can be used to view and explore maps. It can show a map in various different ways, each emphasizing a different aspect of the map. It offers functionality such as zooming, scrolling, and searching, which facilitates the detailed examination of a map.

VOSviewer is primarily intended to be used for analyzing bibliometric networks. The program can for instance be used to create maps of publications, authors, or journals based on a co-citation network or to create maps of keywords based on a co-occurrence network. Various examples of maps created using VOSviewer are available [here](#).

VOSviewer has been written in the Java programming language and runs on most hardware and operating system

VOSviewer has been used to construct a map of *Nature* and *Science* editorials. A brief [correspondence](#) on this research has appeared in *Nature*.

Bibliometrics for Social Sciences: Challenges of a Different, Diverse Literature

- Social scientists publish in internationally influential journals, but also use books (monographs, book chapters), national publications, and non-scholarly media (“Four literatures of social science” – Diana Hicks, 2004)
- Books tend to have content and exhibit patterns of communication distinctly different from journals
- National, local publications are important outlets for social scientists who apply their research in the public sphere (policy, legislation, economics, cultural issues → social impact)
- Style of discourse and spectrum of meaning of citations is different from science (diversity of approaches, schools of thought vs. more uniform consensus on quality criteria)
- Technical issues: Inclusion of other literatures; adequacy of coverage; language considerations; low citation rates, slow citation accumulation but longer period of utility for social science publications

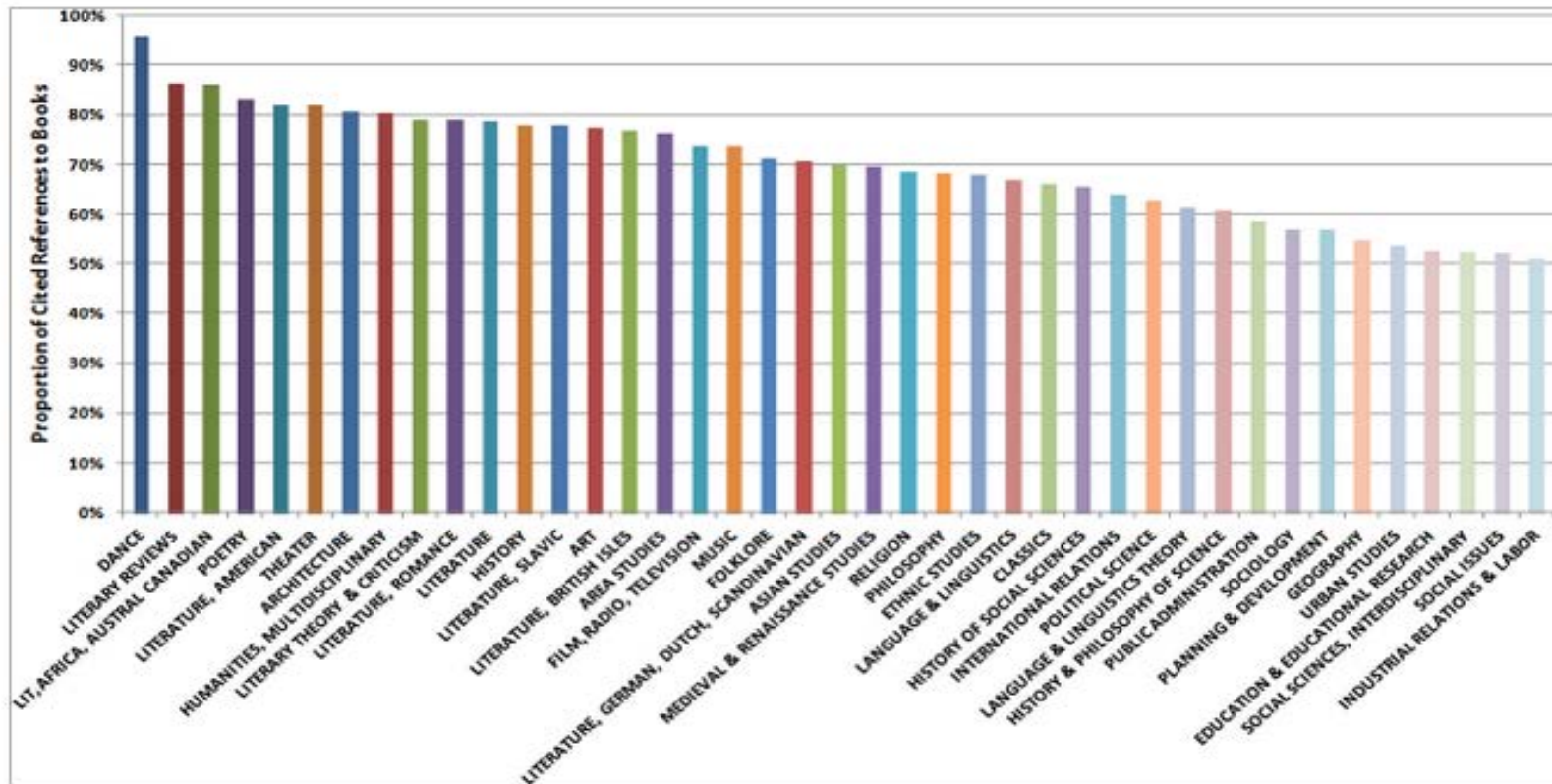
Significance of Non-Journal Literature in Social Sciences, Coverage Issues

Table 7.3. ISI coverage indicators per discipline

<i>Discipline</i>	<i>1a Importance of journals (%)</i>	<i>1b ISI coverage of journal literature (%)</i>	<i>1a*1b Overall ISI coverage (%)</i>
Molecular biology & biochemistry	96	97	92
Biological sciences related to humans	95	95	90
Chemistry	90	93	84
Clinical medicine	93	90	84
Physics & astronomy	89	94	83
* Total ISI *	84	90	75
Applied physics & chemistry	83	89	73
Biological sciences ~ animals and plants	81	84	69
Psychology & psychiatry	75	88	66
Geosciences	77	81	62
Other social sciences ~ medicine & health	75	80	60
Mathematics	71	74	53
Economics	59	80	47
Engineering	60	77	46
Other social sciences	41	72	29
Humanities & arts	34	50	17

Henk F. Moed, *Citation Analysis in Research Evaluation*, Springer, 2005, p 126

Percentage of Cited References from Journals to Books (> 50%): Humanities → Social Sciences



Juan Gorraiz, Philip J. Purnell, and Wolfgang Glänzel, "Opportunities for and Limitations of the Book Citation Index," *Journal of the American Society for Information Science and Technology*, 64 (7): 1388-1398, 2013

Dramatically Different: Citations Reveal Status of Books, Longer 'Shelf Life' for Social Sciences

Figure 7.1 — Share of references made to journal articles indexed in the WoS, by field, 1980–2007

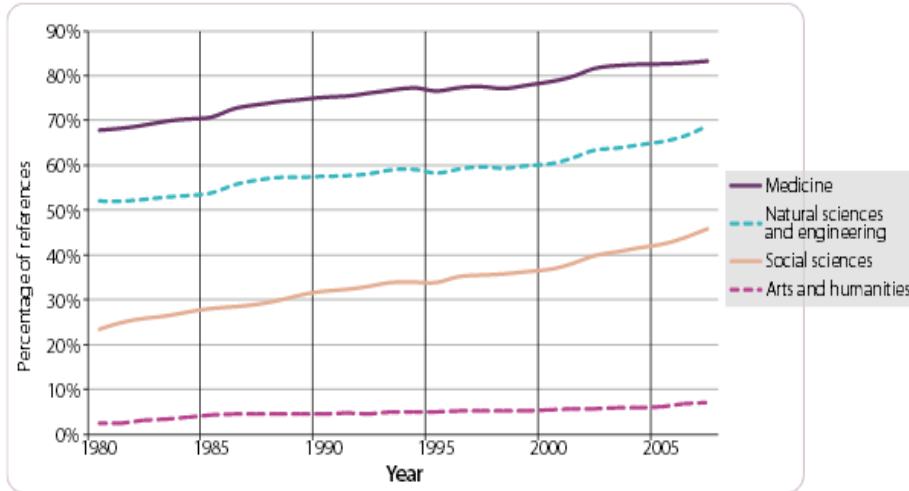


Figure 7.3 — Citations of papers per year following publication

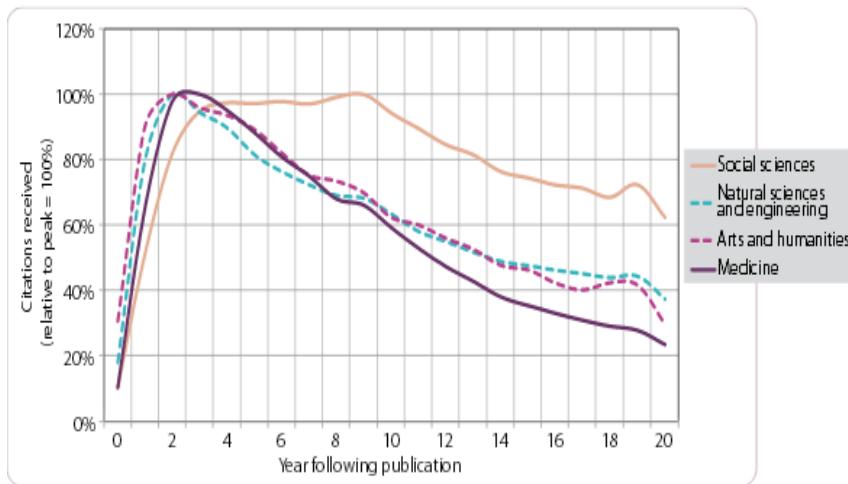
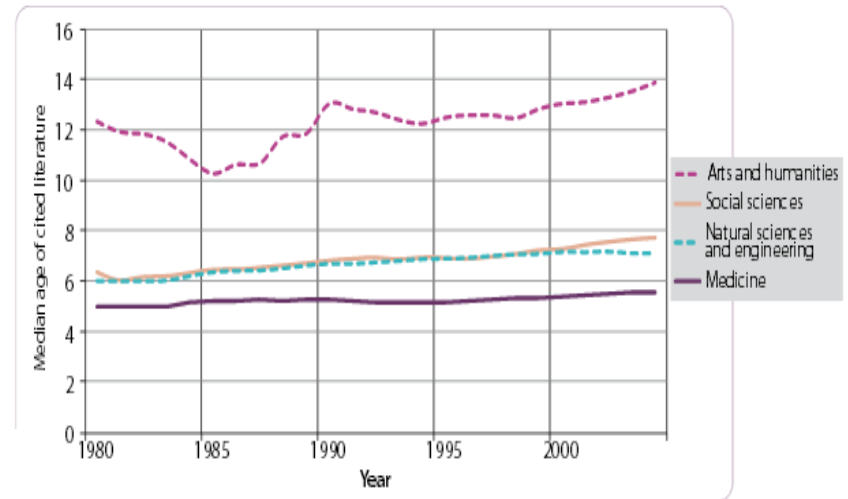


Figure 7.2 — Median age of cited literature by field (100-year citation window), 1980–2005



Éric Archambault and Vincent Lavrière, “The Limits of Bibliometrics for the Analysis of Social Sciences and Humanities Literature,” in *World Social Science Report*, (UNESCO, 2010), pp. 251-254



Thomson Reuters Launched *Book Citation Index* in 2011 within *Web of Science*

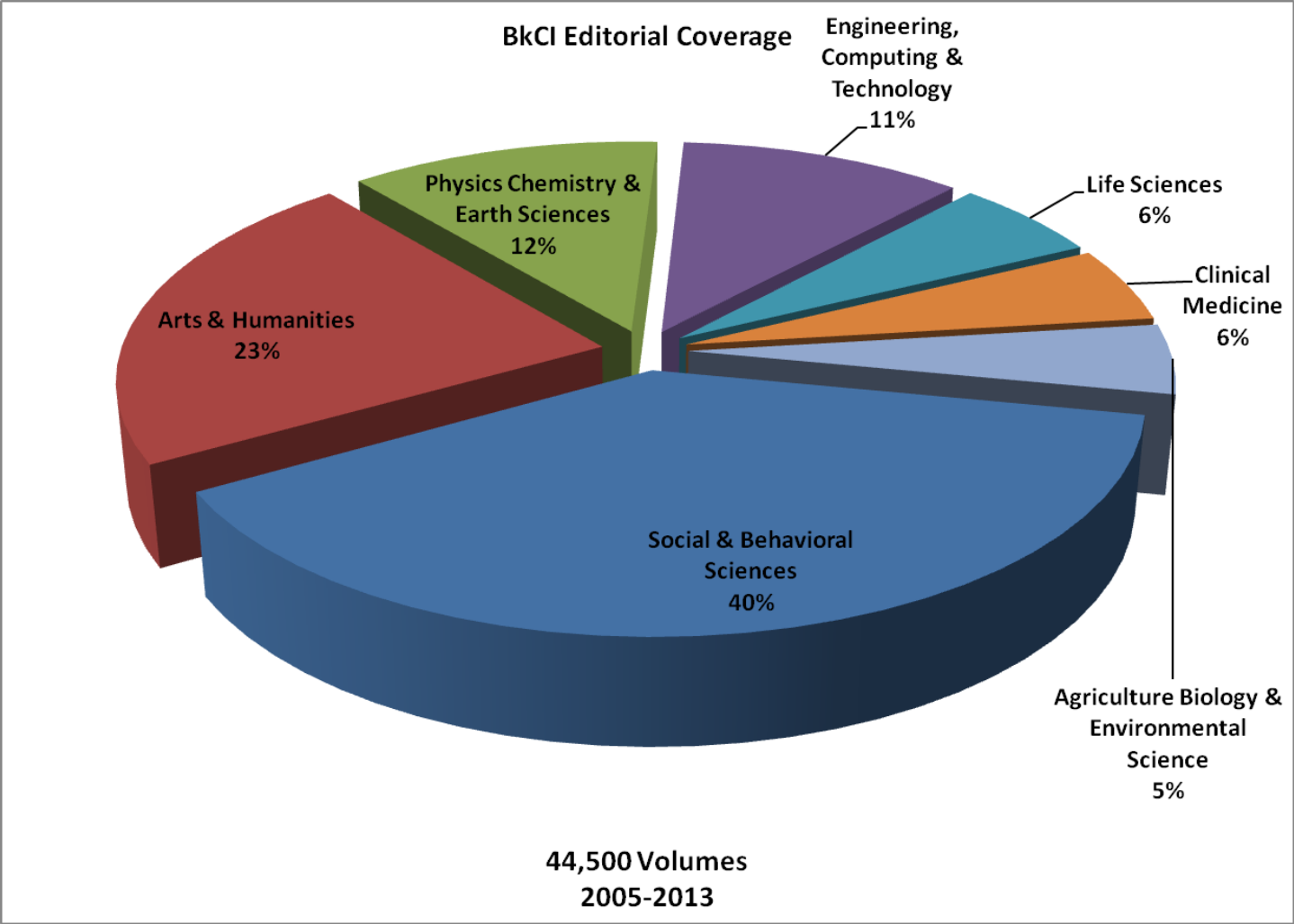
THE BOOK SELECTION PROCESS FOR THE
BOOK CITATION INDEX
IN *WEB OF SCIENCE*

- More complete coverage of social sciences and arts and humanities literature
- Books are often highly cited compared to journal articles (sometimes 3:1)
- Books appear to be more transdisciplinary, in what they communicate and who uses them (citations to/from)

COMPLETING THE RESEARCH PICTURE
THE BOOK CITATION INDEXSM



Distribution of Subjects in Thomson Reuters Book Citation Index, Introduced 2011 (2005-2013)



A Way Forward....

- The Kelvin Dictum: *“If you can measure that of which you speak, and can express it by a number, you know something of your subject; but if you cannot measure it, your knowledge is meager and unsatisfactory.”* — William Thomson (Lord Kelvin)
- The Viner Dictum: *“When you can measure it, when you can express it in numbers, your knowledge is still of a meager and unsatisfactory kind.”* — Jacob Viner
- The Knight Dictum: *“If you cannot measure a thing, go ahead and measure it anyway.”* — Frank Knight



Robert K. Merton, David L. Sills, and Stephen M. Stigler, “The Kelvin Dictum and Social Science: An Excursion into the History of an Idea,” *Journal of the History of the Behavioral Sciences*, 20 (4): 319-331, 1984

World Shares for Singapore by *Web of Science* Field Classifications, 2004-2008 and 2009-2013

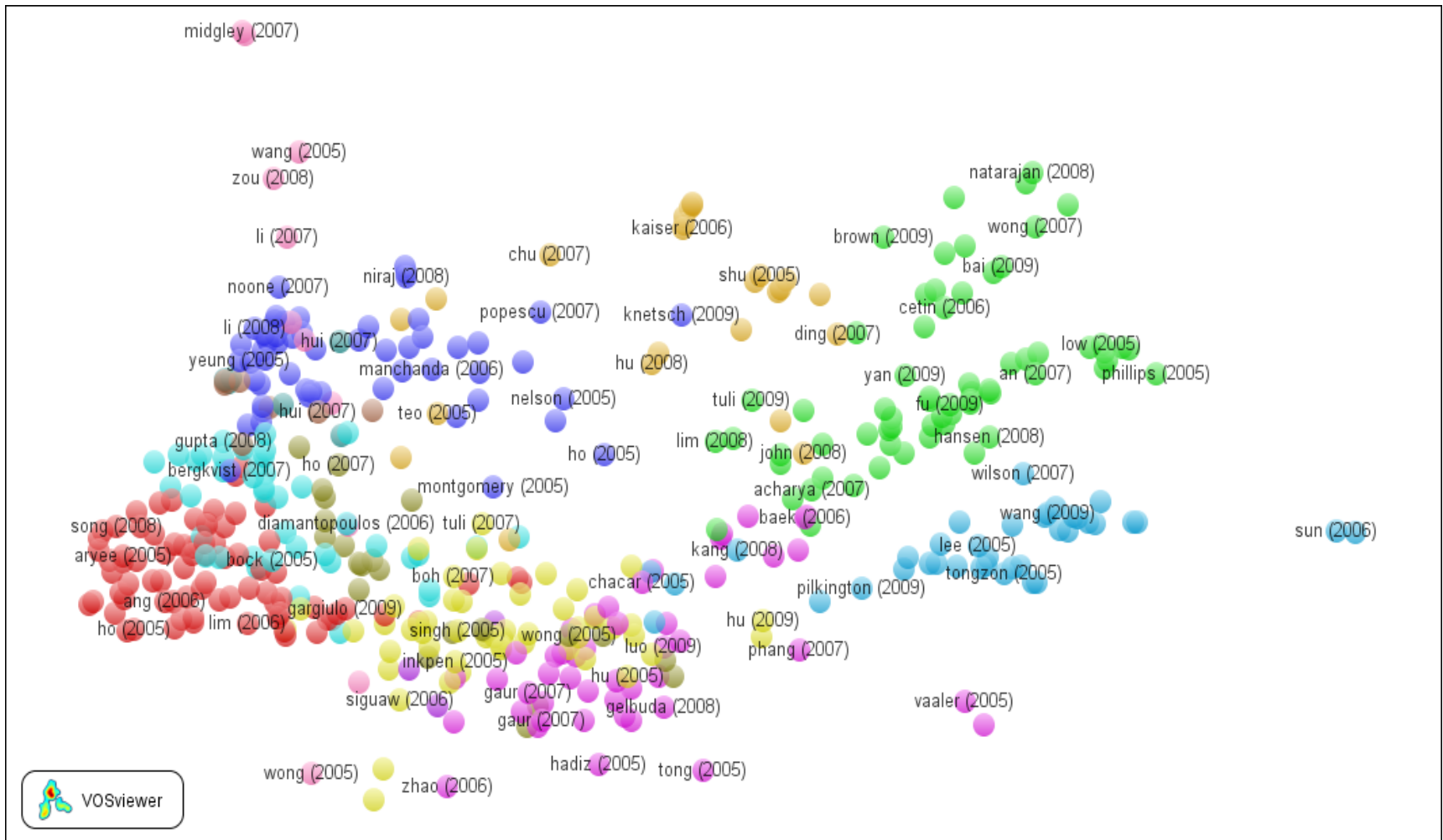
Rank	Field	Papers 2004-2008	World Share (%)	Field	Papers 2009-2013	World Share (%)
1	Operations Res.	526	2.06	Asian Studies	117	2.64
2	Asian Studies	52	1.96	Area Studies	175	1.95
3	Transportation	173	1.78	Finance	312	1.83
4	Management	444	1.76	Operations Res.	658	1.71
5	Business	252	1.53	Transportation	213	1.65
6	Finance	156	1.53	SS Math Methods	160	1.58
7	Inform/Library Sci.	179	1.52	Management	638	1.56
8	Area Studies	76	1.46	Inform/Library Sci.	240	1.48
9	Urban Studies	79	1.33	Urban Studies	122	1.47
10	Med. Informatics	87	1.15	Business	362	1.35
11	Geography	104	1.04	Education	513	1.19
12	SS Math Methods	72	.94	Communications	152	1.18
13	Planning	69	.92	Appl. Psychology	180	1.17
14	Economics	471	.89	Intl. Relations	149	1.13
15	Intl. Relations	78	.88	Med. Informatics	134	1.12
16	Appl. Psychology	96	.84	Soc. Psychology	189	1.11
17	Education	167	.76	Economics	783	.97
18	Communications	58	.73	Demography	37	.92
19	Hospitality	20	.62	Linguistics	187	.91
20	Social Psychology	62	.50	Geography	143	.89

Exercise # 1: Mapping and Analysis of Singapore's Research in Economics/Business, 2005-2013

- Data collected from Web of Science in three groups: 2005-2009, 2007-2011, and 2009-2013 (publication year); WoS categories of Economics, Business, Management, and Business Finance; articles, proceedings papers, reviews, books, and book chapters; and address Singapore; top cited 500 papers selected (thresholds 10, 8, 4 citations, respectively), representing approx. 25%-33% national output
- VOSviewer software used for clustering by bibliographic coupling and for visualization
- Detailed inspection of cluster contents for appropriate naming; special attention to SMU authors and publications; observation of changing themes over time, emerging specialties, other phenomenon, illustration of practical uses

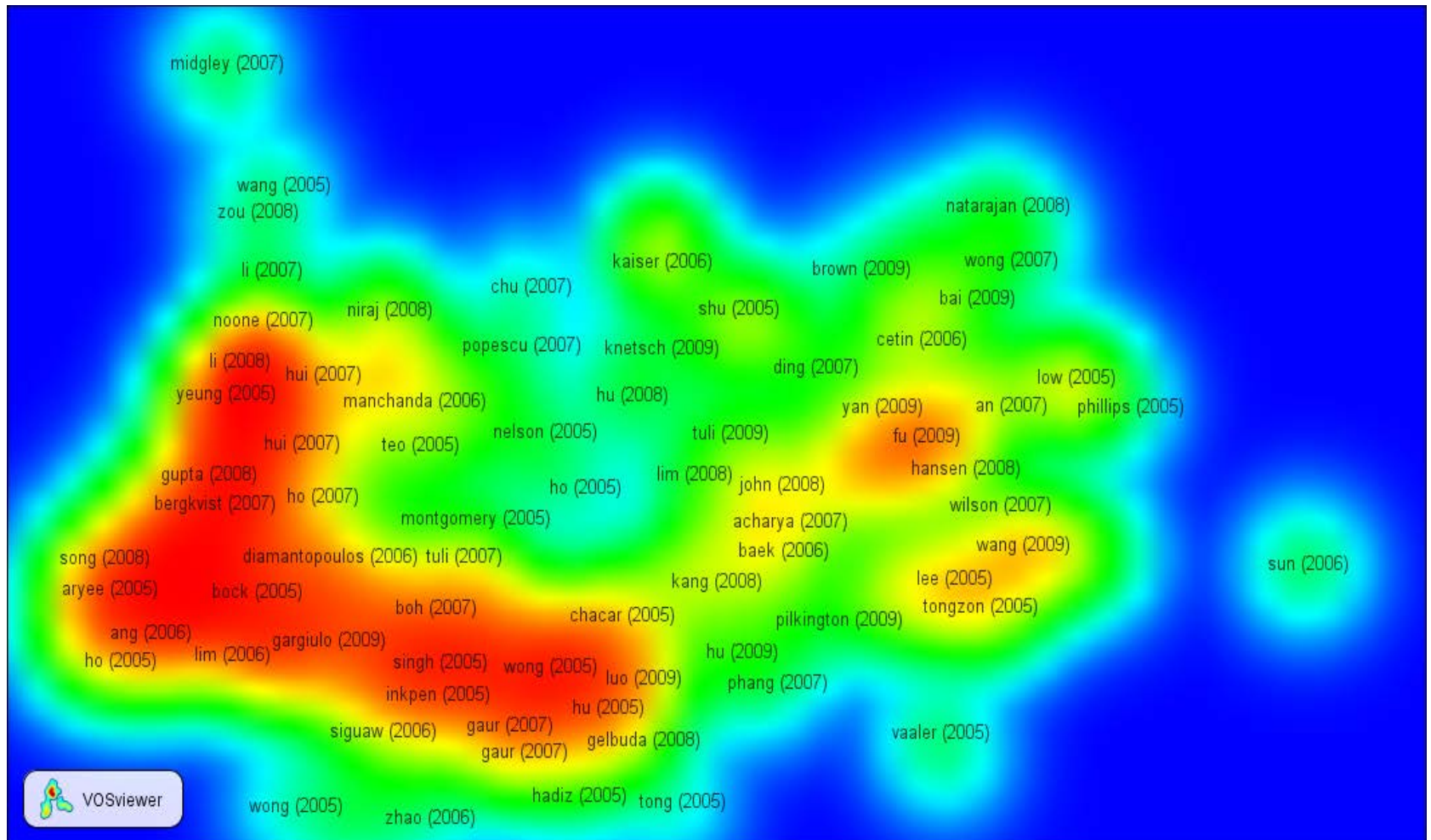
SINGAPORE: Economics and Business, 2005-2009

Clusters created by bibliographic coupling



SINGAPORE: Economics and Business, 2005-2009

Clusters created by bibliographic coupling



Highly Cited Paper: SMU's Kapil Tuli (2007)



Kapil Rajendra Kumar TULI

Associate Professor of Marketing, SMU

“Rethinking customer solutions: From product bundles to relational processes,” *Journal of Marketing*, 70 (3), 1-17, 2007

Citations to date: 163 (vs. field average of 10)

Highly Cited Paper: SMU's Sungbae An (2007)



Sungbae AN

Assistant Professor of Economics, SMU

“Bayesian analysis of DSGE models,”
Econometric Reviews, 26 (2-4): 113-172, 2007

Citations to date: 164 (vs. field average of 10)

* DSGE = Dynamic stochastic general equilibrium

Highly Cited Paper: SMU's Fangjian Fu (2009)



Fangjian FU

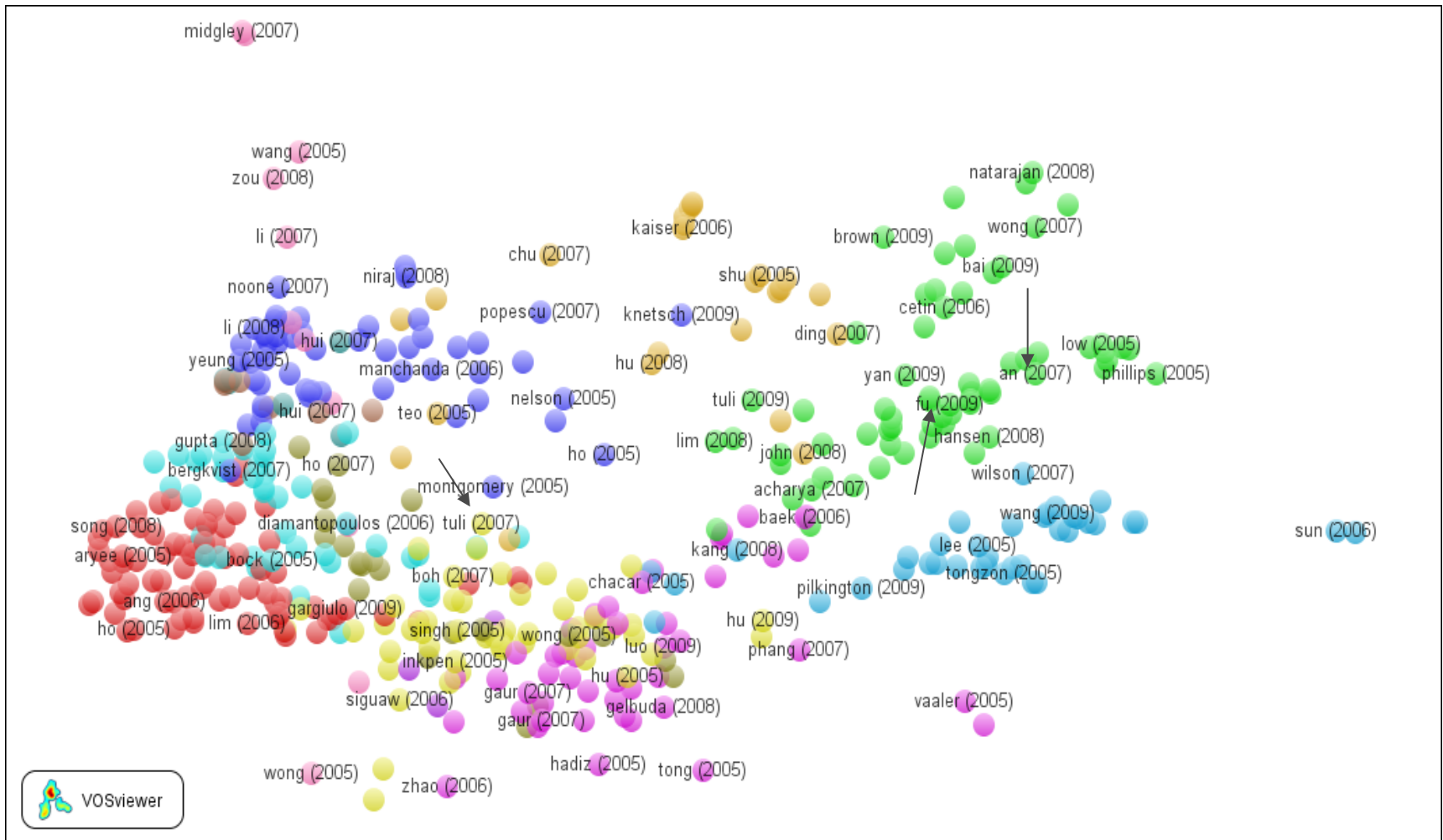
Assistant Professor of Finance, SMU

“Idiosyncratic risk and the cross-section of expected stock returns,” *Journal of Financial Economics*, 91 (1): 24-37, 2009

Citations to date: 69 (vs. field average of 6)

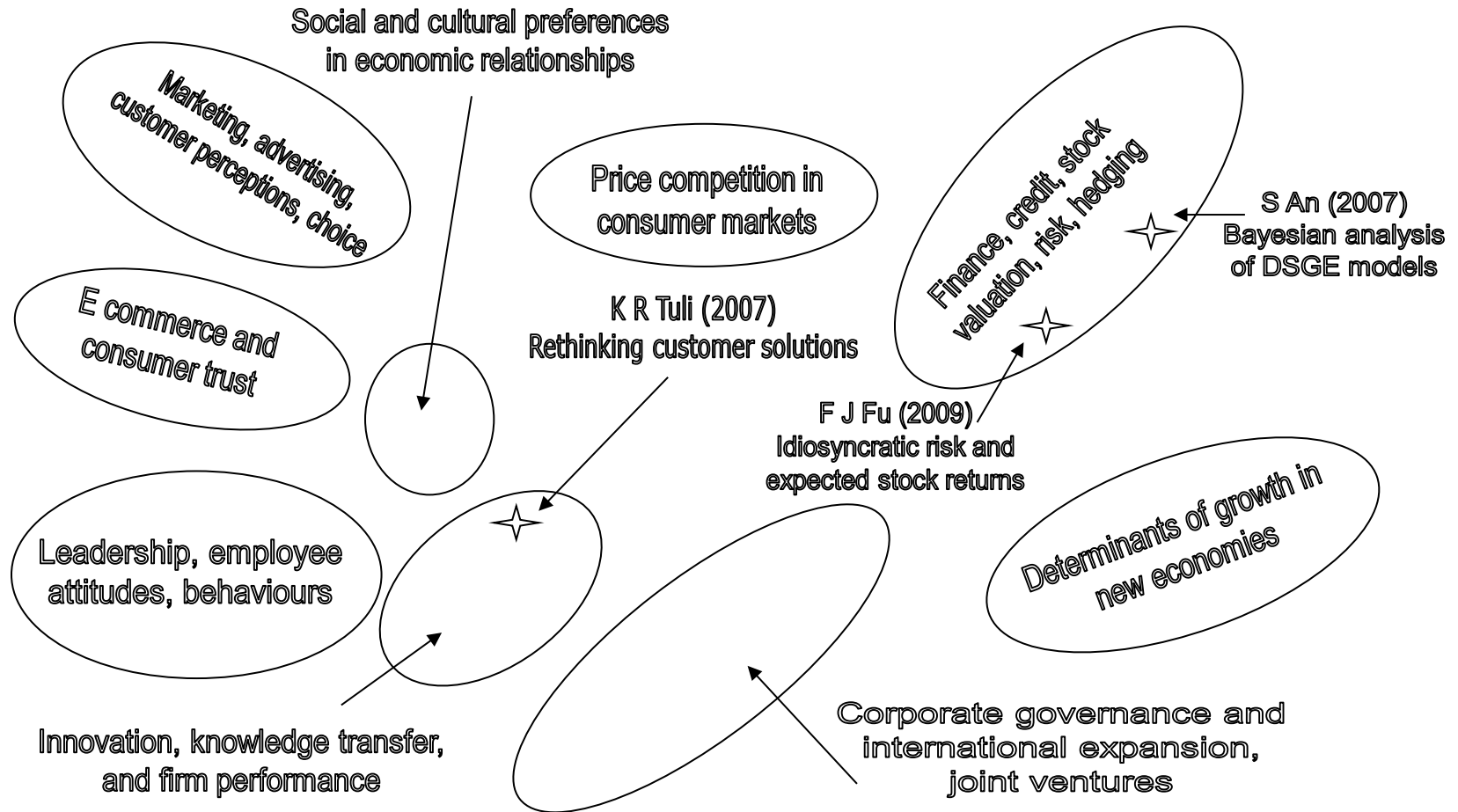
SINGAPORE: Economics and Business, 2005-2009

Clusters created by bibliographic coupling



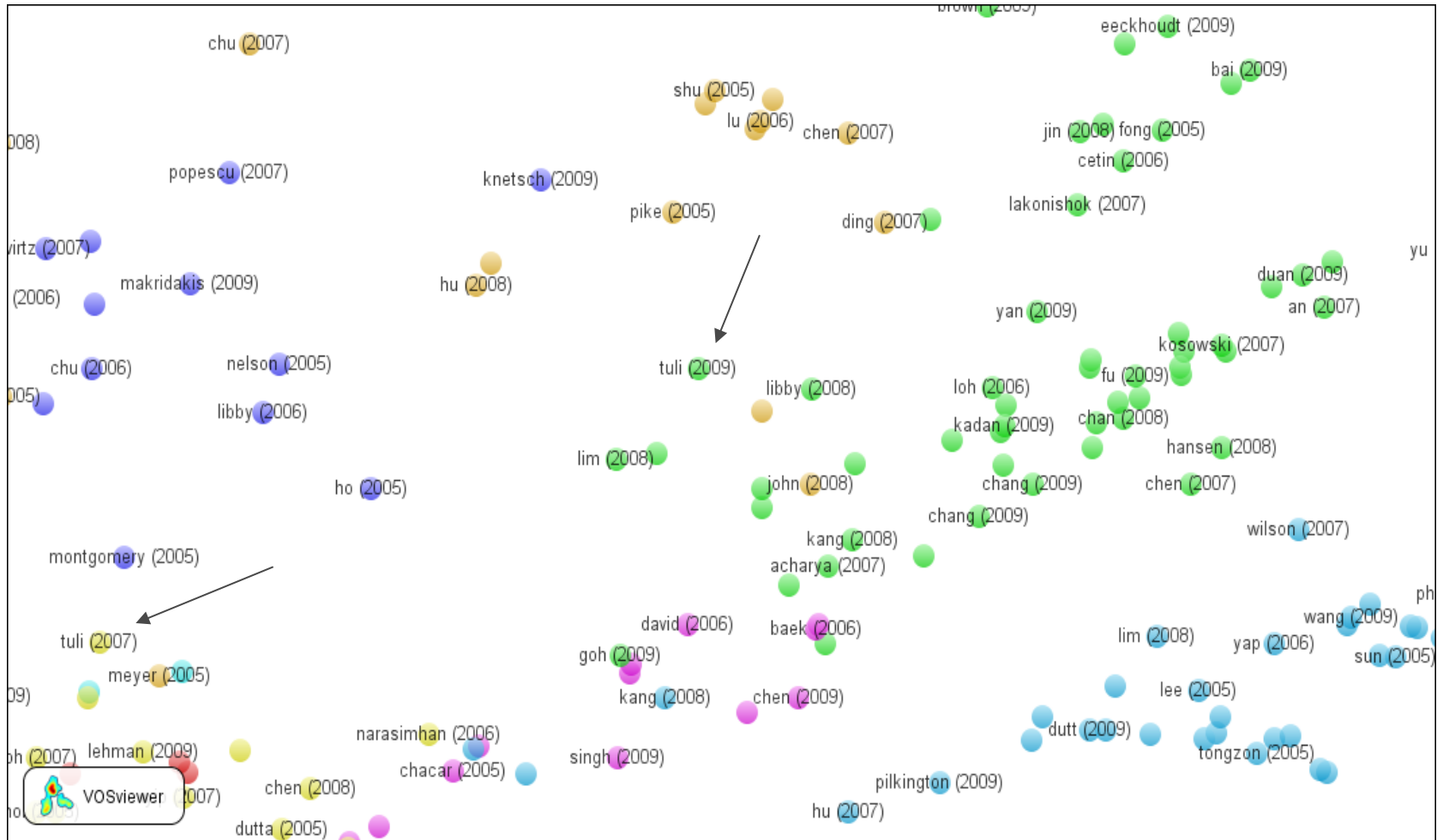
SINGAPORE: Economics and Business, 2005-2009

Clusters created by bibliographic coupling



SINGAPORE: Economics and Business, 2005-2009

Clusters created by bibliographic coupling



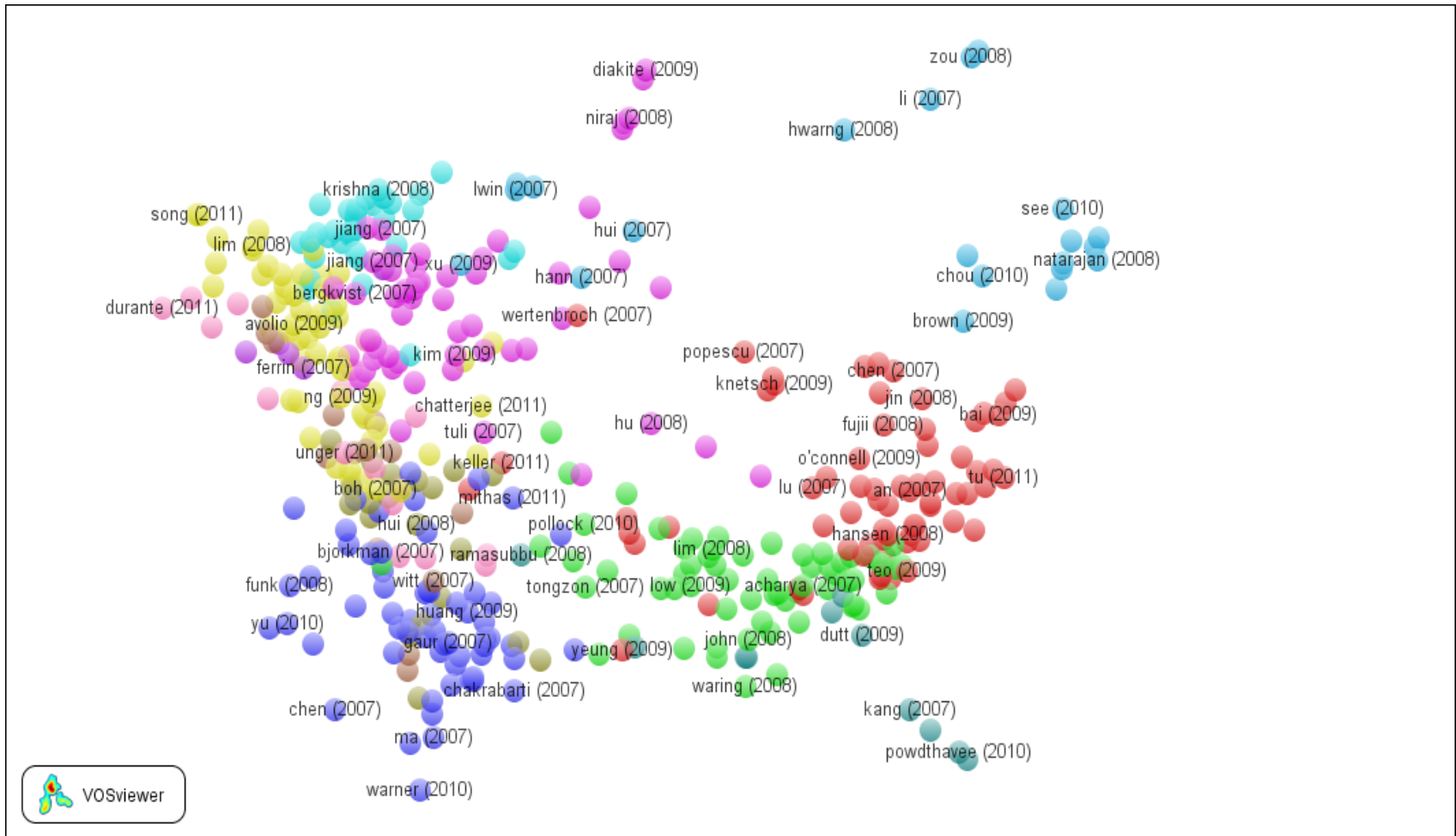
Singapore Management University within Singapore, Business/Economics, 2005-2009

Finance, stock valuation, credit, risk, and hedging	27/66 papers	41% cluster	S AN, CY CHEN, FJ FU, BW GOH, M TEO, KR TULI, J YU
Leadership, employee attitudes, behaviors	21/79 papers	27% cluster	D CHAN , G ERTUG, G GREGURAS, J REB,
Innovation, knowledge transfer, firm performance	14/51 papers	27% cluster	KG HUANG, R KOTHI, RK SRIVASTAVA , WL TAN, FT TSCHANG, KR TULI
Corporate governance, intl. expansion, joint ventures	12/47 papers	26% cluster	SY PHANG, T YOSHIKAWA
Social and cultural preferences in transactions	5/23 papers	22% cluster	T FAN, G GREGURAS, WL TAN
Marketing, advertising, consumer views, choices	10/56 papers	18% cluster	MP LEE, J REB, JING WANG
E commerce and consumer trust	7/41 papers	17% cluster	DL FERRIN, G PAN
Determinants of growth in new economies	5/38 papers	13% cluster	PCB PHILLIPS
Price competition in consumer markets	3/24 papers	13% cluster	Q DING*, N HU*



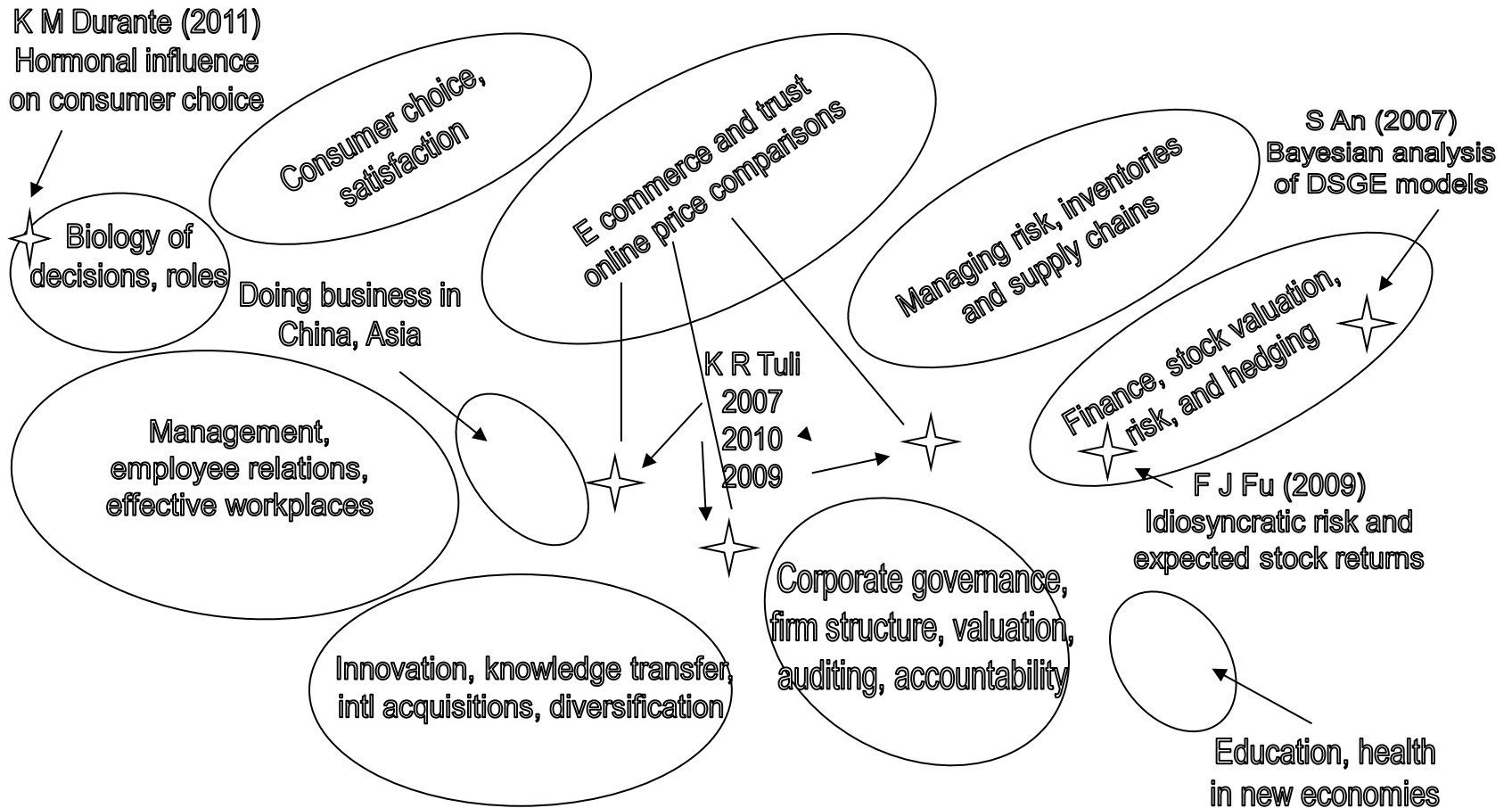
SINGAPORE: Economics and Business, 2007-2011

Clusters created by bibliographic coupling

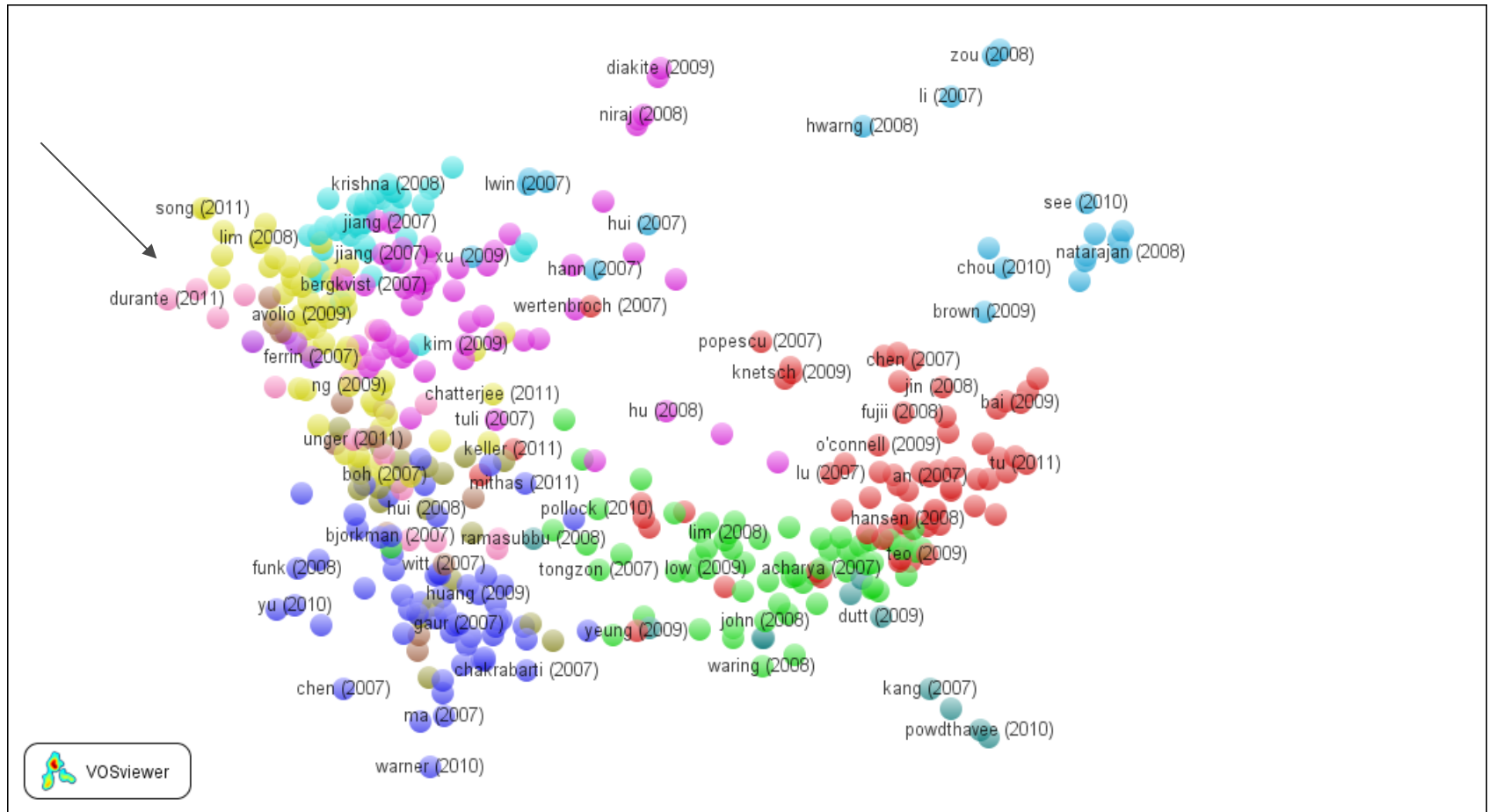


SINGAPORE: Economics and Business, 2007-2011

Clusters created by bibliographic coupling



Emerging Specialty: Genetic and Biological Basis of Leadership, Entrepreneurship, Consumer Choice



Emerging Specialty: Genetic and Biological Basis of Leadership, Entrepreneurship, Consumer Choice



Norman P. Li

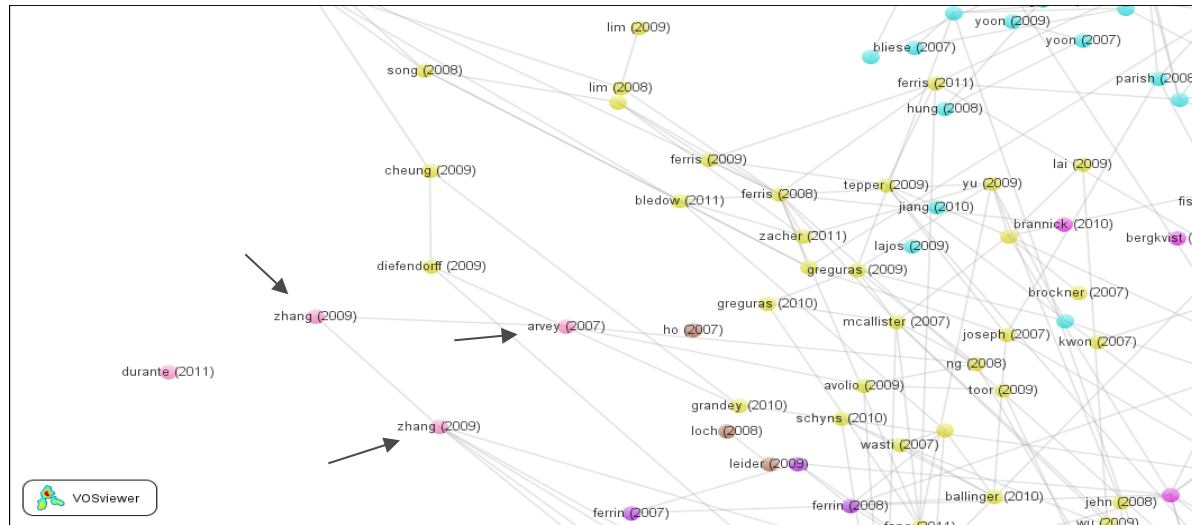
Associate Professor of Psychology, SMU

“Ovulation, female competition, and product choice: Hormonal influences on consumer behavior,” *Journal of Consumer Research*, 37 (6): 921-934, 2011 [first author Durante KM]

Citations to date: 41 (vs. field average of 2)

Three other papers in the cluster by Richard D. Arvey at National University of Singapore Business School

Possible Collaboration Suggested by Similarity



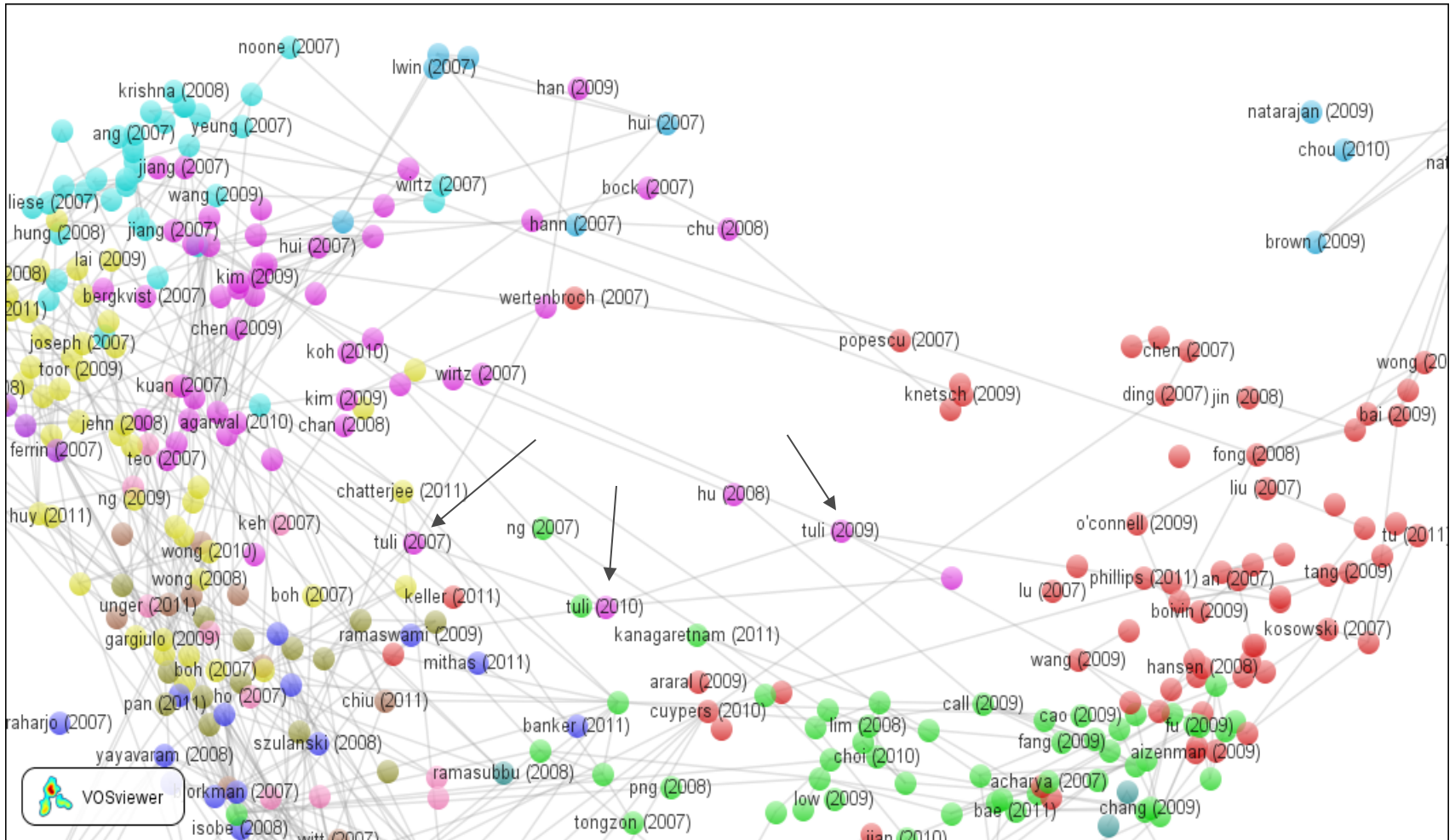
Zhang (2009) w/ Arvey “The genetic basis of entrepreneurship: Effects of gender and personality”

Zhang (2009) w/ Arvey “Beyond genetic explanations for leadership: The moderating role of the social environment”

Arvey (2007) “Developmental and genetic determinants of leadership role occupancy among women”

SINGAPORE: Economics and Business, 2007-2011

Clusters created by bibliographic coupling

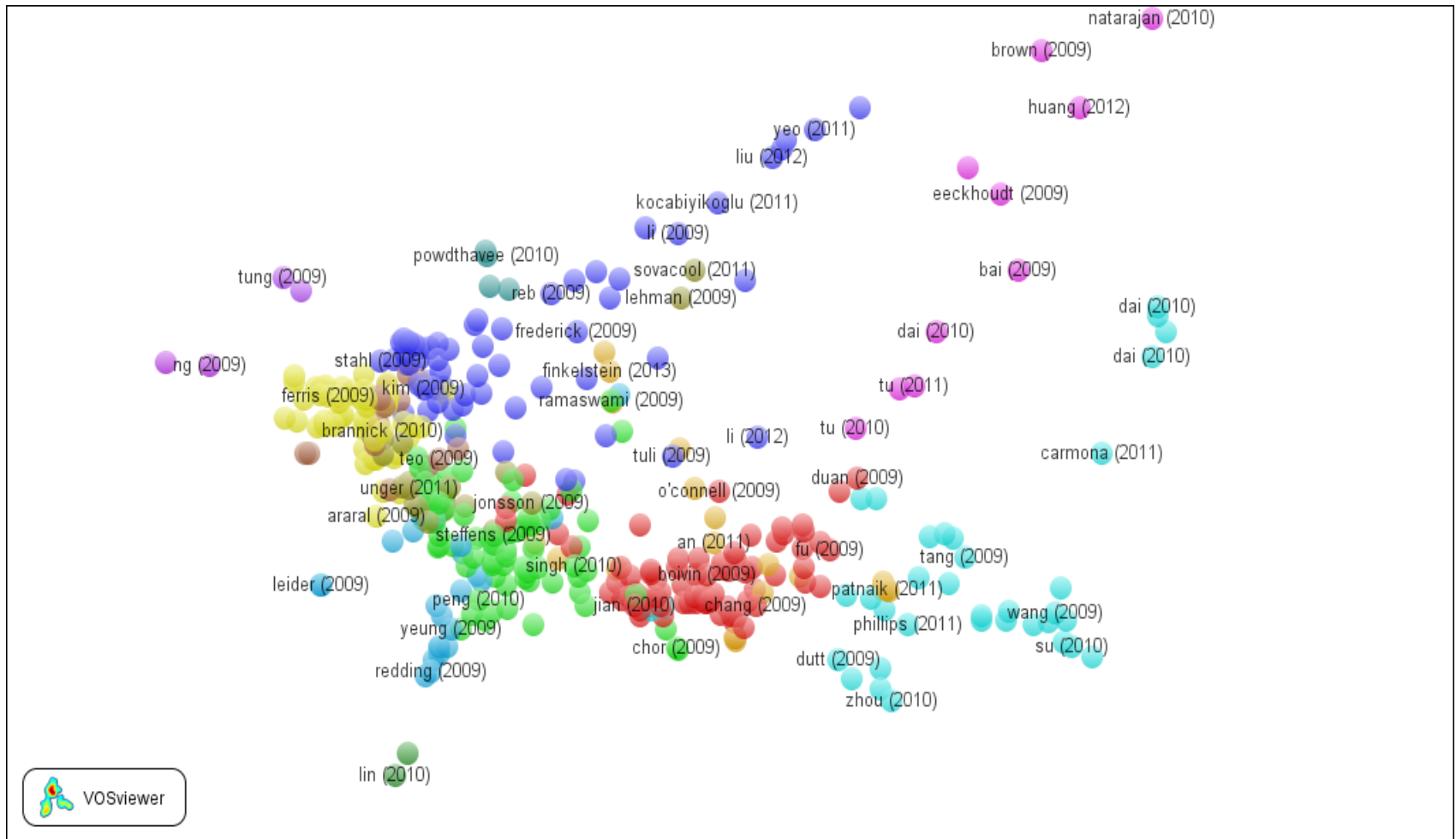


Kapil Tuli (Marketing): Three Papers, their Clusters and Linkages in Different Directions

Paper	Cluster Assignment	Near Cluster
“Rethinking customer solutions: From product bundles to relational processes,” <i>Journal of Marketing</i> , 70 (3), 1-17, 2007	E commerce and trust, online price comparisons	Doing business in China, Asia, and Innovation, knowledge transfer
“Customer satisfaction and stock returns,” <i>Journal of Marketing</i> , 73 (6): 184-197, 2009	E commerce and trust, online price comparisons	Finance, stock valuation, risk, and hedging
“Ties that bind: The impact of multiple types of ties with a customer on sales growth and sales volatility,” <i>Journal of Marketing Research</i> , 47 (1): 36-50, 2010	E commerce and trust, online price comparisons	Corporate governance, firm structure, valuation, auditing, accountability

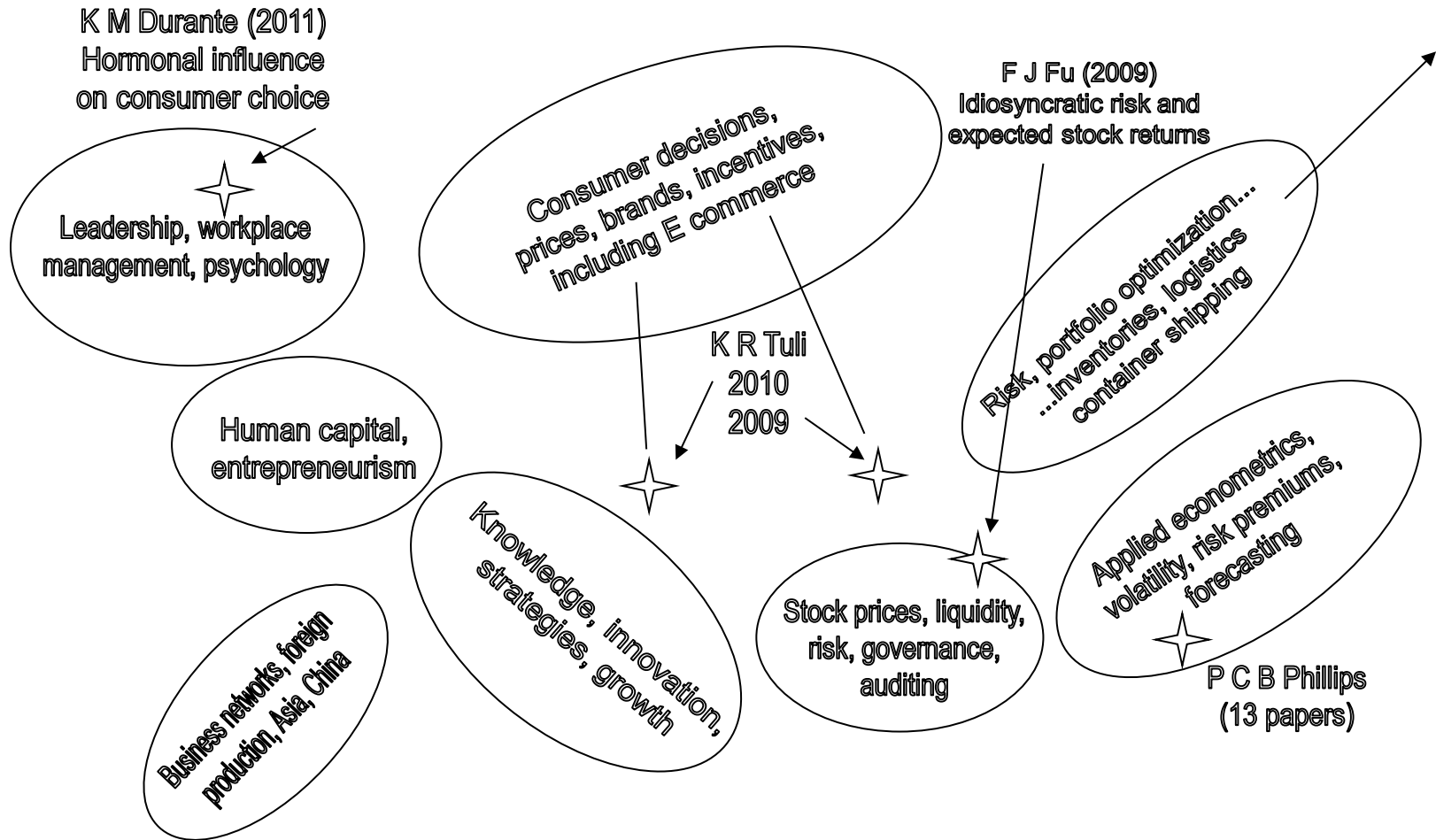
SINGAPORE: Economics and Business, 2009-2013

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Clusters created by bibliographic coupling



Dynamic Changes in Cluster Themes: 2005-2009 Compared to 2009-2013

2005-2009	2009-2013
Finance, stock valuation, credit, risk, and hedging	Risk, portfolio optimization... inventories, logistics, container shipping
Leadership, employee attitudes, behaviors	Leadership, workplace management, psychology
Innovation, knowledge transfer, firm performance	Knowledge, innovation, strategies, growth
Corporate governance, intl. expansion, joint ventures	Stock price, liquidity, risk, governance, auditing (and tunneling)
Social and cultural preferences in transactions	Business networks, foreign production, Asia, China
Marketing, advertising, consumer views, choices	Consumer decisions, prices brands, incentives, including E commerce
E commerce and consumer trust	Human capital, entrepreneurship
Determinants of growth in new economies	Applied econometrics, volatility, risk premiums, forecasting
Price competition in consumer markets	



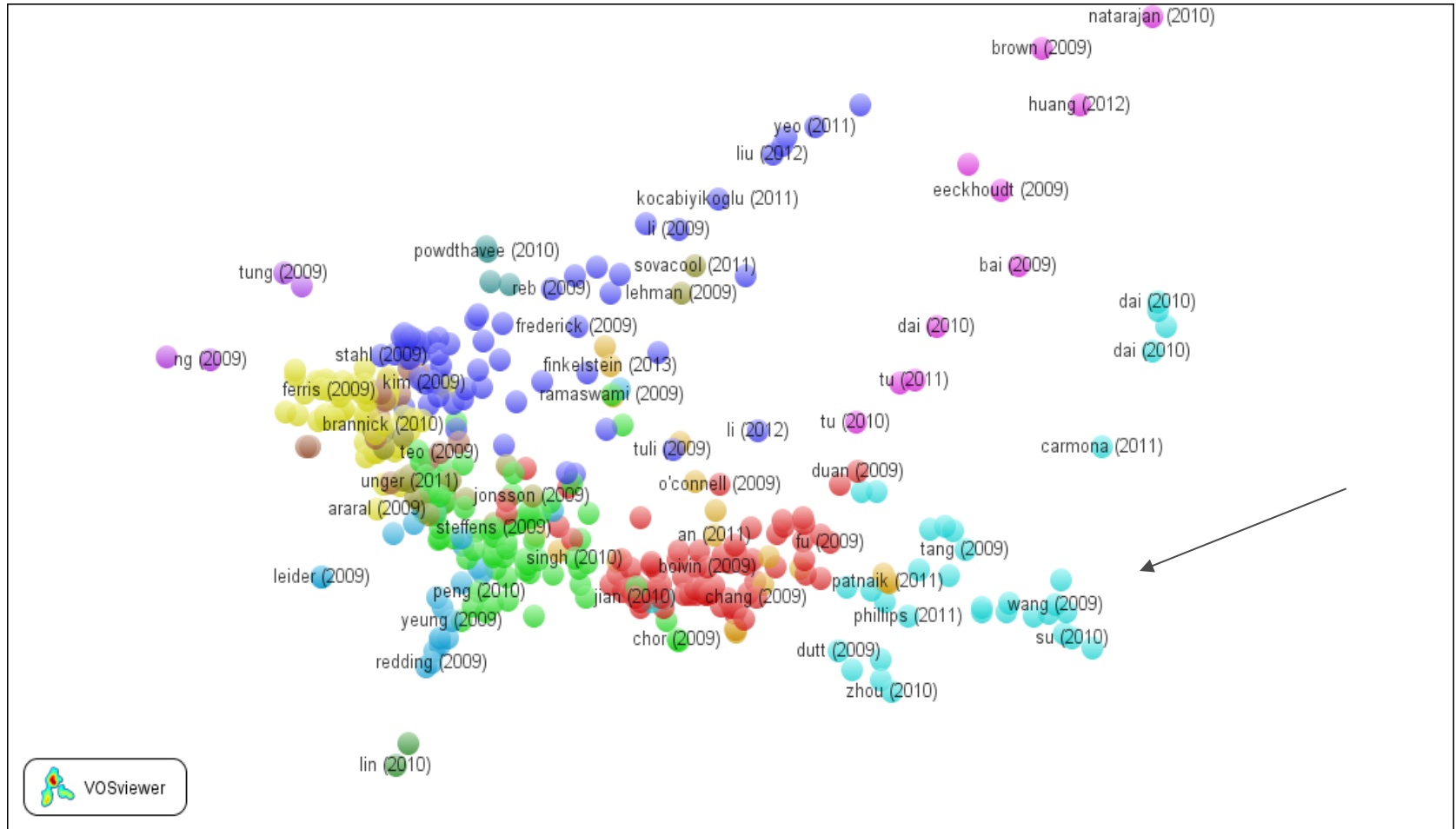
Peter C.B. Phillips joins SMU as Distinguished Term Professor, 2008: Econometrics Expands



Prof. Phillips was selected in 2013 as a Thomson Reuters Citation Laureate, which designates researchers 'of Nobel class' as indicated by their publication and citation records. Citation Laureates are forecast as possible Nobel Prize winners. Since 2002, 10 Thomson Reuters Citation Laureates in Economics have gone on to win the Nobel Prize, including all three from last year (Eugene F. Fama, Lars Peter Hansen, and Robert J. Shiller).

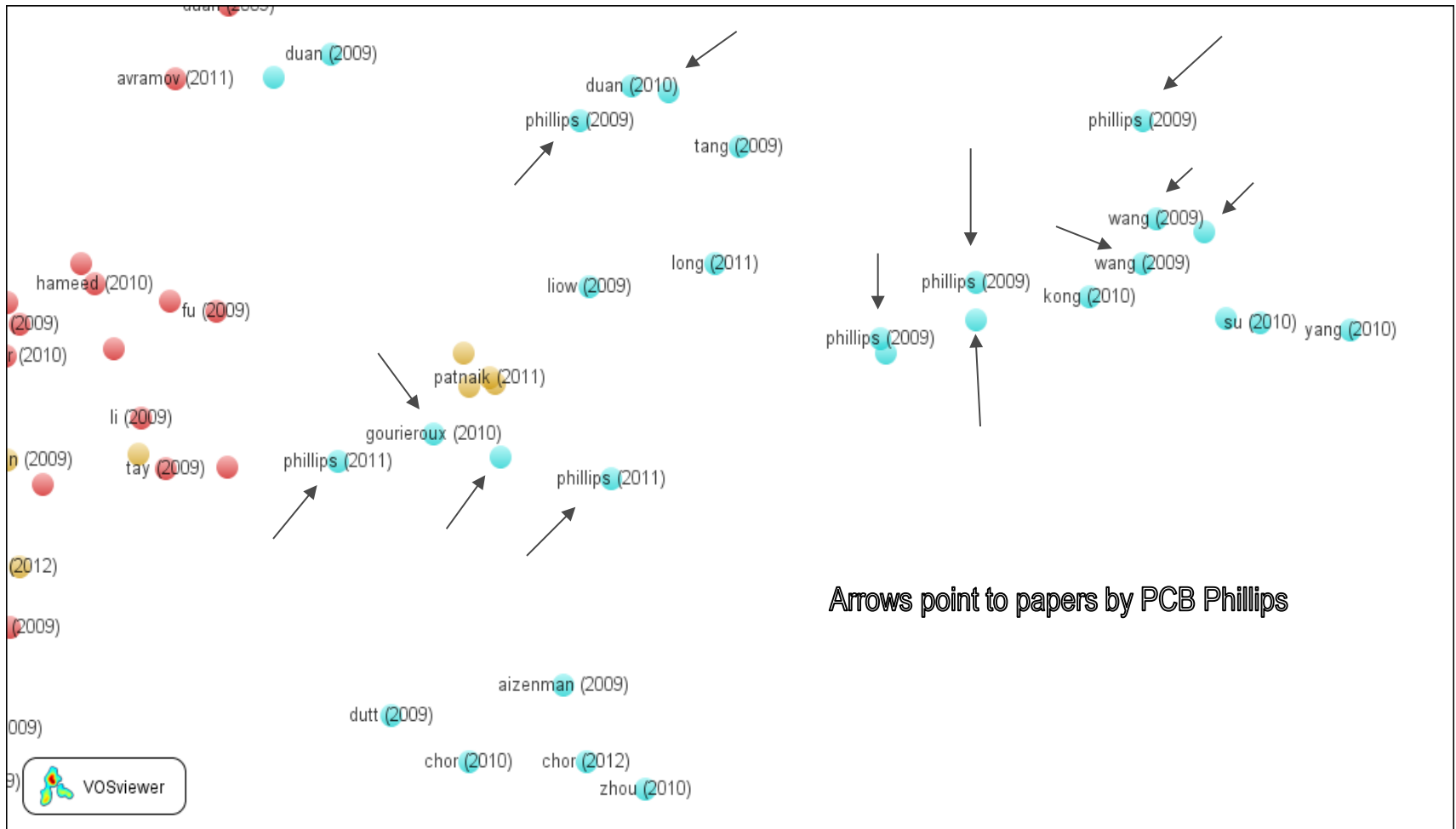
<http://sciencewatch.com/nobel/predictions/econometric-time-series>

Applied Econometrics and Forecasting: Cluster Differentiation and Expansion



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Clusters created by bibliographic coupling

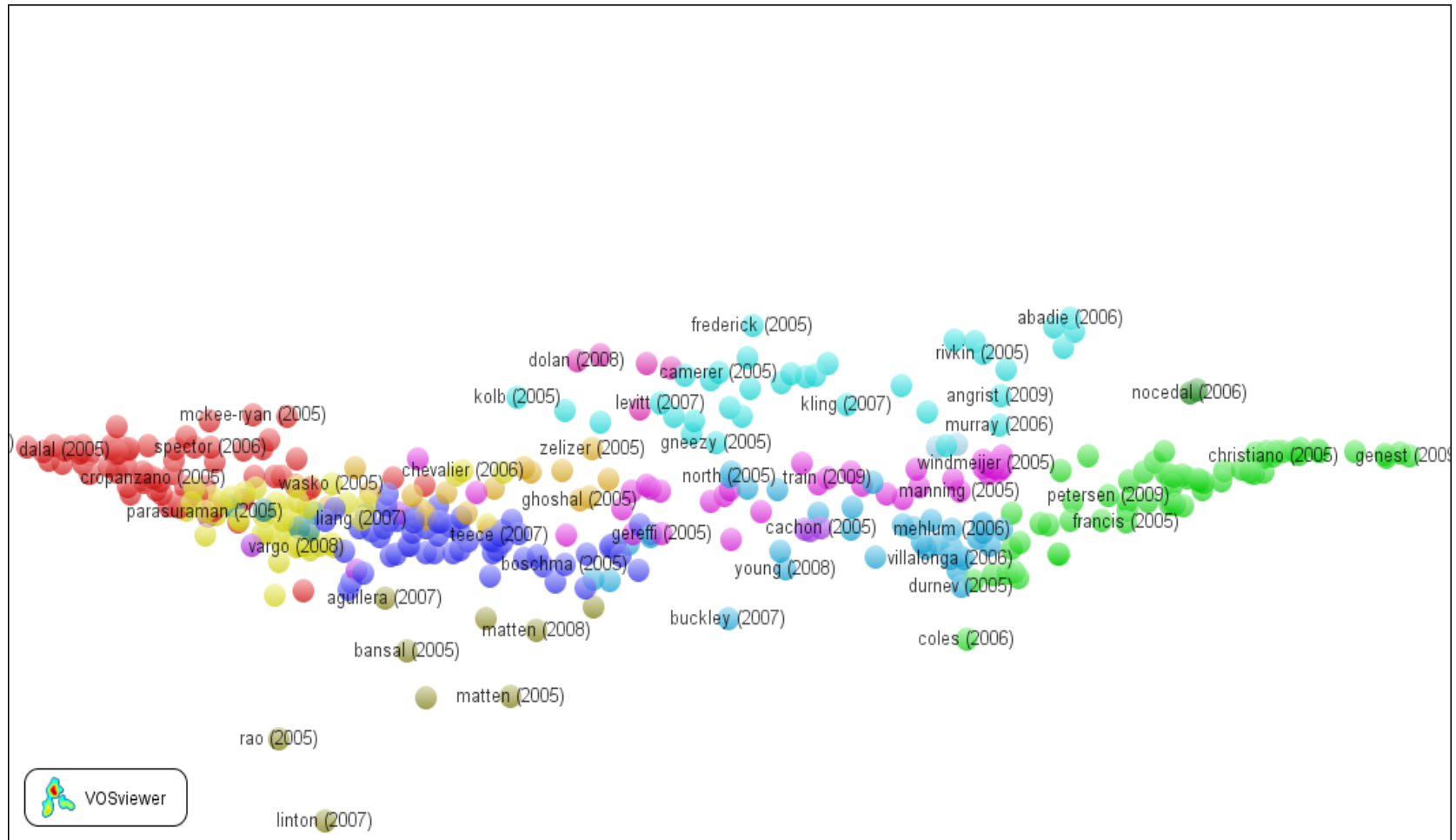


Exercise # 2: Mapping and Analysis of World Research in Economics/Business, 2005-2013

- Data collected from Web of Science in three groups: 2005-2009, 2007-2011, and 2009-2013 (publication year); WoS categories of Economics, Business, Management, and Business Finance; articles, proceedings papers, reviews, books, and book chapters; square root of world papers selected (thresholds 160, 98, 55 citations, respectively)
- VOSviewer software used for clustering by bibliographic coupling and for visualization
- Detailed inspection of cluster contents for appropriate naming; special attention to difference of world map and Singapore map; illustration of importance of books; some and publications from Singapore in world map

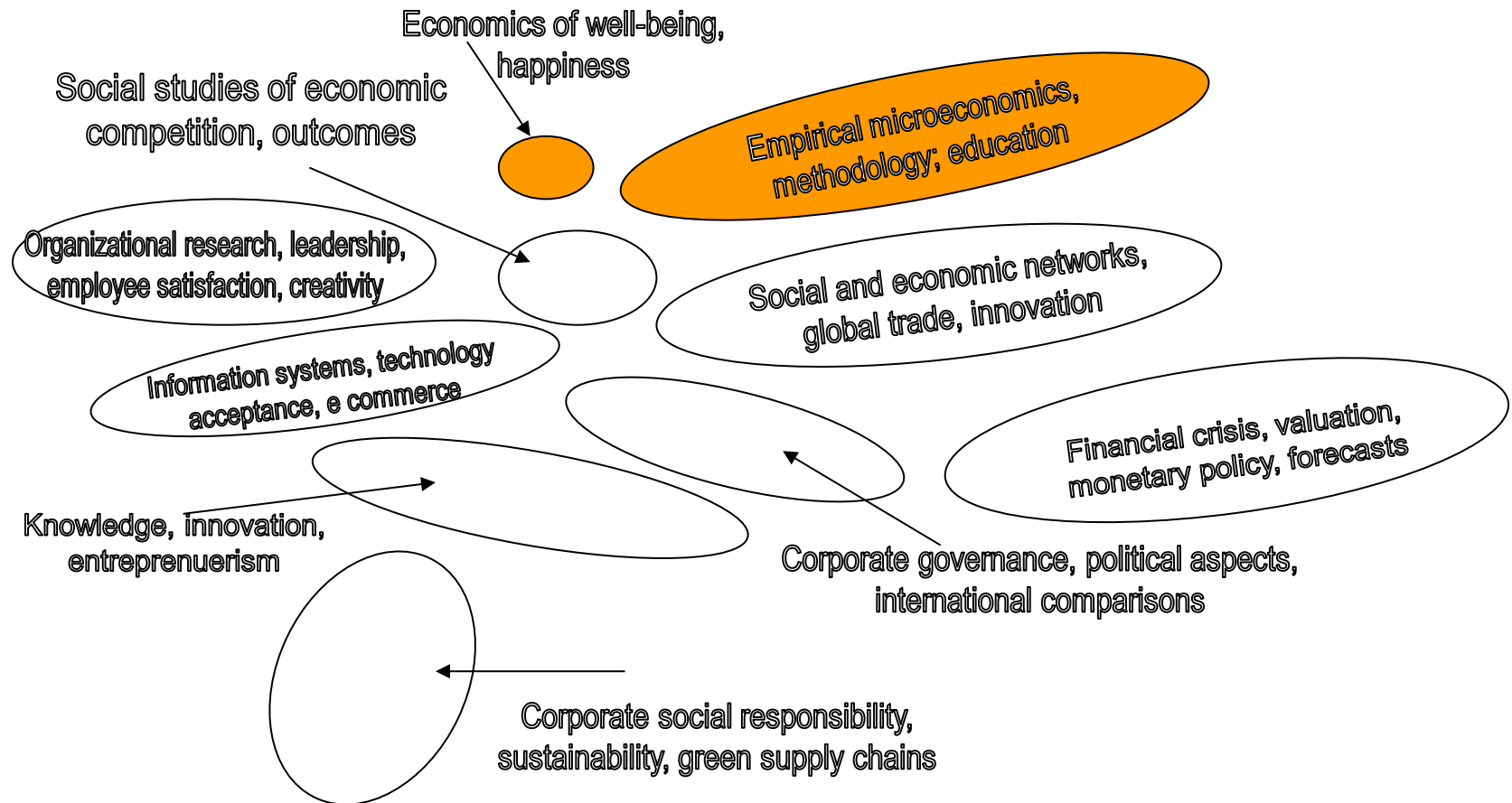
WORLD: Economics and Business, 2005-2009

Clusters created by bibliographic coupling



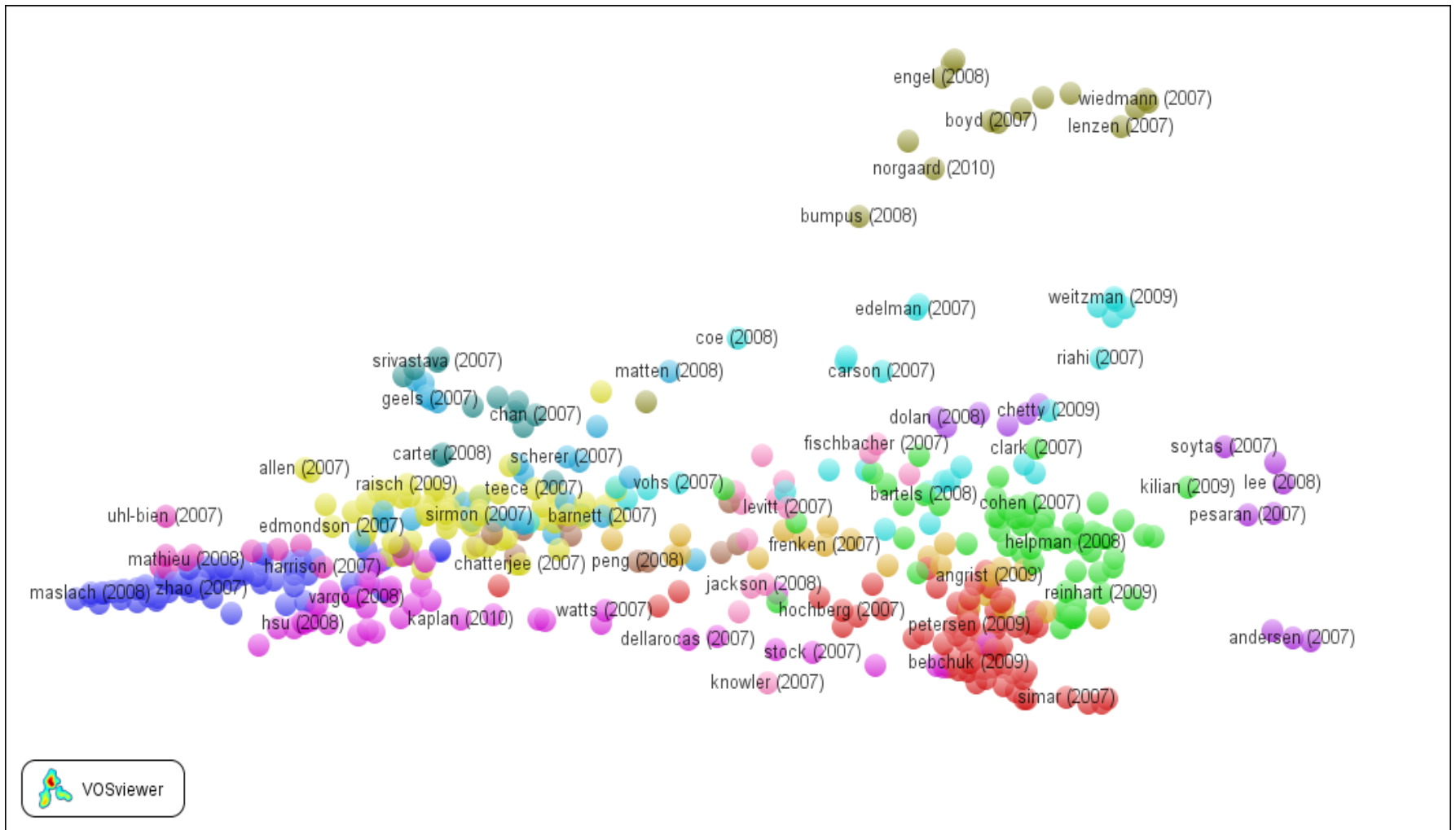
WORLD: Economics and Business, 2005-2009

Clusters created by bibliographic coupling



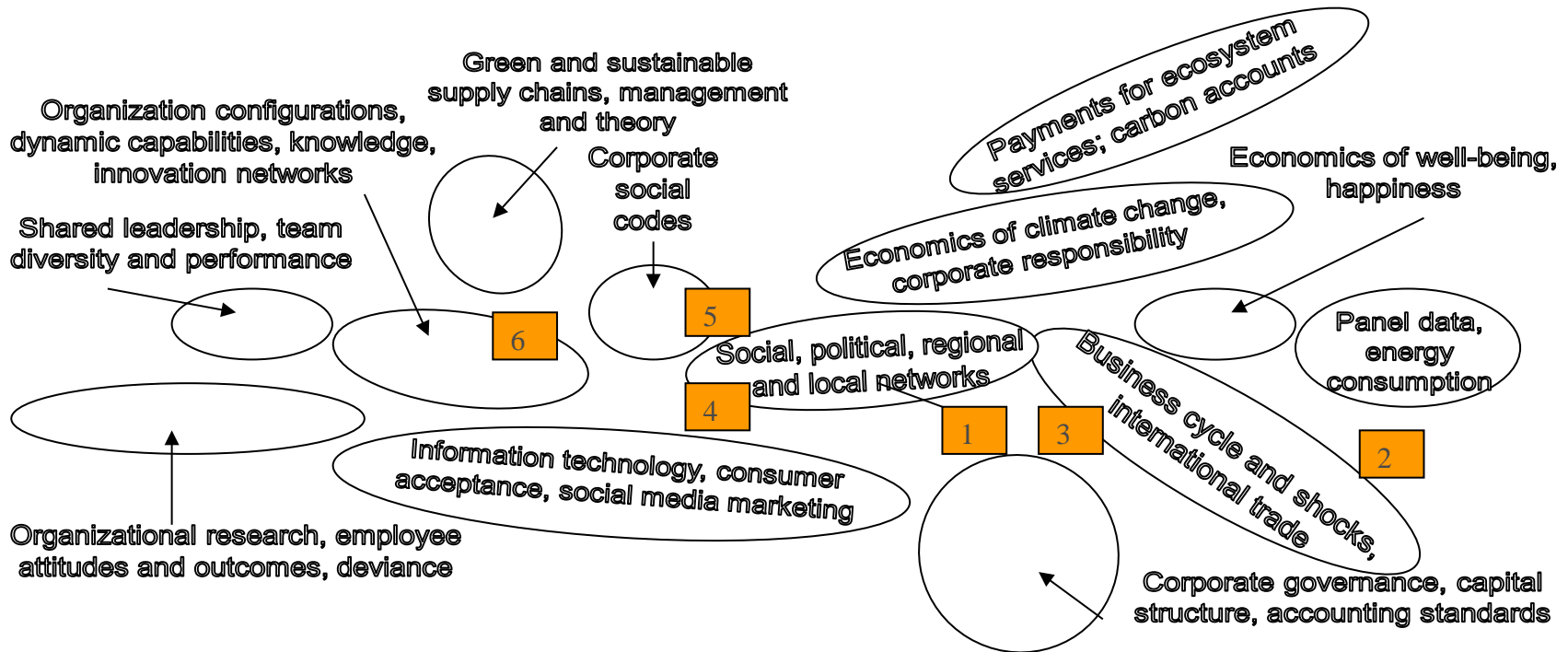
WORLD: Economics and Business, 2007-2011

Clusters created by bibliographic coupling



WORLD: Economics and Business, 2007-2011

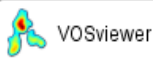
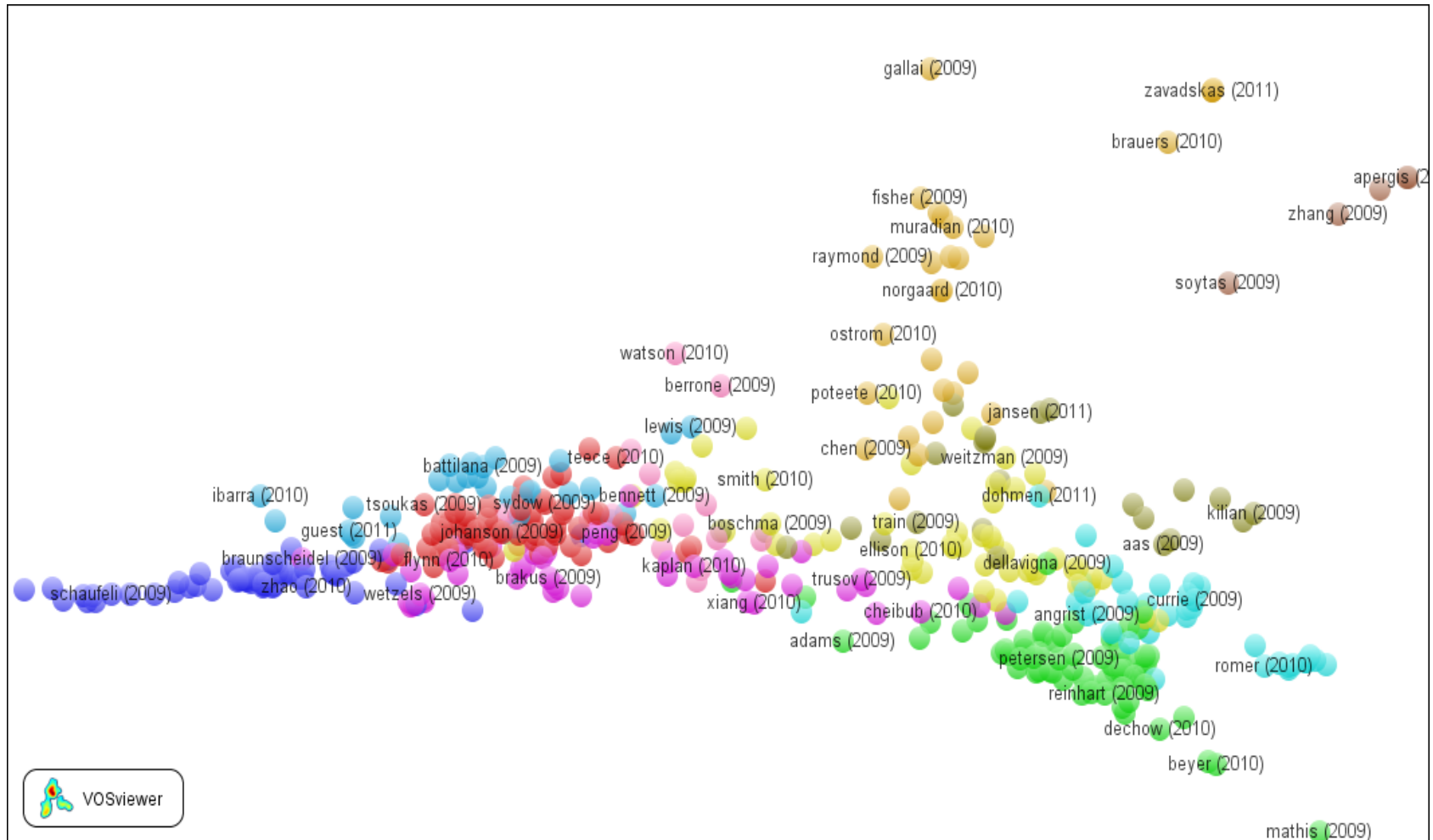
Clusters created by bibliographic coupling



1. J.D. Angrist, J.S. Pischke, *Mostly Harmless Economics: An Empiricist's Companion*, 2009
2. C.M. Reinhart, K.S. Rogoff, *This Time is Different: Eight Centuries of Financial Folly*, 2009
3. G.A. Akerlof, R.J. Shiller, *Animal Spirits: How Human Psychology Drives the Economy*, 2009
4. M.O. Jackson, *Social and Economic Networks*, 2008
5. A.R. Poteete, M.A. Janssen, E. Ostrom, *Working Together: Collective Action, the Commons, and Multiple Methods in Practice*, 2010
6. T. Bennett, et al., *Culture, Class, Distinction*, 2009

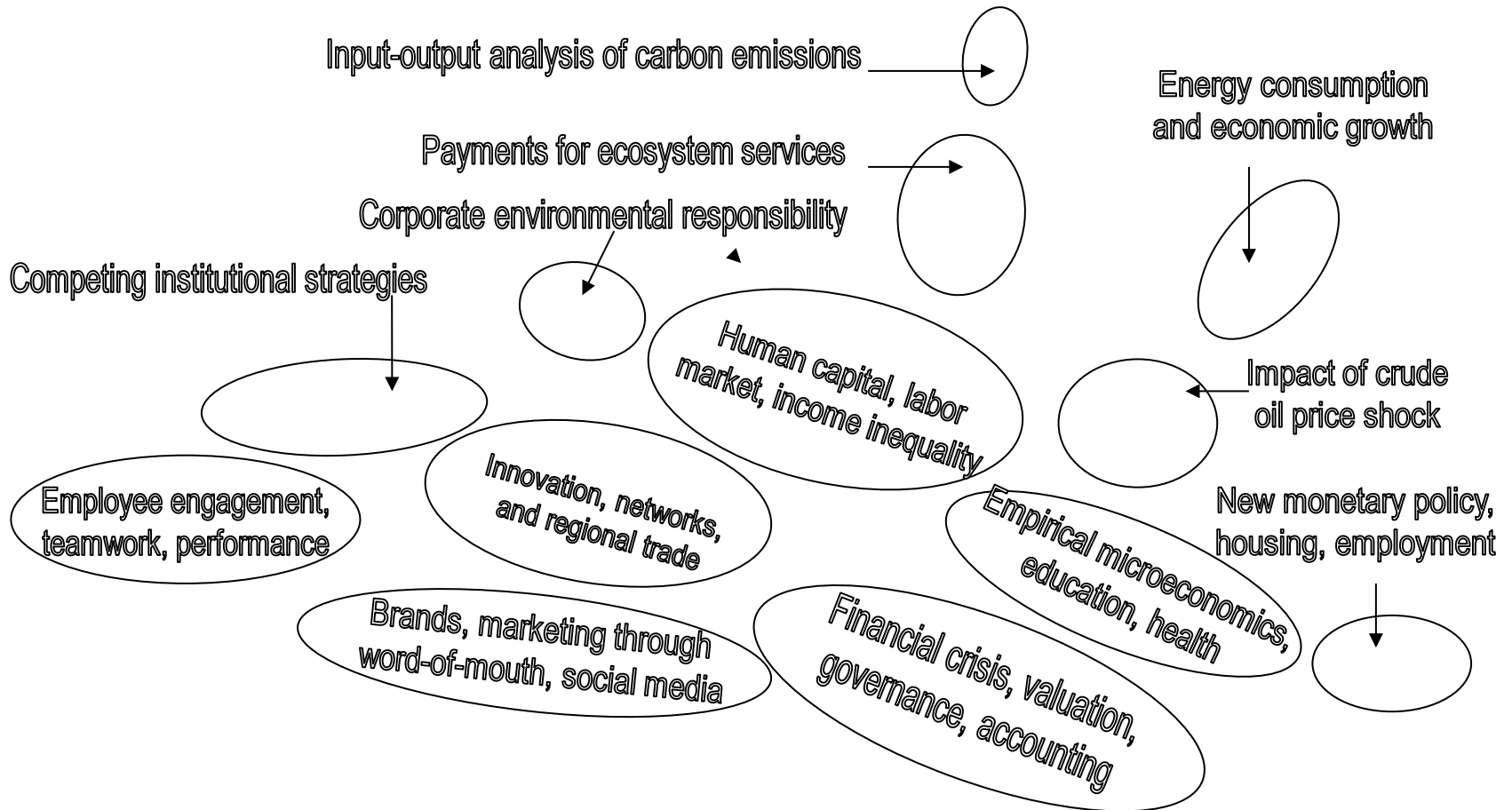
WORLD: Economics and Business, 2009-2013

Clusters created by bibliographic coupling



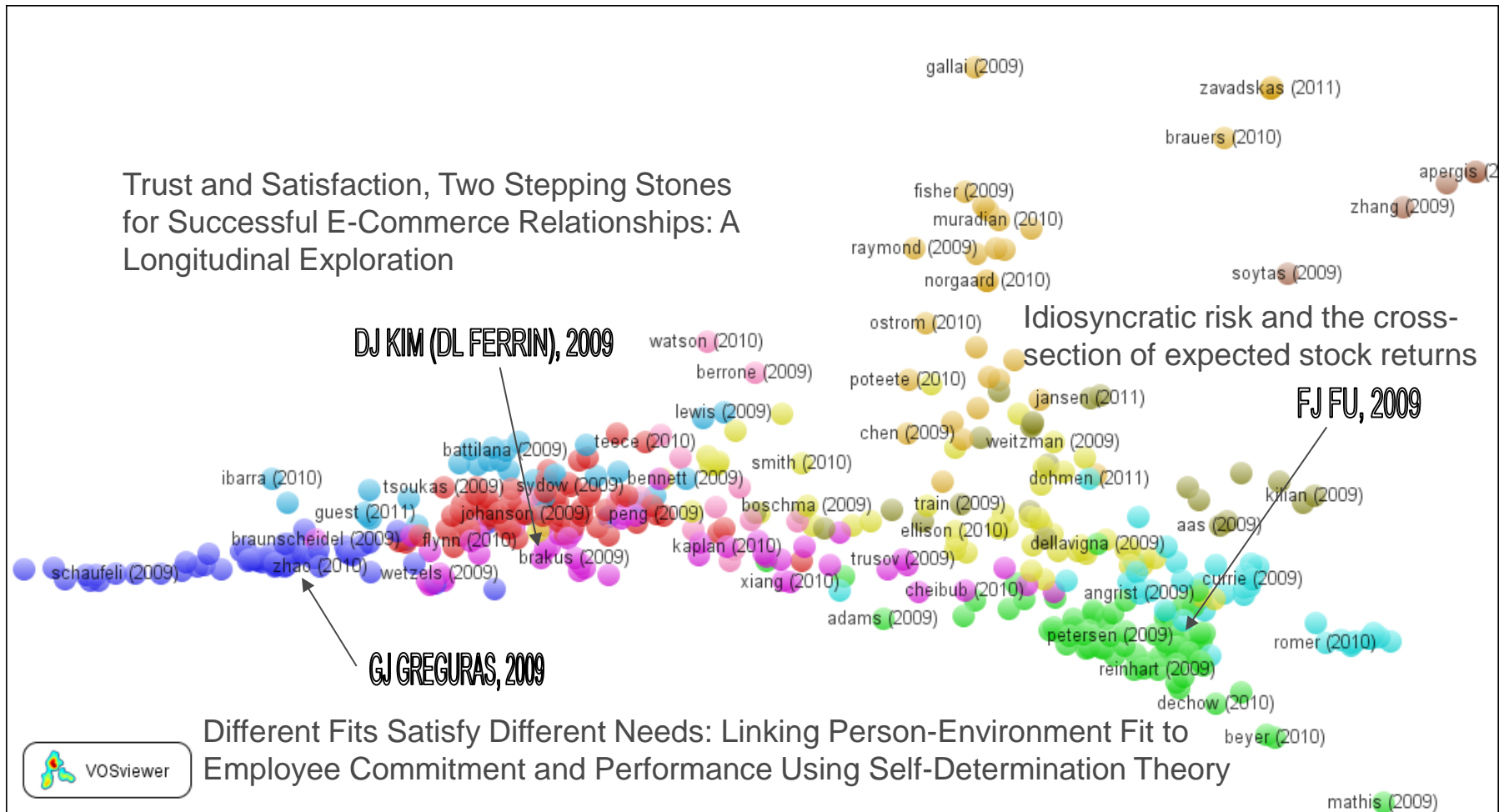
WORLD: Economics and Business, 2009-2013

Clusters created by bibliographic coupling



WORLD: Economics and Business, 2009-2013

Clusters created by bibliographic coupling



Science Maps for Science Policy and Research Management: Uses for Monitoring, Planning

An analyst can explore research fronts to:

- Show where in the map a nation, institution, research group or individual is active and to reveal the status of the actors according to measures that characterize their importance (output, impact, associations)
- Identify emerging, growing, and 'hot' areas with relevance to a research program or portfolio; check whether or not researchers of a nation or an institution are present
- Inform strategies in research policy and planning, such as targeting potential collaborators or focusing on an interdisciplinary area that appears to be forming from separate research fronts, one that may benefit from special funding
- However, the data and maps are *descriptive, not prescriptive*, and require interpretation to contribute meaningful results

Summary Points

- Using bibliometric data to create maps of the socio-cognitive structure and dynamics of research has come of age in the last decade and this offers policymakers, funders, and managers new tools to support decisions about allocating research resources
- Research in the social sciences (and humanities) can, to varying degrees, be treated in a manner similar to the natural sciences ***if and only if*** special efforts are made to extend the types of publication outputs considered, to appreciate the different nature of scholarly discourse (including citations) of the social sciences from the sciences, and to recognize the broader research goals of many social scientists
- In all cases, quantitative analysis using bibliometrics ***should*** be coupled with the qualitative expert knowledge and interpretation of researchers themselves in order to yield valid conclusions upon which to base policy, funding, and management decisions

Suggested Reading on Science Mapping

Katy Börner, *Atlas of Science: Visualizing What We Know*, MIT Press, 2010

Katy Börner, Richard Klavans, Michael Patek, Angela M. Zoss, Joseph R. Biberstine, Robert P. Light, Vincent Larivière, and Kevin W. Boyack, “Design and Update of a Classification System: The UCSD Map of Science,” *PLoS ONE*, 7 (7): e39464, 2012

Chaomei Chen, *Mapping Science Frontiers: The Quest for Knowledge Visualization*, 2nd edition, Springer, 2013

Nicola de Bellis, *Bibliometrics and Citation Analysis: From the Science Citation Index to Cybermetrics*, Chapter 5, pp. 141-179, Scarecrow Press, 2009

Andrea Scharnhorst, Katy Börner, Peter van den Besselaar, eds., *Models of Science Dynamics: Between Complexity Theory and Information Sciences*, Springer, 2012

Henry Small, “Visualizing Science by Citation Mapping,” *Journal of the American Society for Information Science and Technology*, 50 (9): 799-813, 1999

Henry Small, “Paradigms, Citations, and Maps of Science: A Personal History,” *Journal of the American Society for Information Science and Technology*, 54 (5): 394-399, 2003

Benjamin Vargas-Quesada and Félix de Moya Anegón, *Visualizing the Structure of Science*, Springer, 2007

Suggested Reading on Bibliometrics and the Social Sciences and Humanities

Éric Archambault and Vincent Lavrière, “The Limits of Bibliometrics for the Analysis of Social Sciences and Humanities Literature,” in *World Social Science Report*, UNESCO, 2010, pp. 251-254

Éric Archambault and Étienne Vignola Gagné, *The Use of Bibliometrics in the Social Sciences and Humanities*, Science-Metrix, 2004

Linda Butler and Martijn Visser, “Extending Citation Analysis to Non-Source Items,” *Scientometrics*, 66 (2): 327-343, 2006

Diana Hicks, “The Four Literatures of Social Science,” in H.F. Moed, W. Glänzel, U. Schmoch, *Handbook of Quantitative Science and Technology Research*, Chapter 21, pp. 473-496, Kluwer, 2004

Henk F. Moed, *Citation Analysis in Research Evaluation*, Springer, 2005, passim

Anton J. Nederhof, Thed N. van Leeuwen, and Robert J.W. Tijssen, *International Benchmarking and Bibliometric Monitoring of UK Research Performance in the Social Sciences*, CWTS Report for the UK Economic and Social Research Council, 2004

Anton J. Nederhof, “Bibliometric Monitoring of Research Performance in the Social Sciences and Humanities: a Review” *Scientometrics*, 66 (1): 81-100, 2006

Anton J. Nederhof, Thed N. van Leeuwen, and Anthony F.J. van Raan, “Highly Cited Non-Journal Publications in Political Science, Economics and Psychology: a First Exploration,” *Scientometrics*, 83 (2): 363-374, 2010

Suggested Reading on Use of Bibliometric Maps for Research Policy, Funding, and Management

Kevin W. Boyack, Brian N. Wylie, and George S. Davidson, "Domain Visualization Using VxInsight for Science and Technology Management," *Journal of the American Society for Information Science and Technology*, 53 (9): 764-774, 2003

Chris W. Belter, "A Bibliometric Analysis of NOAA's Office of Ocean Exploration and Research," *Scientometrics*, 95 (2): 629-644, 2013

Peter Ingwersen, Birger Larsen, and Ed Noyons, "Mapping National Research Profiles in Social Science Disciplines," *Journal of Documentation*, 57 (6): 715-740, 2001

Ed C.M. Noyons, *Bibliometric Mapping as a Science Policy and Research Management Tool*, DSWO Press, 1999

Ed C.M. Noyons, "Bibliometric Mapping of Science in a Science Policy Context," *Scientometrics*, 50 (1): 83-98, 2001

Ed C.M. Noyons, "Science Maps within a Science Policy Context," in H.F. Moed, W. Glänzel, U. Schmoch, *Handbook of Quantitative Science and Technology Research*, Chapter 10, pp. 237-255, Kluwer, 2004

Ed C.M. Noyons and Clara Calero-Medina, "Applying Bibliometric Mapping in a High Level Science Policy Context," *Scientometrics*, 79 (2): 261-275, 2009

Ismael Rafols, Alan L. Porter, Loet Leydesdorff, "Science Overlay Maps: A New Tool for Research Policy and Library Management," *Journal of the American Society for Information Science and Technology*, 61 (9): 1871-1887, 2010



THANK YOU

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