



Beyond scientific impact

Evolving frameworks and novel methods in scientometrics

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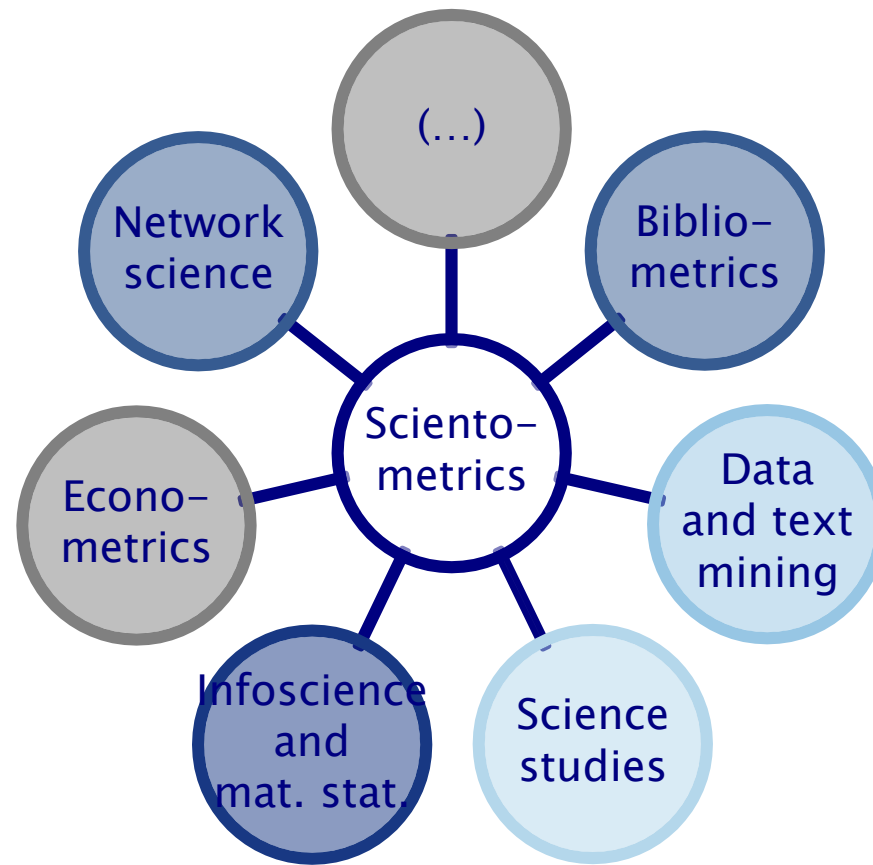


Scientometrics and research evaluation

- Three common misperceptions:
 - Scientometrics is publication statistics (science administration's view)
 - Scientometrics is exclusively concerned with the measurement of scientific performance (researcher's view)
 - Scientometrics is a form of research evaluation (policy maker's view)

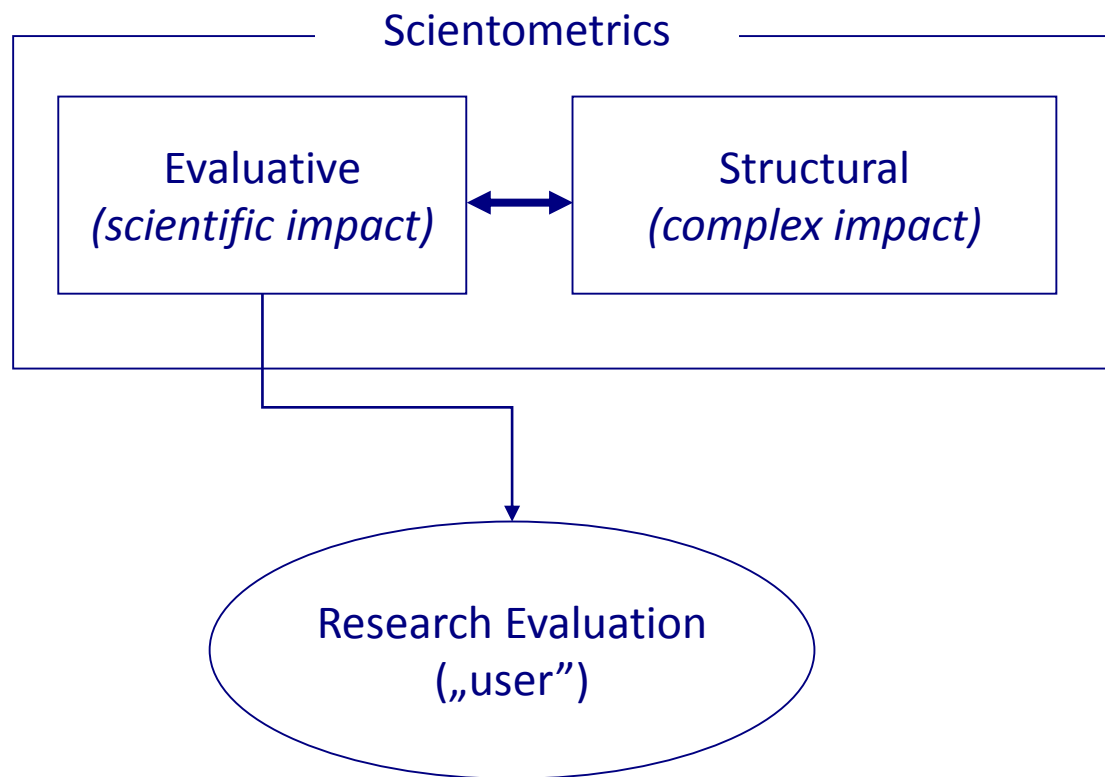


Scientometrics and research evaluation





Scientometrics and research evaluation





Paradigm change?

- „Is there currently a scientific revolution in scientometrics?”

Lutz Bornmann, forthcoming in JASIST

„One of the key terms in scientometrics is **scientific impact** which nowadays is understood to mean not only the impact on science but the impact on every area of society”



Running examples of addressing broad impact

The screenshot shows the homepage of the SISOB website. At the top left is the SISOB logo, which consists of the letters 'SISOB' in a stylized, purple, blocky font with a green dot above the 'S'. Below the logo are two green buttons labeled 'LOGIN' and 'SEARCH'. To the right of the logo is a large purple rectangular box with white text that reads 'An Observatorium for Science in Society based in Social Models'. Below this box is a horizontal row of eight small orange squares, each containing a number from 1 to 8. The main content area is divided into three columns. The first column is titled 'THE PROJECT' and contains a bulleted list of links: 'About SISOB', 'Objectives', 'Case studies', 'Workpackages', 'Workplan', 'Project meetings', 'Confluence', and 'JIRA'. The second column is titled 'THE CONSORTIUM' and contains a bulleted list of member organizations: 'Universidad de Málaga (UMA)', 'Economy, Innovation and Science Regional Ministry of Andalusia (CICE)', 'Universität Duisburg-Essen (UDE)', 'Institute for Research Organization, Hungarian Academy of Sciences (MTA KSZI)', 'Frontiers Research Foundation (FrontiersIn)', 'Fondazione Rosselli (FR)', and 'Red de Indicadores de Ciencia y Tecnología (RICYT)'. The third column is titled 'THE RESULTS' and contains a bulleted list of outputs: 'Reports', 'SISOB Software', 'Deliverables', 'Publications', 'SISOB Workshop', and 'Visualizations'. At the bottom of the page, there is a navigation bar with the text 'you are here: Home' on the left, a row of social media icons (Twitter, Facebook, YouTube, etc.) in the center, and the date '23-January -2015' on the right. Below the navigation bar is a footer with the text 'SISOB: An Observatorium for Science in Society based in Social Models'.

SISOB

**An Observatorium
for Science in Society
based in Social Models**

THE PROJECT

- About SISOB
- Objectives
- Case studies
- Workpackages
- Workplan
- Project meetings
- Confluence
- JIRA

THE CONSORTIUM

- Universidad de Málaga (UMA)
- Economy, Innovation and Science Regional Ministry of Andalusia (CICE)
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THE RESULTS

- Reports
- SISOB Software
- Deliverables
- Publications
- SISOB Workshop
- Visualizations

you are here: Home

23-January -2015

SISOB: An Observatorium for Science in Society based in Social Models



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Running examples of addressing broad impact

Evaluating the impact and outcomes of European SSH research | Workspace



IMPACT-EV
Evaluating the impact and outcomes of EU SSH research



This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration (FP7/2014-2017) under grant agreement n° 613202.

[About](#) [Approach](#) [Research Team](#) [Outcomes](#) [Share your Impact](#) [Contact](#) 



A group of people are seated around a long table in a meeting room, engaged in a discussion. A whiteboard and a projector screen are visible in the background.

News & Events

[News](#)

[Events](#)

Social Media



Measuring „social” dimensions of scientific impact

- Known unavoidable difficulties in evaluation practice:
 - Causality problem (scientific developments as causal factors)
 - Attribution problem (the role of knowledge production in „complex systems”)
 - Time-scale problem (long-term vs. short-term outcomes)

Ben Martin, SPRU



Direct scientometric approach

- Impact: direct quantification of knowledge flows between within-science and outside-science venues of societal importance
 - Patent references to publications (**economic impact**), patent citation network analysis
 - Collaboration of academic and private sector → InCites™: % of industry co-authorship (**economic impact**)
 - Clinical guidelines based on medical research results (**social impact: life quality**)
 - Policy document and legislation referring to social science research and results (**SSH impact on policy making**) → IMPACT-EV baselines
 - Research affecting the public discourse, on-line social venues, Webometrics, ALTMETRICS → SISOB „Knowledge Sharing” (**societal impact**)

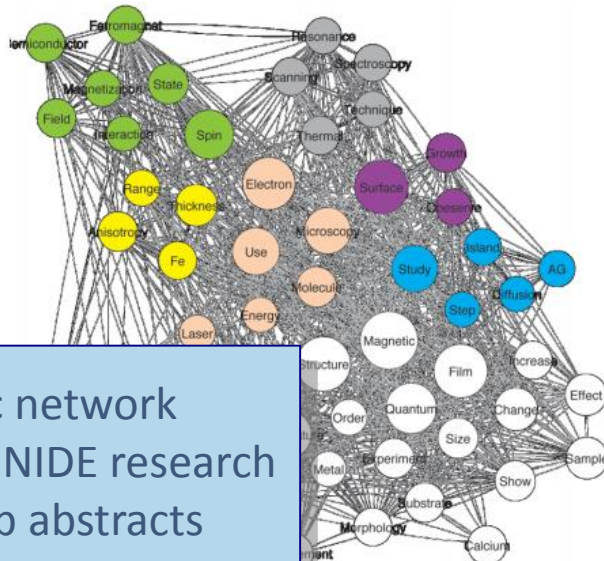


Direct scientometric approach

- Problems with direct approaches:
 - Narrow operationalization of impact (only direct relations)
 - Use of scientific knowledge is not a priori impact: criticism of patent citation analysis (role of citations is not knowledge utilization, economic value is not attributed to patenting, etc)
 - Data is sporadic (direct references to scholarly venues, e.g. press releases) and noisy (ALTMETRICS, on-line venues)
- **Further step: reconceptualizing the measurement of broad impact...**

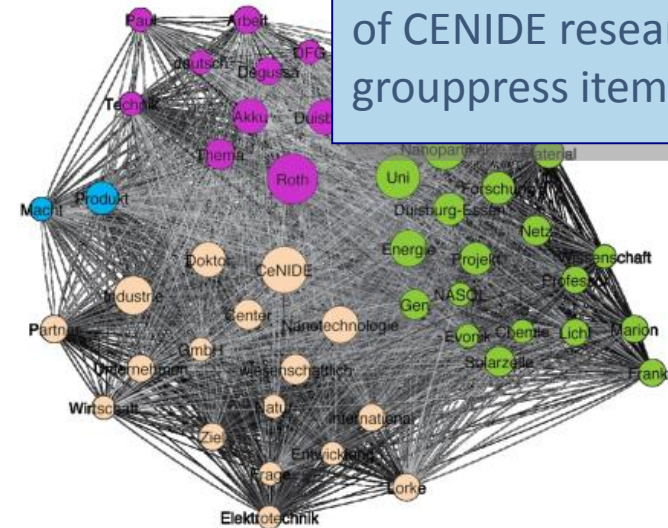
Towards structural approaches

- SISOB and societal impact, „*P-map*“, „*S-map*“ algorithm: Contrasting the scientific and social „relevance“ of research subjects (based on the work of Leydesdorff)



Topic network of CENIDE research group abstracts

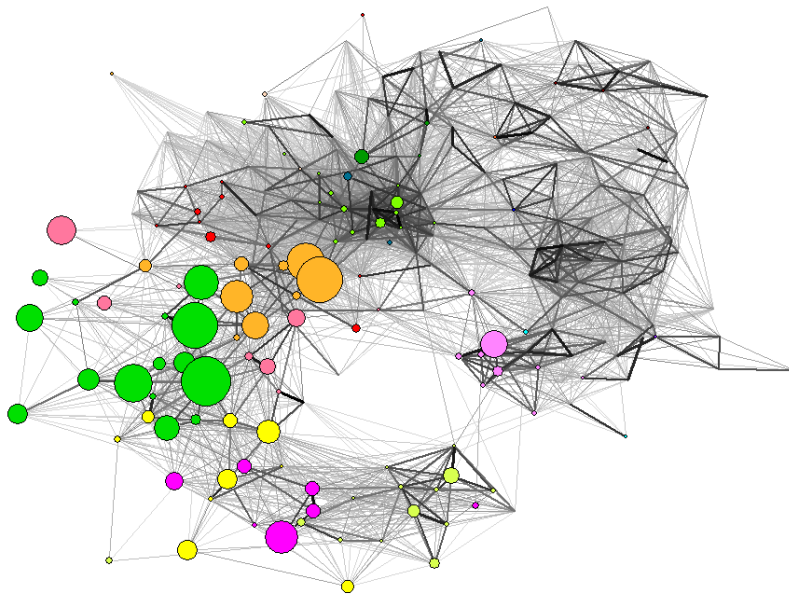
<http://sisob.lcc.uma.es>



Topic network
of CENIDE research
group press items

Structural approach: S&T mapping

- Mapping and measuring the socio-cognitive organization, processes and dynamics in science by analyzing various dimensions of knowledge flow
- Broad impact can be identified, even quantified
- Example: IDR (interdisciplinarity research) and its applications: The overlay technique (Rafols—Leydesdorff)





Structural approach: S&T mapping

- Measuring multi- and interdisciplinarity (IDR) upon this model: the Stirling index
- Novelty: Three structural features accounted for:
 - Number of SCs („variety”)
 - Distribution of pubs over SCs („balance”)

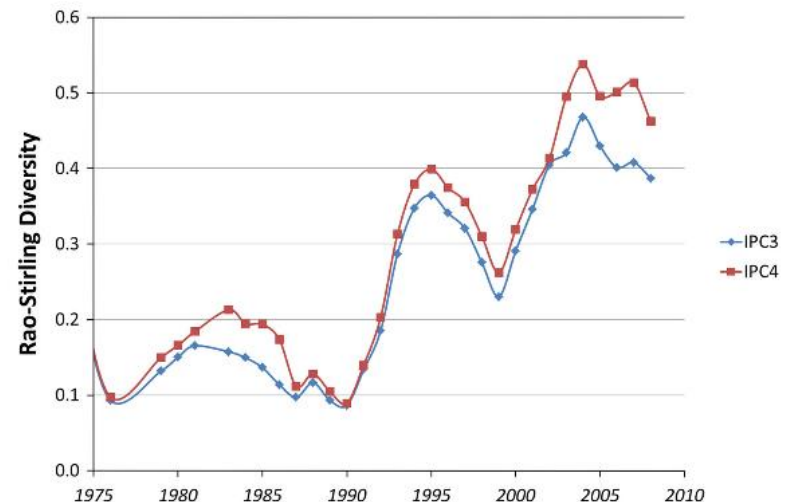
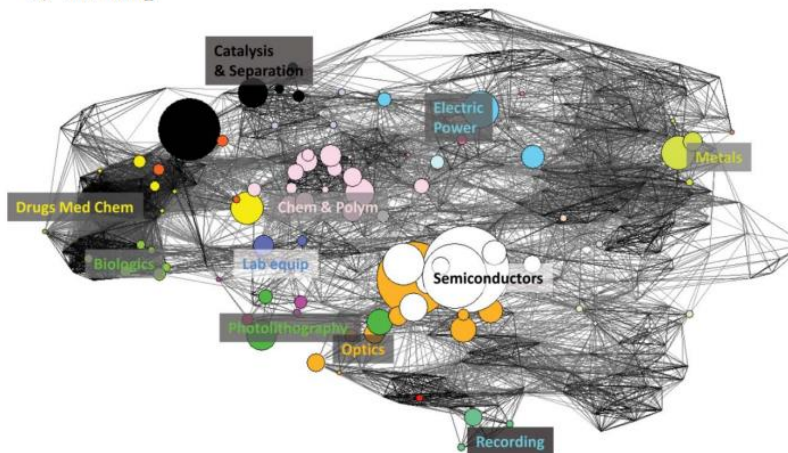
Table 1 *Typology of the Stirling index in measuring research diversity*

	Formula (versions of the generalized Stirling index)	d_{ij}	Underlying science map (level of aggregation)	Measuring diversity of...
1	$\sum_{ij(i \neq j)} d_{ij} p_i p_j$	$1 - s_{ij}$, where $s_{ij} = \cos(i, j)$	Similarity network of (1) journals (2) ISI Subject Categories (based on the cited and citing dimension) Rafols, Meyer, Porter, Leydesdorff	(1) journals, (2) work of researchers, (3) output of organizations
2	$\sum_{ij(i \neq j)} d_{ij}$	g_{ij} shortest path from i to j (# edges)	Similarity network of papers (based on bibliographic coupling) Rafols, Meyer	particular research area

Structural approach: S&T mapping

- Patent overlay mapping (basemap: global proximity network of technology classes, based on aggregate patent citations)
- Benchmarking firms (Rotolo et al. 2014)
- Measuring trends of diversification/specialization in a technological market
- Evaluation may be a result of such a mapping of output contrasted with policy goals for funding schemes

a) Samsung





Structural approach: S&T mapping

- Proposed uses to detect economic/outward impact (under elaboration):
 - Distance within scientific impact profile in terms of applied/application-oriented and basic research fields (shift toward markets)
 - Funding information (especially for FP outputs): distance within scientific profile in terms of funding agencies (competitiveness of science)



Conclusion

- Broad impact measurement is not necessarily different from measuring scientific impact (i.e. citation analysis)
- Structural methods of citation analysis reveal broad impact outside the realm of science
- Large-scale data is available (not only case study fashion)
- A single value measurement should be replaced by structural insights in scientometrics
- Thank you for your attention!