Metrics-Based Research Assessment

Henk F. Moed

Senior Scientific Advisor, Elsevier, Netherlands

Former professor of Research Assessment Methodologies, Leiden University

Vilnius,Lithoania, 19 March 2014

Short CV Henk F. Moed

Years	Position
1981-2009	Staff member at Centre for Science and Technology Studies (CWTS), Leiden Univ.
2009	Professor of Research Assessment Methodologies at Leiden University
2010 – Sept 2012	Elsevier, SciVal Dept. Senior Scientific Advisor
As from Sept 2012	Elsevier, AGRM Dept. Head of Informetric Research Group
As from July 2014	Elsevier (2 days/week) and visiting professor at academic institutions

Contents

1	Metrics: Potentialities and limitations
2	Multi-dimensional Research Assessment
3	Informetrics as Big Data Science

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2	Multi-dimensional Research Assessment
3	Informetrics as Big Data Science

USA

Main collaborators
UK
China
Germany
Canada

Brazil

Main collaborators
Argentina
USA
Portugal
France
Chile

Malaysia

Main collaborators
Thailand
India
Singapore
Iran
UK

Romania

Main collaborators
France
Hungary
Germany
Italy
Bulgaria

South Africa

Main collaborators
UK
China
USA
Nigeria
Australia
Netherlands

Valuable notions and distinctions

- Data accuracy is crucial
- Use data verified by authors themselves
- Combine metrics and expert knowledge
- Impact factors are no substitutes of actual impact
- Use multiple indicators
- Take into account pros and cons of each indicator
- Take into account researchers' career phase
- Take into account unintended effects

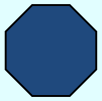
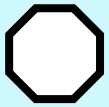
1.

Journal metrics are manipulable and should account for 'free' citations and editorial self-citations

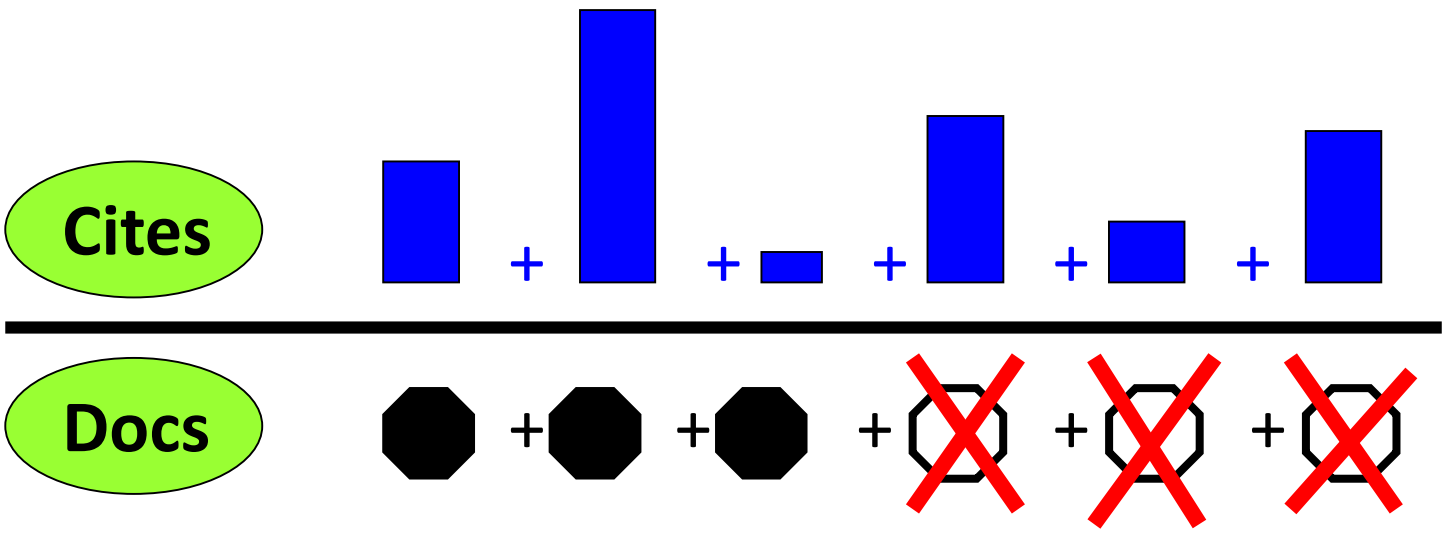
Base journal metric

$$\frac{\text{Citations to all docs}}{\text{\# Citable docs}}$$

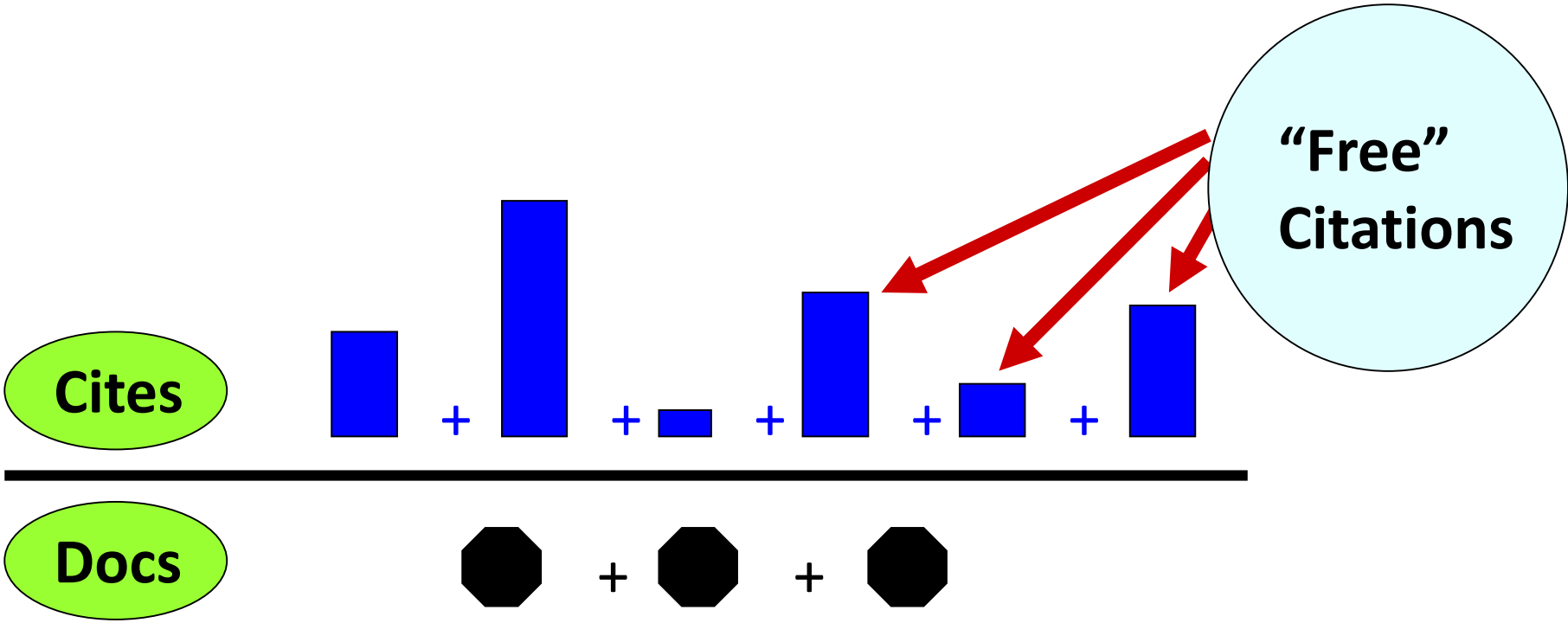
Citable vs. non-citable docs

Citable documents	“non-citable” documents
	
Articles	Letters
Reviews	Editorials
	Discussion papers

The problem of “free” citations - 1



The problem of “free” citations - 2



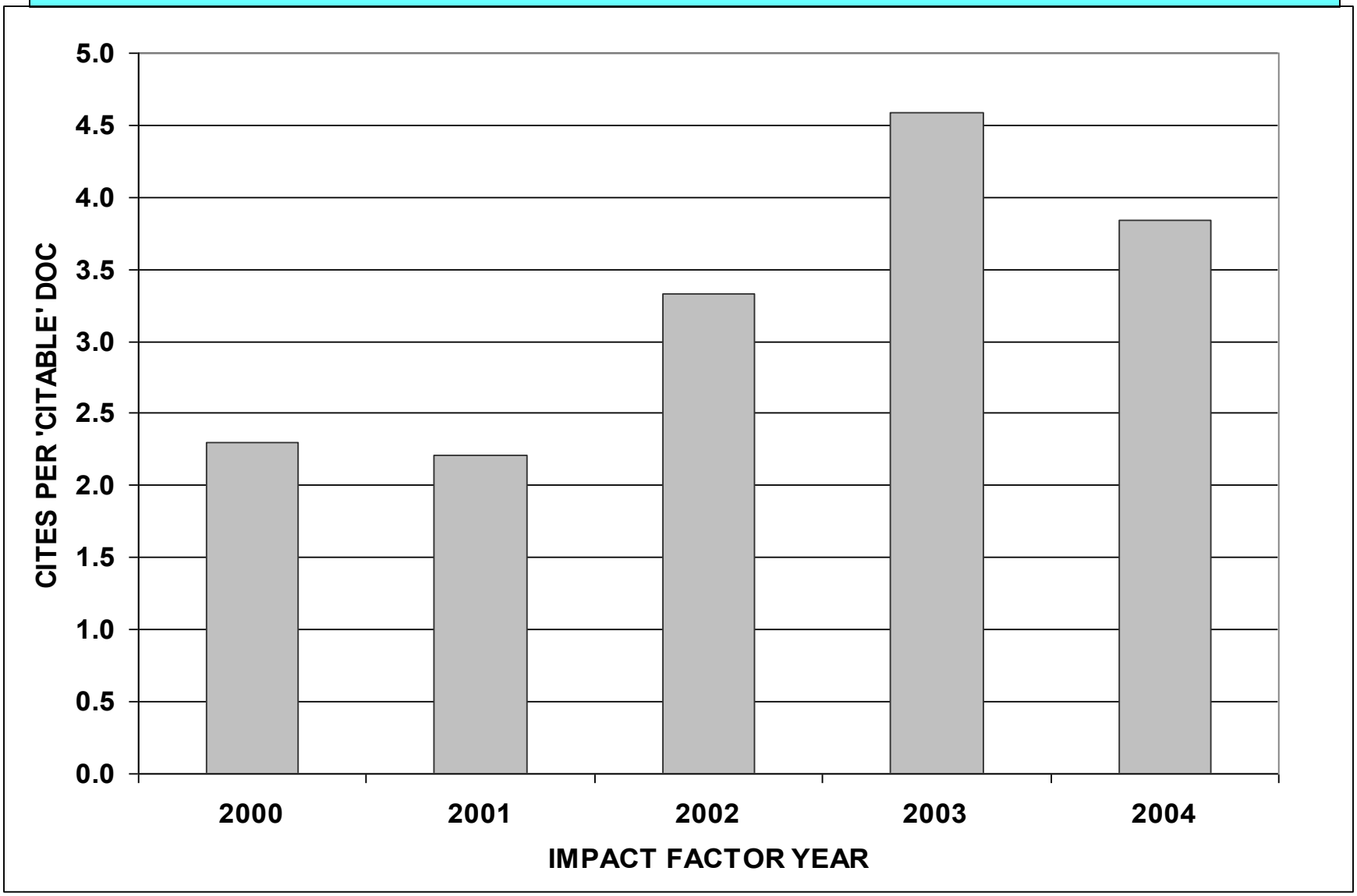
Effects of editorial self-citations upon journal impact factors

[Reedijk & Moed, J. Doc., 2008]

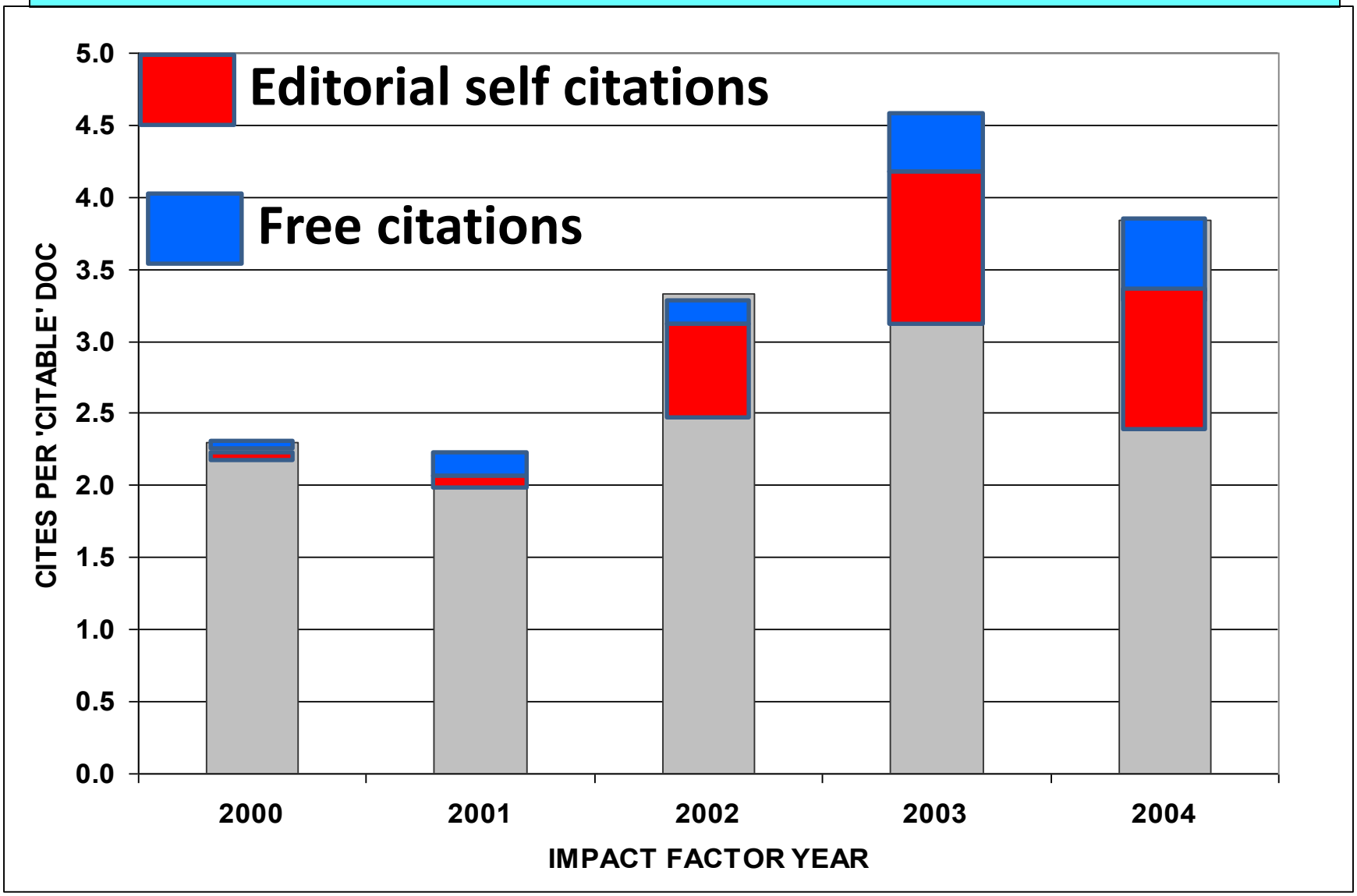
- **Editorial self-citations: A journal editor cites in his editorials papers published in his own journal**
- **Focus on 'consequences' rather than 'motives'**

Case: ISI/JCR Impact Factor of a Gerontology Journal

(published in the journal itself)



Decomposition of the IF of a Gerontology journal



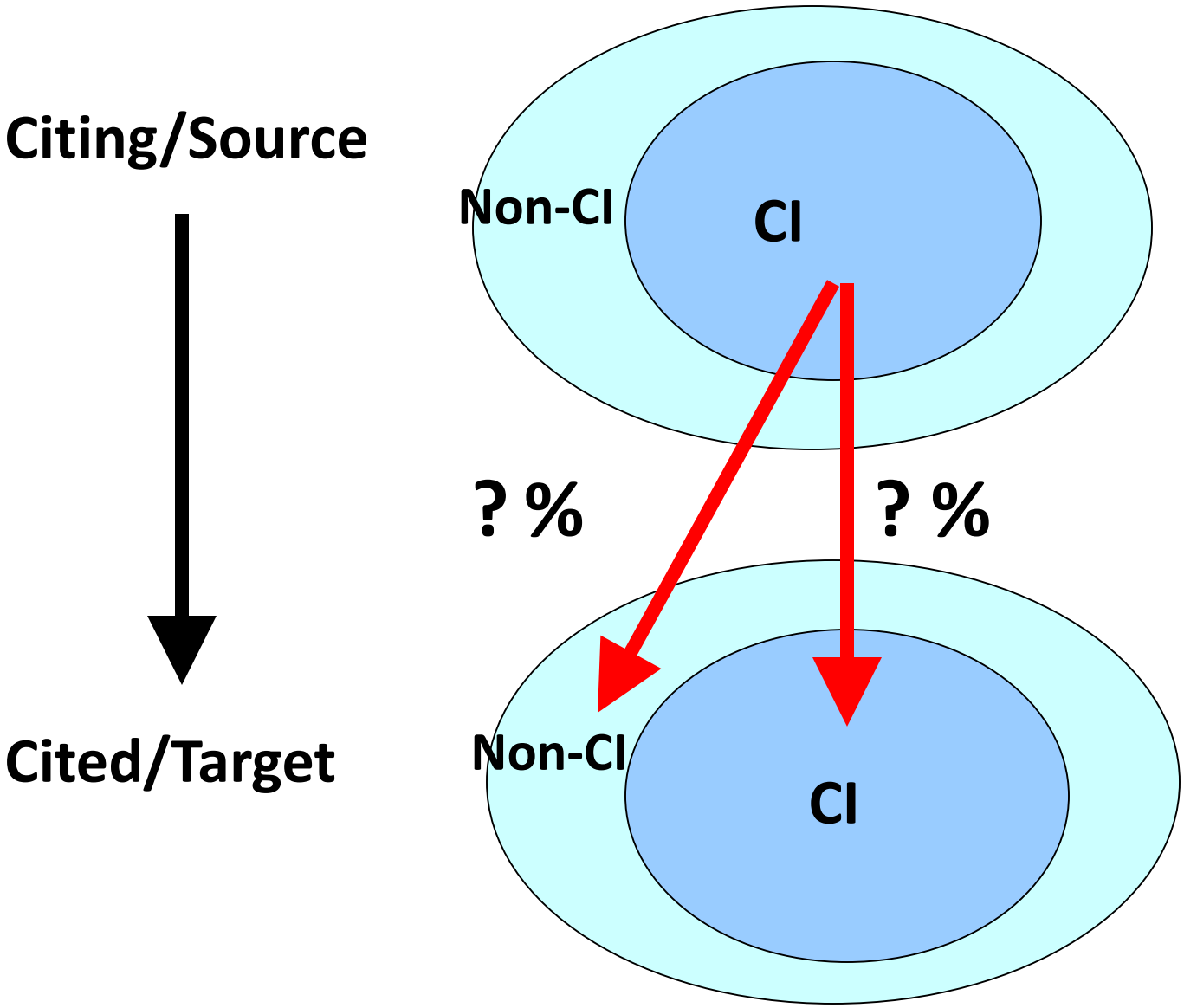
2.

Differences exist in

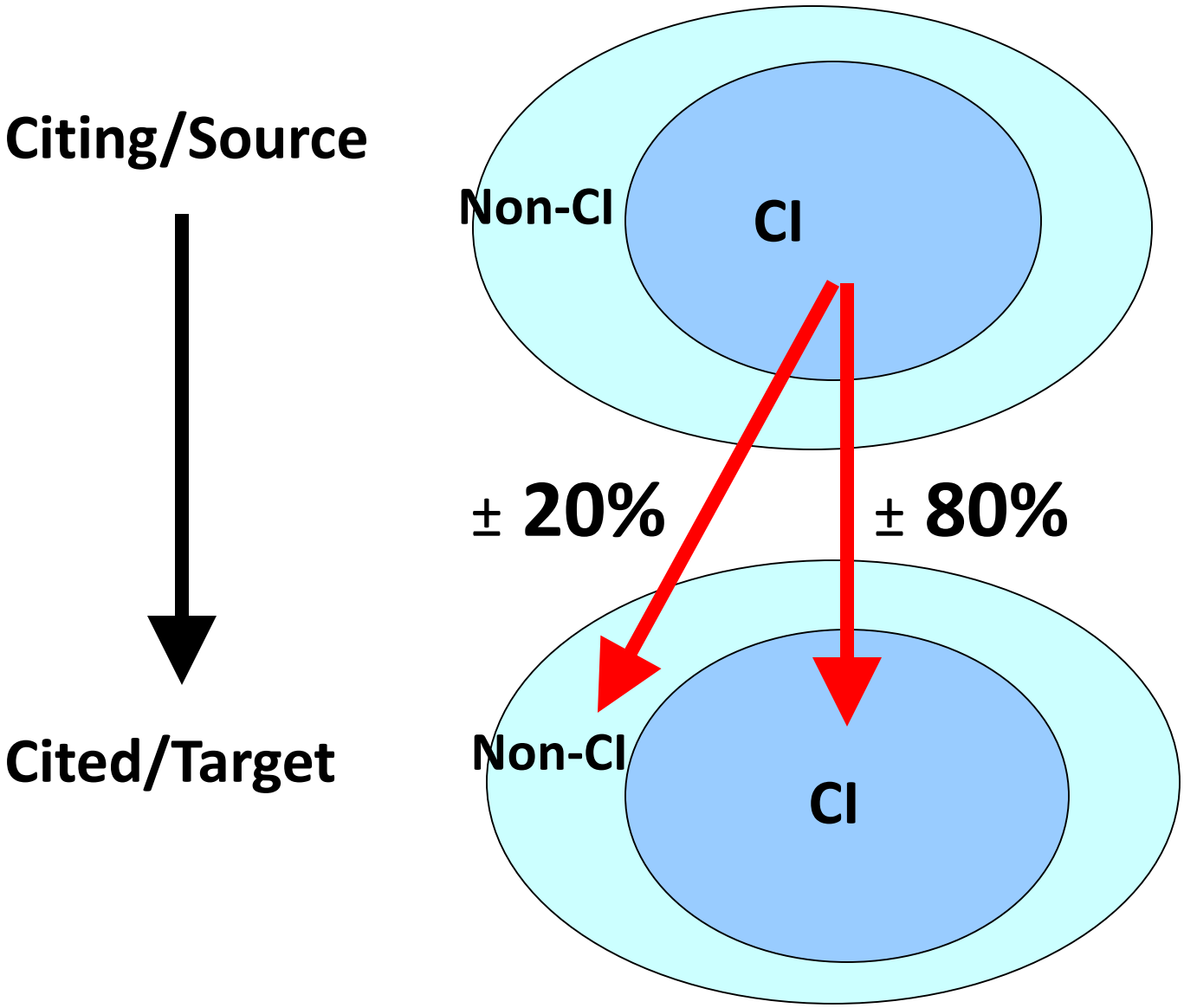
database coverage

between subject fields

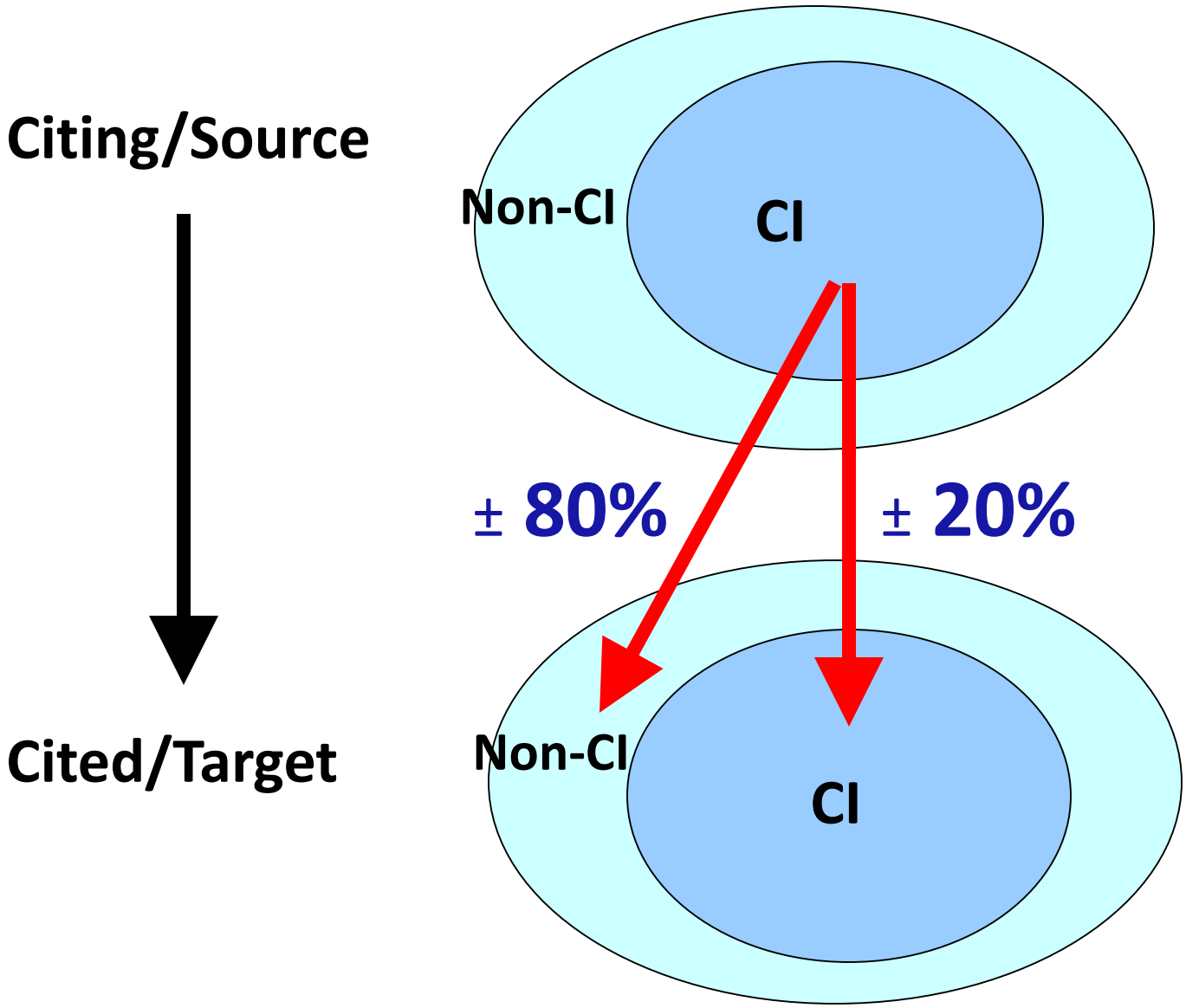
Coverage of journal-based citation index (CI)



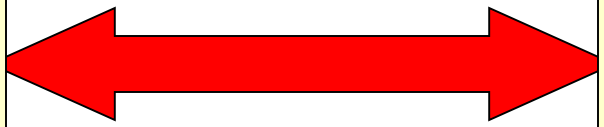
Science



Humanities



CI coverage by field

Journals  Books, proceedings

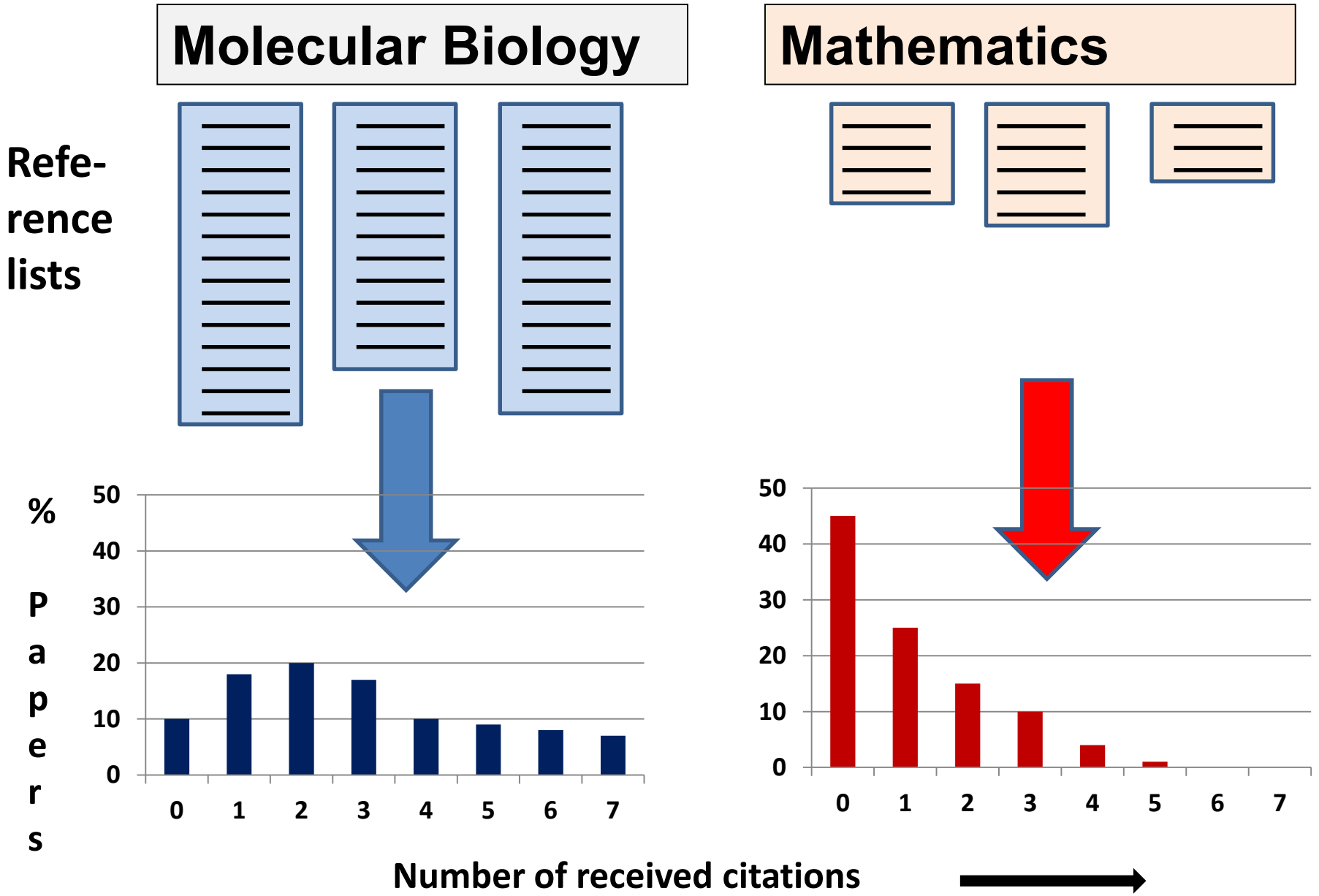
EXCELLENT (>80%)	GOOD (60-80%)	FAIR (40-60%)	MODERATE (<40%)
Biochem & Mol Biol	Appl Phys & Chem	Mathematics	Other Soc Sci
Biol Sci – Humans	Biol Sci – Anim & Plants	Economics	Humanities & Arts
Chemistry	Psychol & Psychiat	Engineering	
Clin Medicine	Geosciences		
Phys & Astron	Soc Sci ~ Medicine		

3.

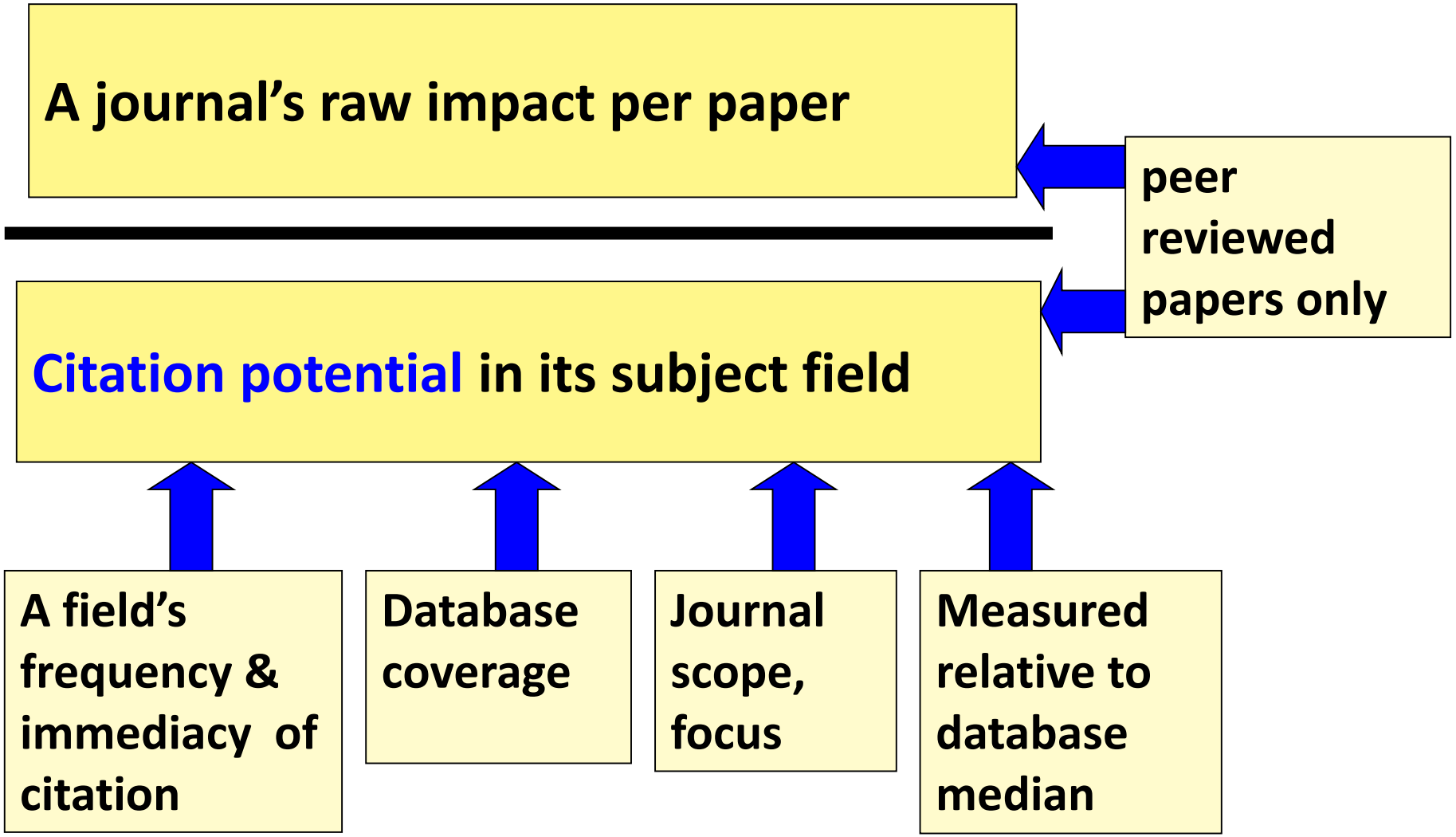
There are alternatives to the journal impact factor:

SNIP; SJR

Differences in citation potential between fields



SNIP (source-normalized impact per paper)



Example 1 : Molec Biol vs. Mathematics

Journal	*RIP*	*Cit Pot*	*SNIP (= JIF/ Cit Pot)*
INVENT MATH	1.5	0.4	3.8
MOLEC CELL	13.0	3.2	4.0

4.

One must be cautious using "social benefit" as an assessment criterion of basic research, as it can not be measured in a politically neutral way

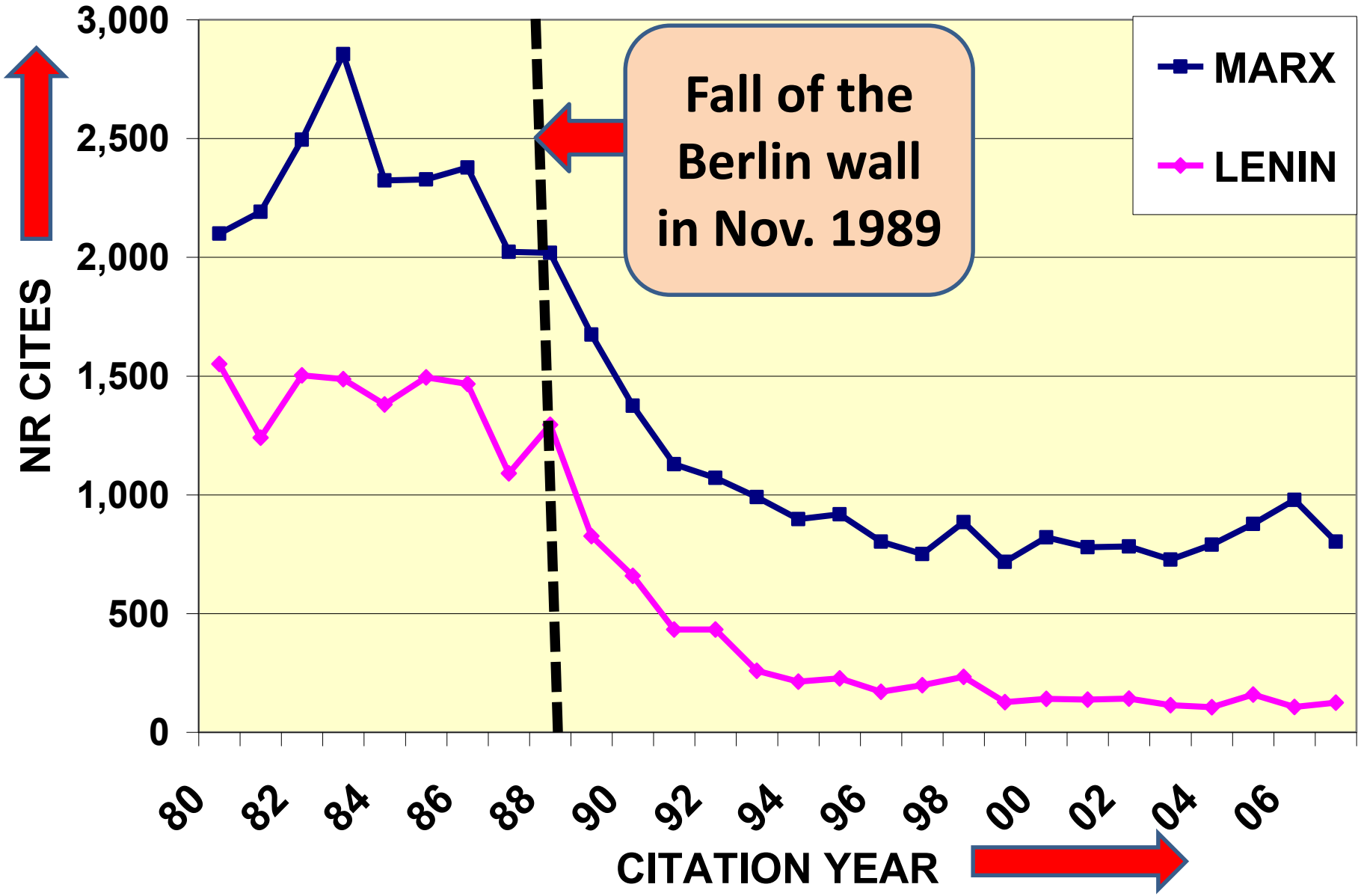
5.

Citations measure scientific-scholarly impact rather than quality or validity

6.

Citation counts in social sciences and humanities may be influenced by political ideologies

Citation impact and ideology

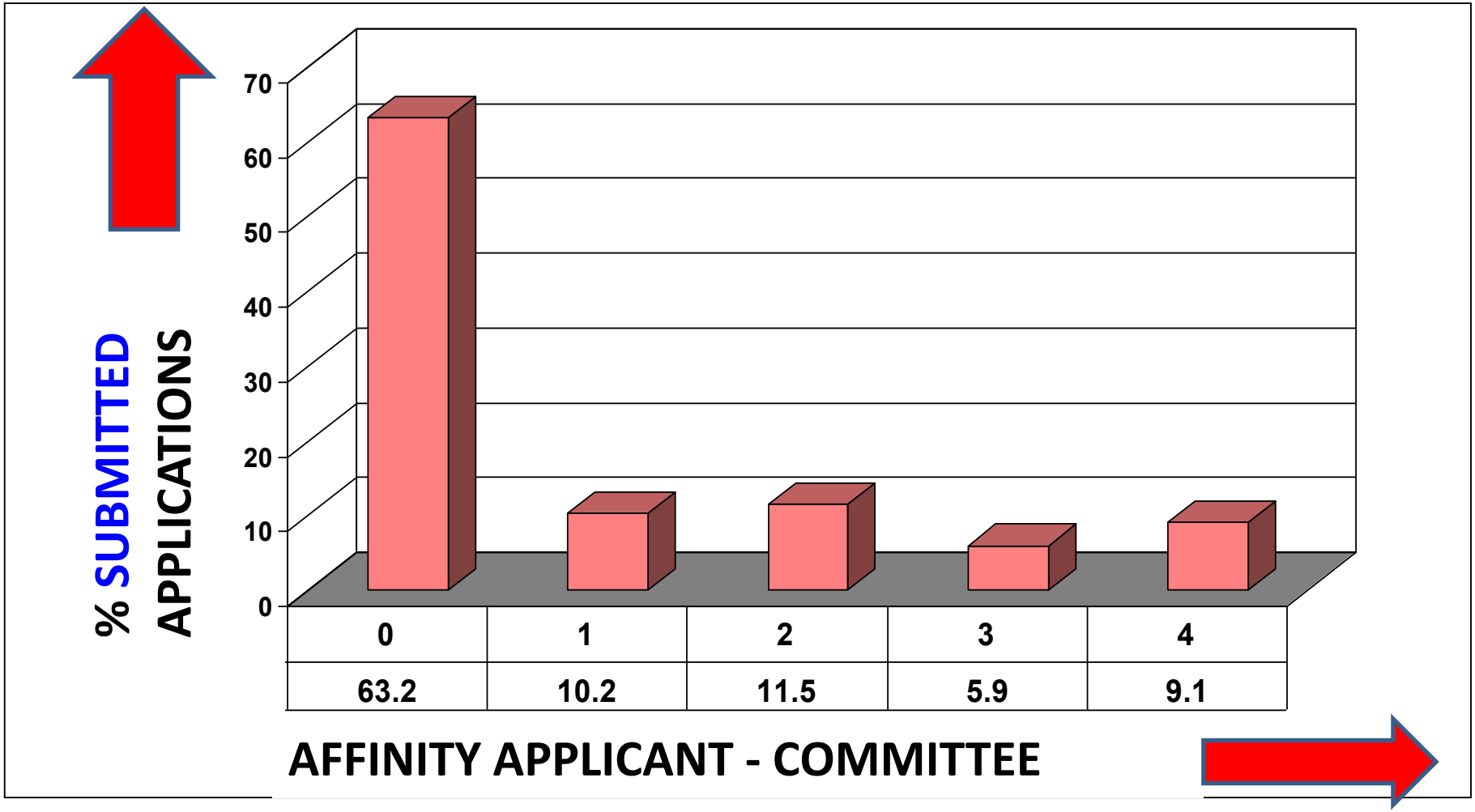


7.
Case study on funding policies of a National Research Council reveals: biases in peer review

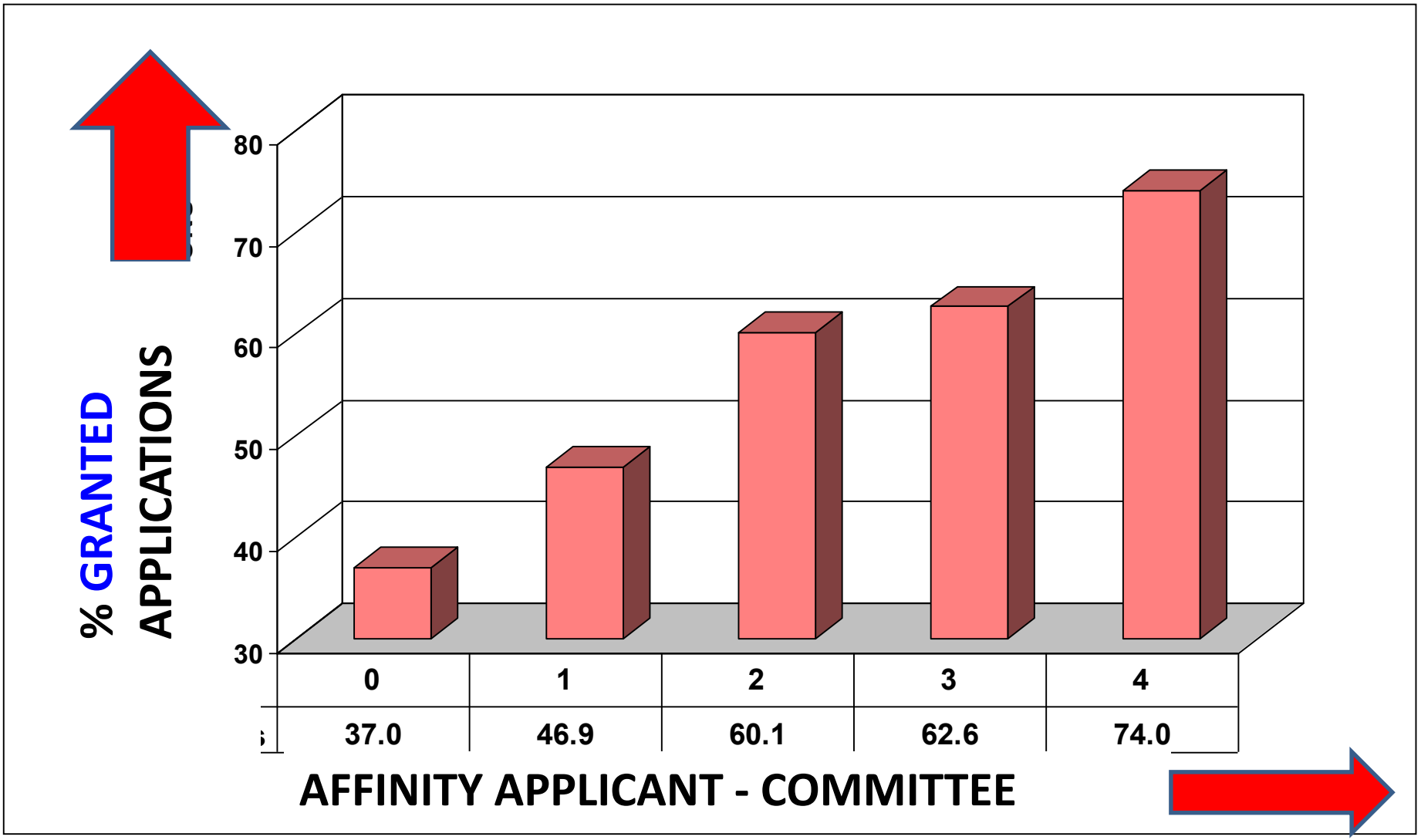
Affinity Applicants – Evaluation Committee

0	Applicants are/were **not** member of **any** Committee
1	***Co-***applicant is/was member of a Committee, but **not** of the one evaluating
2	***First*** applicant is/was member of a Committee, but **not** of the one evaluating
3	***Co-***applicant is member of the Committee(s) evaluating the proposal
4	***First*** applicant is member of the Committee(s) evaluating the proposal

For 15 % of SUBMITTED applications an applicant is a member of the evaluating Committee (Affinity=3, 4)



Probability to be granted increases with increasing affinity applicants-Committee



Logistic regression analysis:

Affinity Applicant-Committee has a significant effect upon the probability to be granted

MAXIMUM-LIKELIHOOD ANALYSIS-OF-VARIANCE TABLE (N=2,499)

Source	DF	Chi-Square	Prob	
INTERCEPT	1	18.47	0.0000	
CITATION IMPACT APPLICANT	3	26.97	0.0000	**
Rel transdisc impact applicant	1	0.29	0.5926	
AFFINITY APPLICANT-COMMITTEE	2	112.50	0.0000	**
Sum requested	1	45.47	0.0000	**
Institution applicant	4	25.94	0.0000	**
LIKELIHOOD RATIO	199	230.23	0.0638	

8.

The future of research assessment lies in the intelligent combination of metrics and peer review

9.

Data must be accurate and verifiable

Contents

1	Metrics: Potentialities and limitations
2	**Multi-dimensional Research Assessment**
3	Informetrics as Big Data Science

The Multi-Dimensional Research Assessment Matrix

Expert Group on the Assessment of University-Based Research (AUBR, 2010)

Multi-dimensional Research Assessment Matrix (Part)

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 multi-discipl. research	Innovation and social benefit	Actual citation impact	Invitations for conferences
Institution	Increase regional engagement	Sustainabi-lity & Scale	Internat. co-authorship	External research income
Research field	Promotion, hiring	Research infrastruct.	citation 'prestige'	PhD com-pletion rates

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Read column-wise

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Indicators that are appropriate in one context may be useless or invalid in another

The choice of indicators depends upon:

- **What units are to be assessed**
- **Which aspect is being assessed?**
- **Why is the assessment done?**
- **“Meta” assumptions on the state of the system under assessment**

Illustration:

Three cases

CASE 1 [My view: non-defensible use]

Meta level : Policy issue

Recruitment of new researchers at research universities

Policy measure

Select the best researchers

Bibliometric operationali-zation

Rank researchers by average impact factor of journals in which they published and select nr. 1

CASE 2 [My view: defensible use]

Meta level : Policy issue	**Research community is not sufficiently oriented toward international networks**
Policy measure	**Stimulate publication in good international journals**
Bibliometric operationali-zation	**Count and reward articles in the first impact quartile of journals in subject field**

CASE 3 [My view: Defensible use]

Meta level : Policy issue	**Professors are legally bound to do research but many of them are not research active**
Policy measure	**Allow only research active professors to decide on recruitment of new research staff**
Bibliometric operationali-zation	**Select only professors with >= 3 publications in 7 years in recruitment committees**

Wider issues

- Change an assessment method every 5-10 years?
- Focus on top or on bottom of quality distribution?
- What is an acceptable “error rate”?
- Wrong in individual cases ⇔ benificiary for the system as a whole

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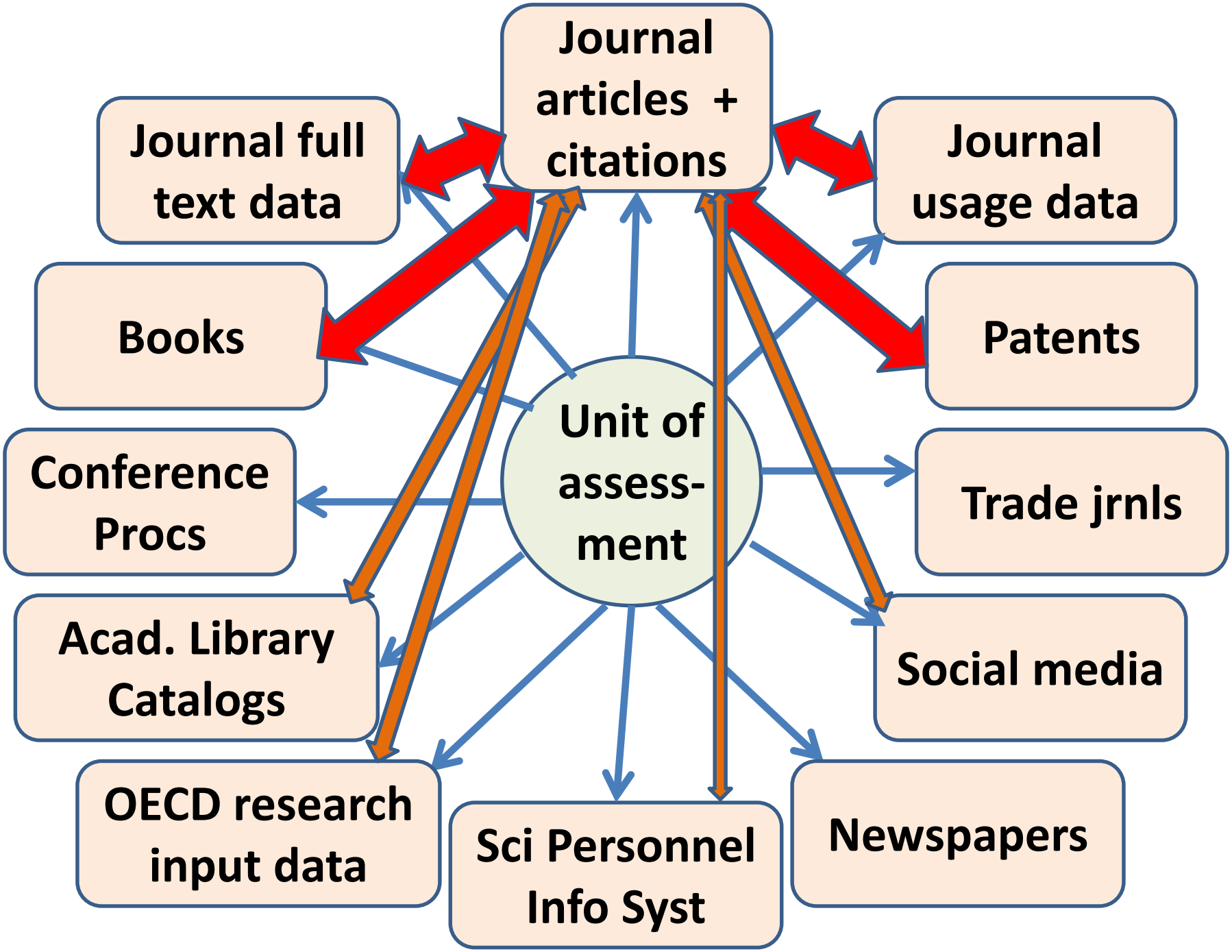

Journal articles + citations
Journal full text data
Journal usage data
Books
Patents
Unit of assess-ment
Conference Procs
Trade jrnls
Acad. Library Catalogs
Social media
OECD research input data
Sci Personnel Info Syst
Newspapers

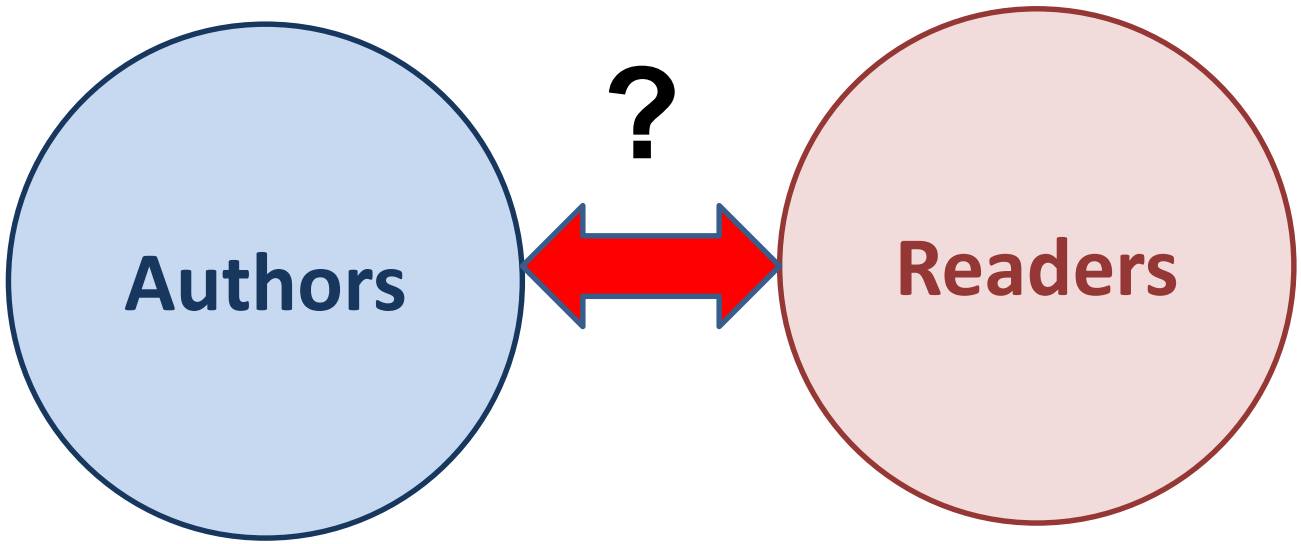
(i)
Downloads vs. Citations

What do full article downloads measure?

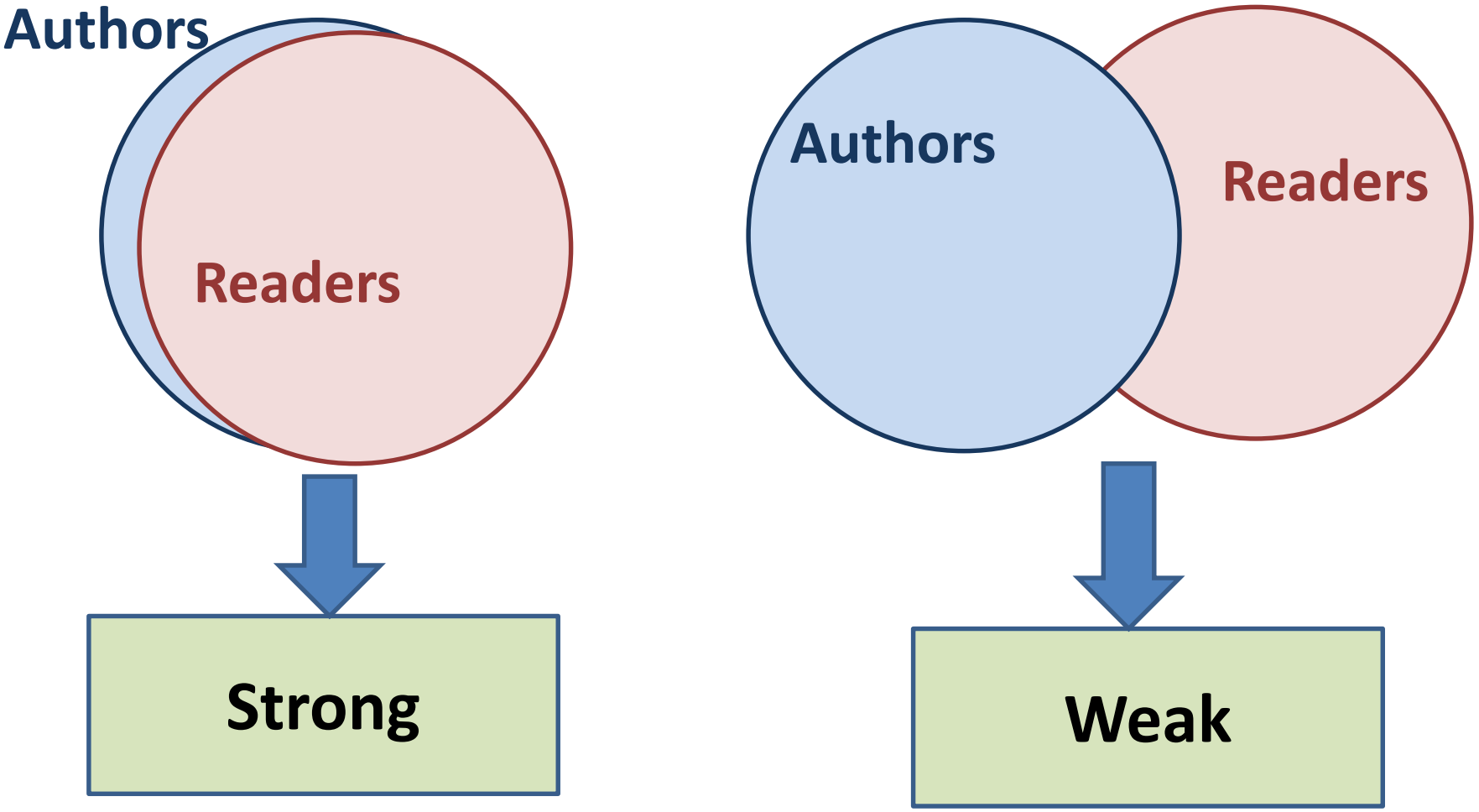
Analogy Model

Formal use	*Informal use*
(Collections of) publishing authors	(Collections of) users
Citing a document	Downloading the full text of a document
Article	User session
Author's institutional affiliation	User's account name
Number of times cited	Number of times down-loaded as full text

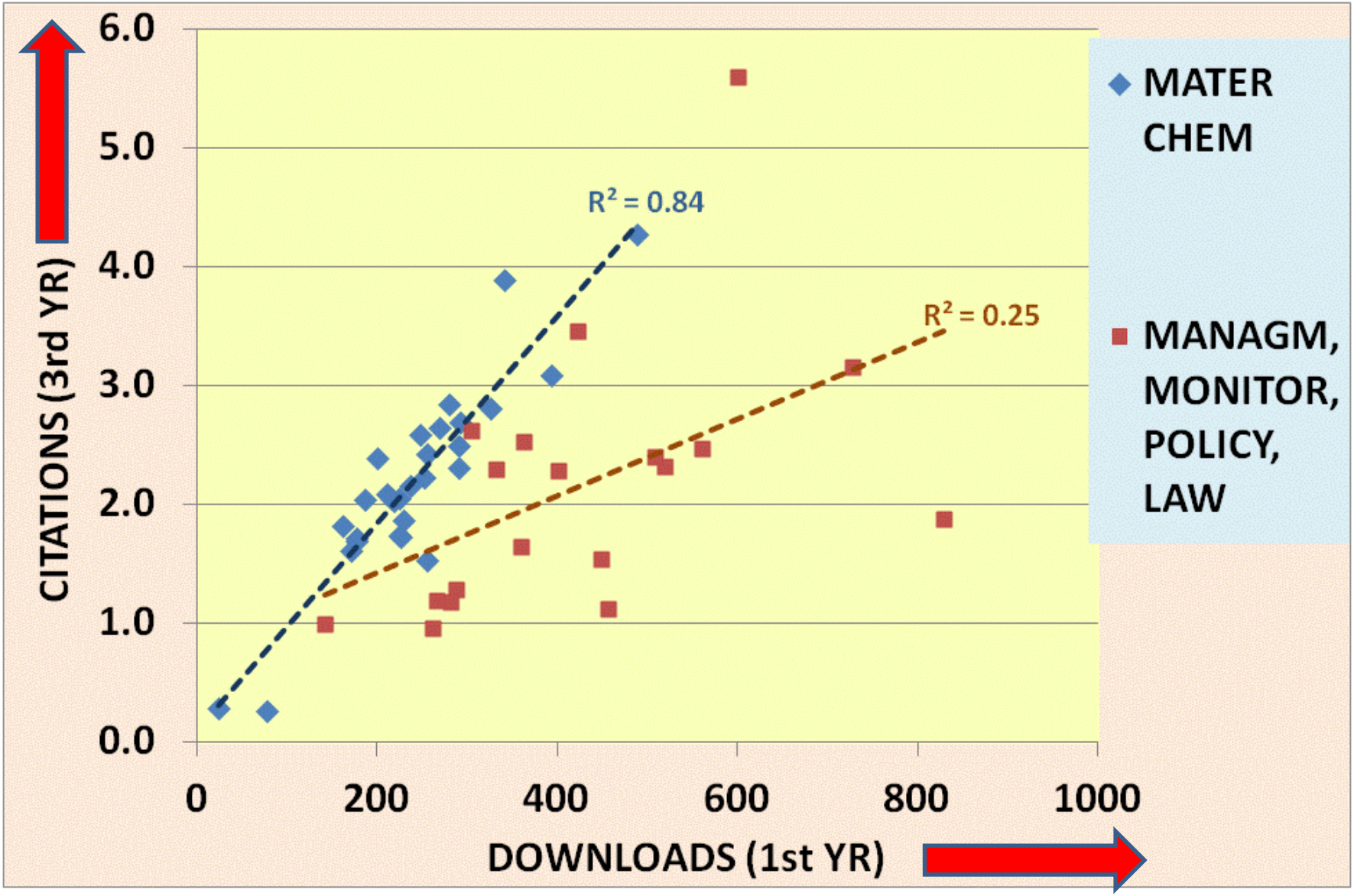
Authors vs. readers



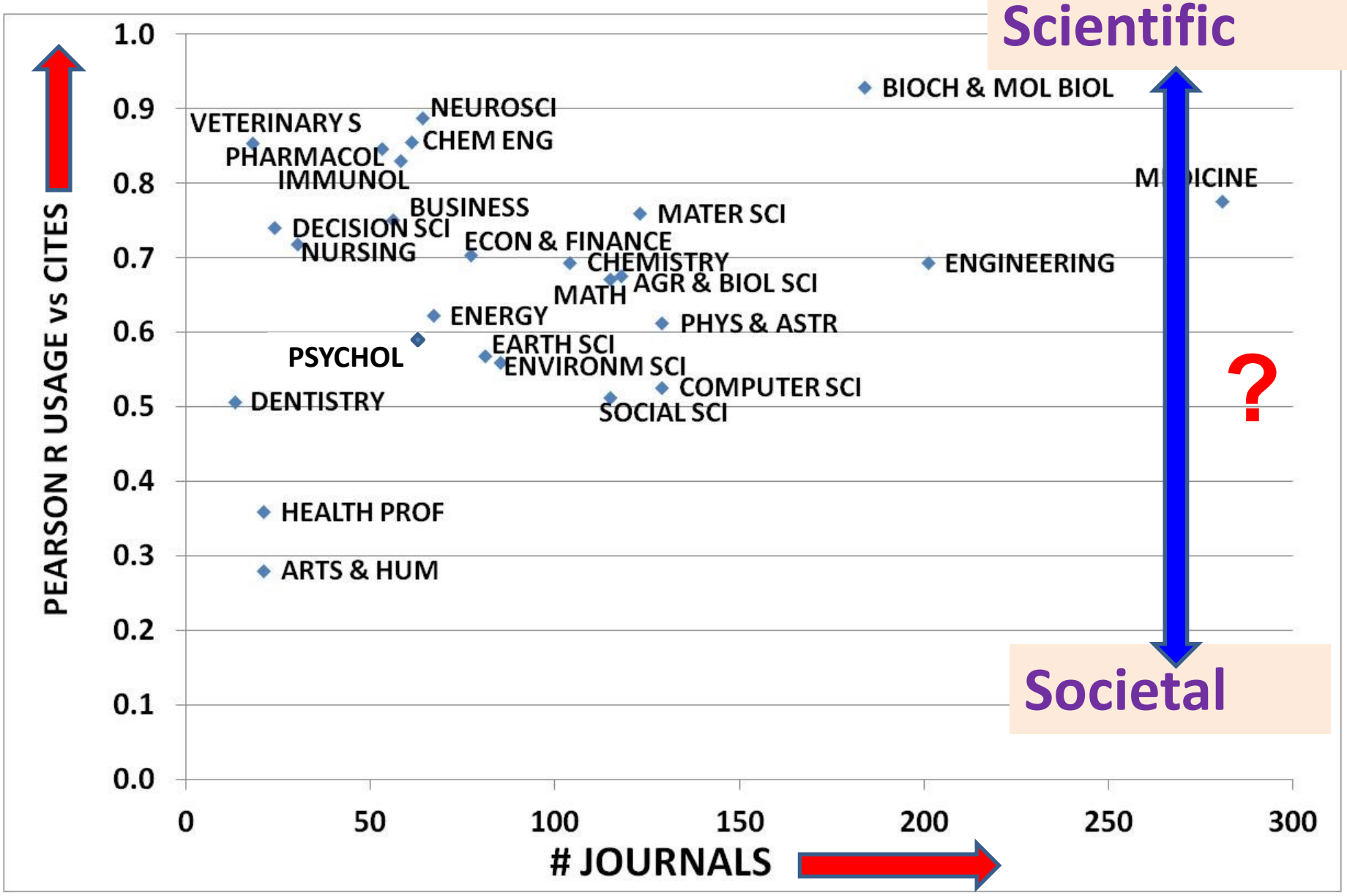
Hypothesis on correlation between downloads and citations



In Materials Chem downloads predict citations to journals, but in Management they do less so



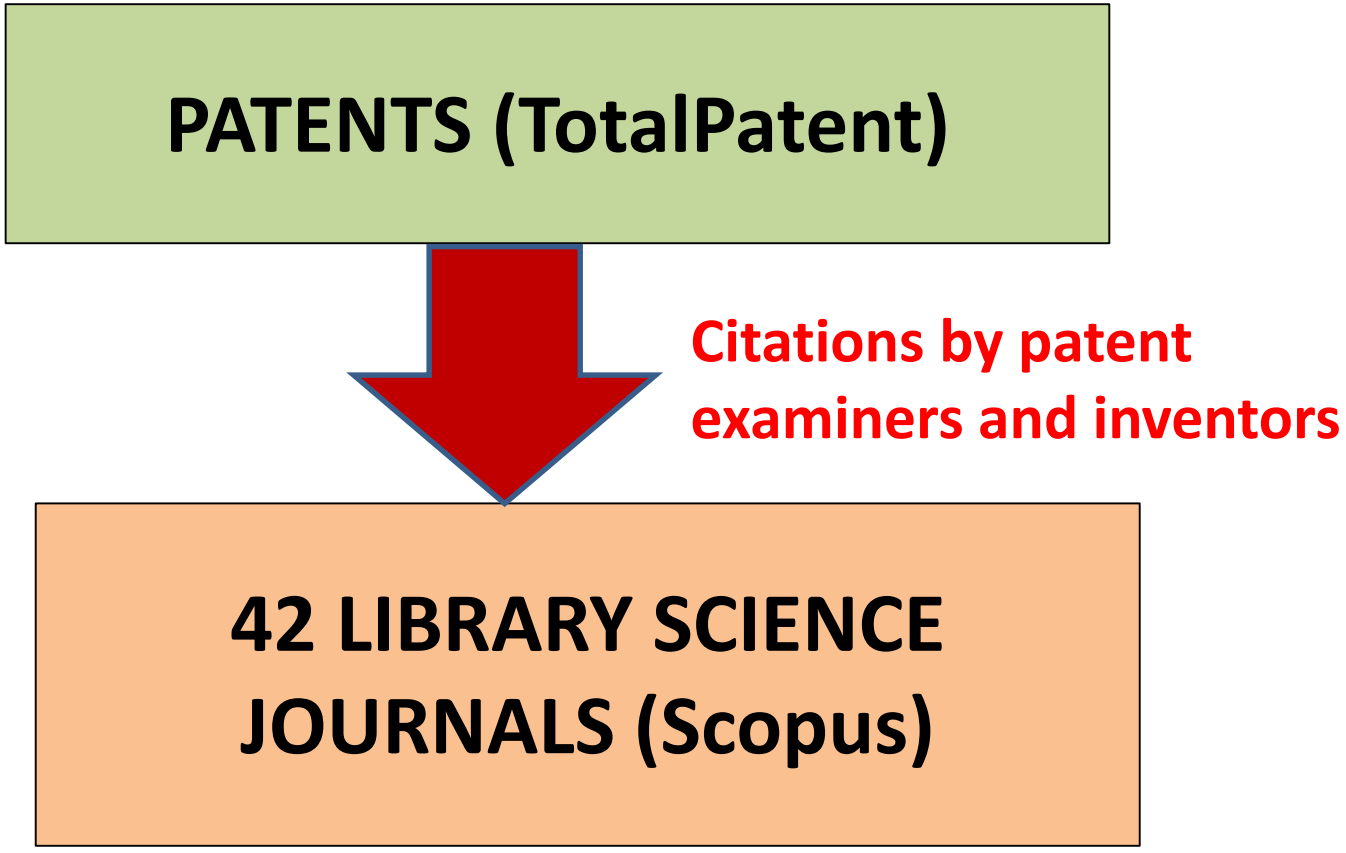
Usage vs. citations per main field



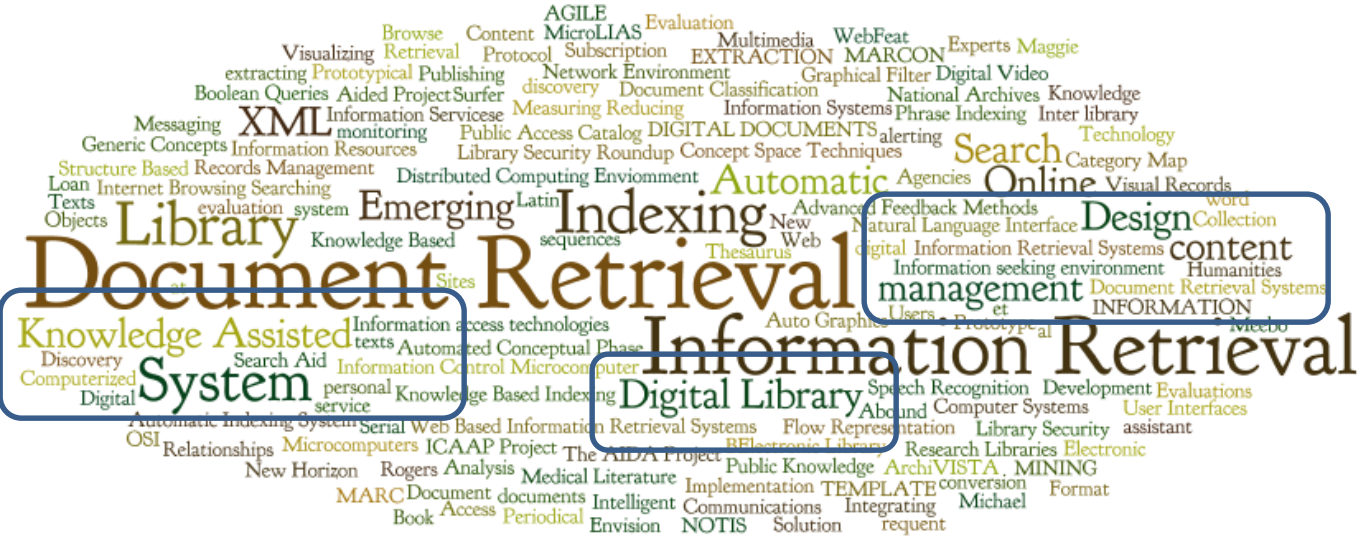
(ii)
Patent citations to journal articles:

The technological impact of research
(G. Halevi et al, 2012)

The Technological Impact of Library Science Research: A Patent Analysis [Halevi et al, 2012]



Articles Key Words



The articles feature information retrieval and indexing, information and documents management systems which pertain to electronic and digital libraries development

Patents Titles Key Words

The patents focus on electronic information administration, navigation, and products and services management in commercial systems.

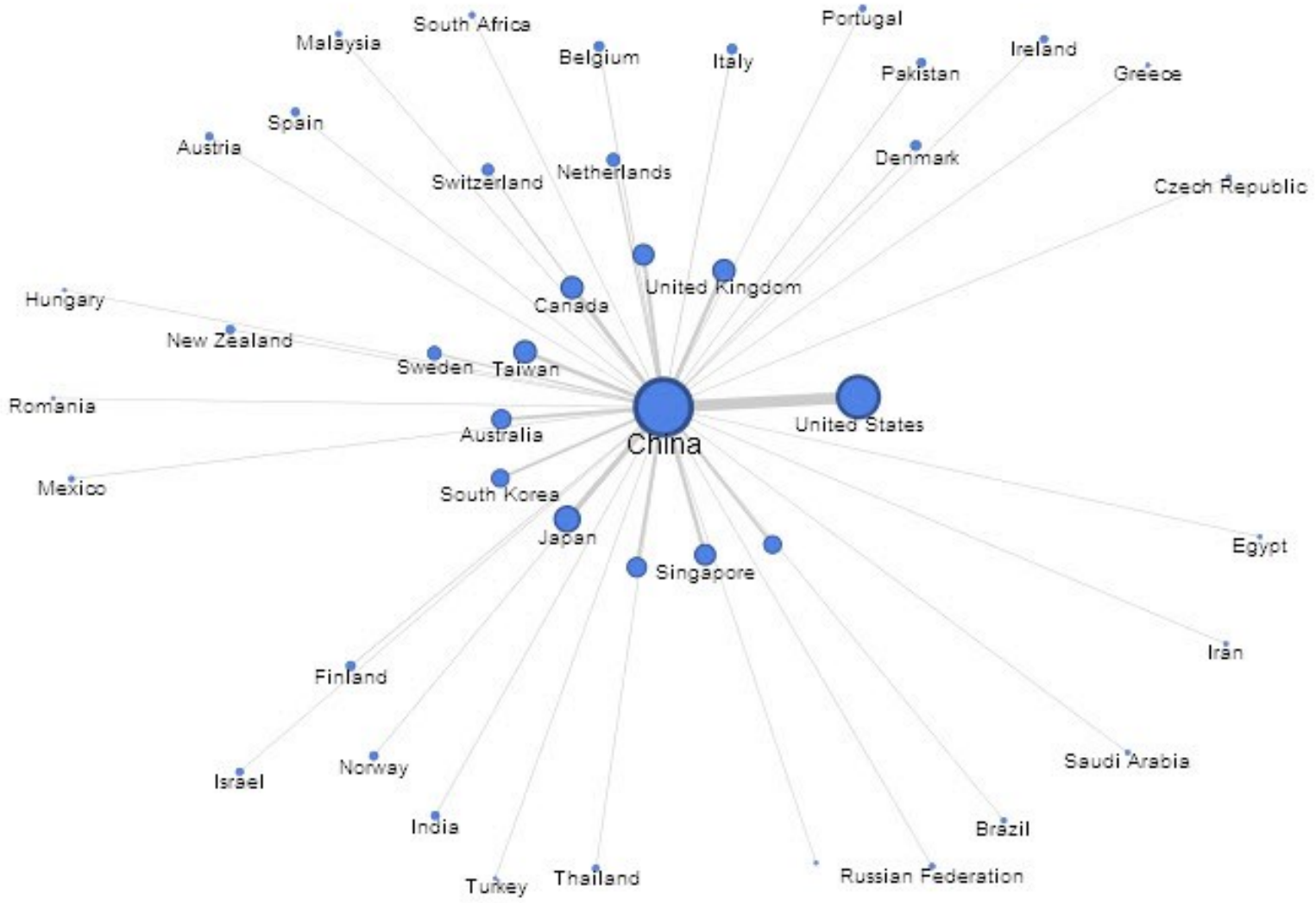
(iii)
Publication vs. survey data; Scientific migration

Scopus author data vs. OECD “input” statistics

International migration vs. co-authorship

Relationship	Definition	Comment
International co-authorship	Authors from institutions located in different countries jointly publish a paper	Country relates to where authors work, NOT to their nationality
International migration	A scientific author moves from one country to another	

Migration to China



(iv)

The use of contextual citations analysis to disclose the thematic and conceptual flow of cross- disciplinary research:

the case of the Journal of Informetics 2007 **(Gali Halevi et al., 2013)**

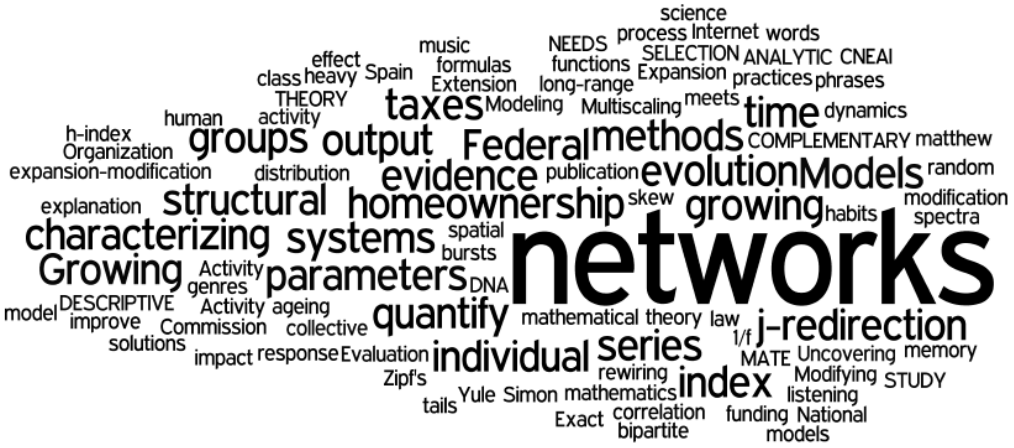
Emerging sectional themes

Out Discipline Themes within the Introduction

Out Discipline themes within the Findings & Discussion

clouds below might suggest that the individual output evaluation done by structured peer review leads to an acknowledgment of the importance and evolution of networks rather than individuals

Out-Discipline Themes in the Conclusions Section



Thank you for your attention

Grazie per la vostra attenzione