# Applied evaluative informetrics: Its validity and usefulness

**Henk F. Moed**

**Lecture presented at the NEICON Conference**

**Jesolo (Italy), 27 Sept 2017**

# Short CV Henk F. Moed

| | |
|---|---|
| 1981-2009 | Senior staff member at Centre for Science and Technology Studies (CWTS), Leiden Univ. |
| 2009 | Professor of Research Assessment Methodologies at Leiden University |
| Feb 2010 - Aug 2012 | Elsevier, SciVal Dept. Senior Scientific Advisor |
| Sept 2012 - Oct 2014 | Elsevier, AGRM Dept; Head of Informetric Research Group |
| As from Sept 2014 | Visiting professor at Sapienza Univ Rome and Univ Granada (2016); Private consultant; |

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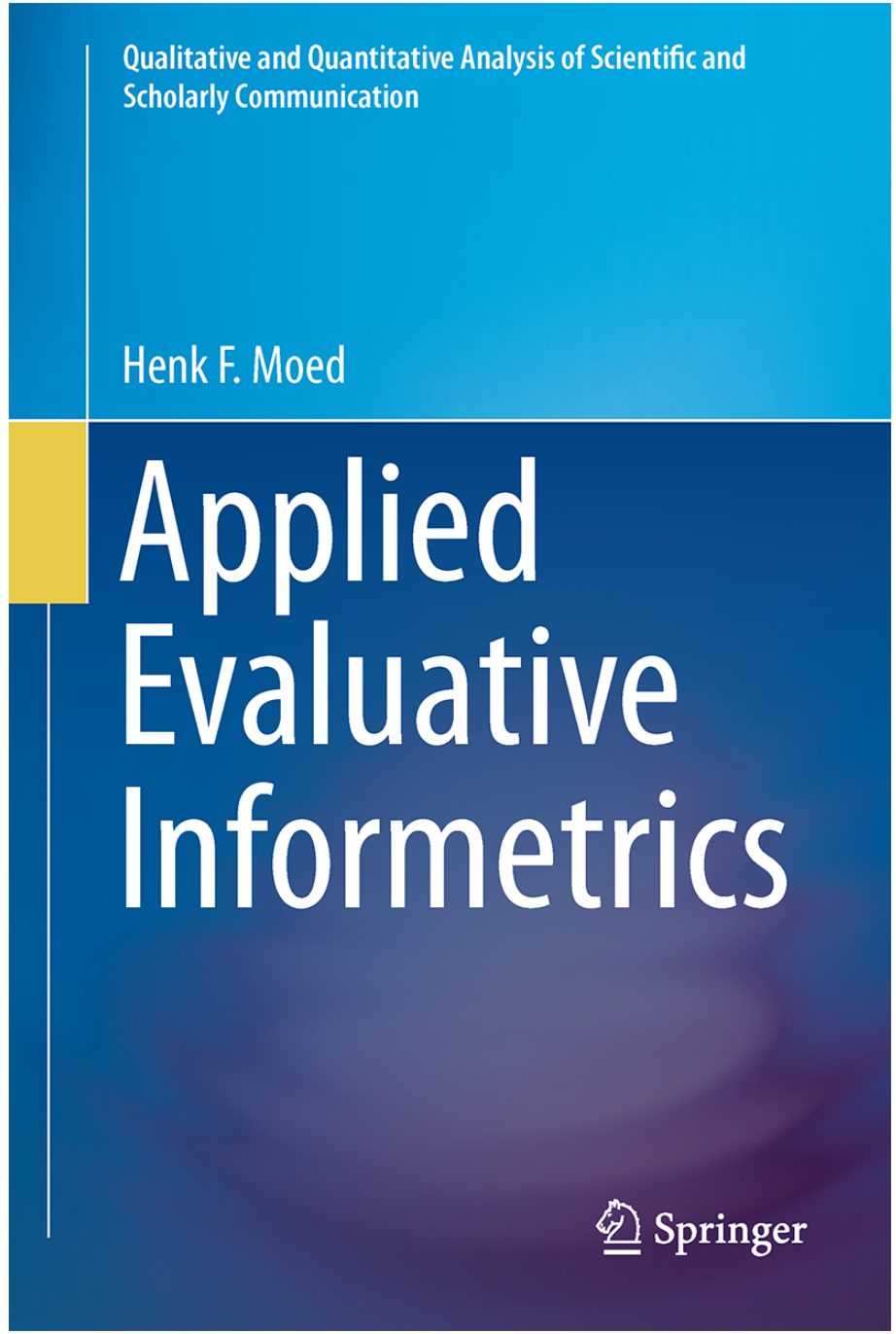
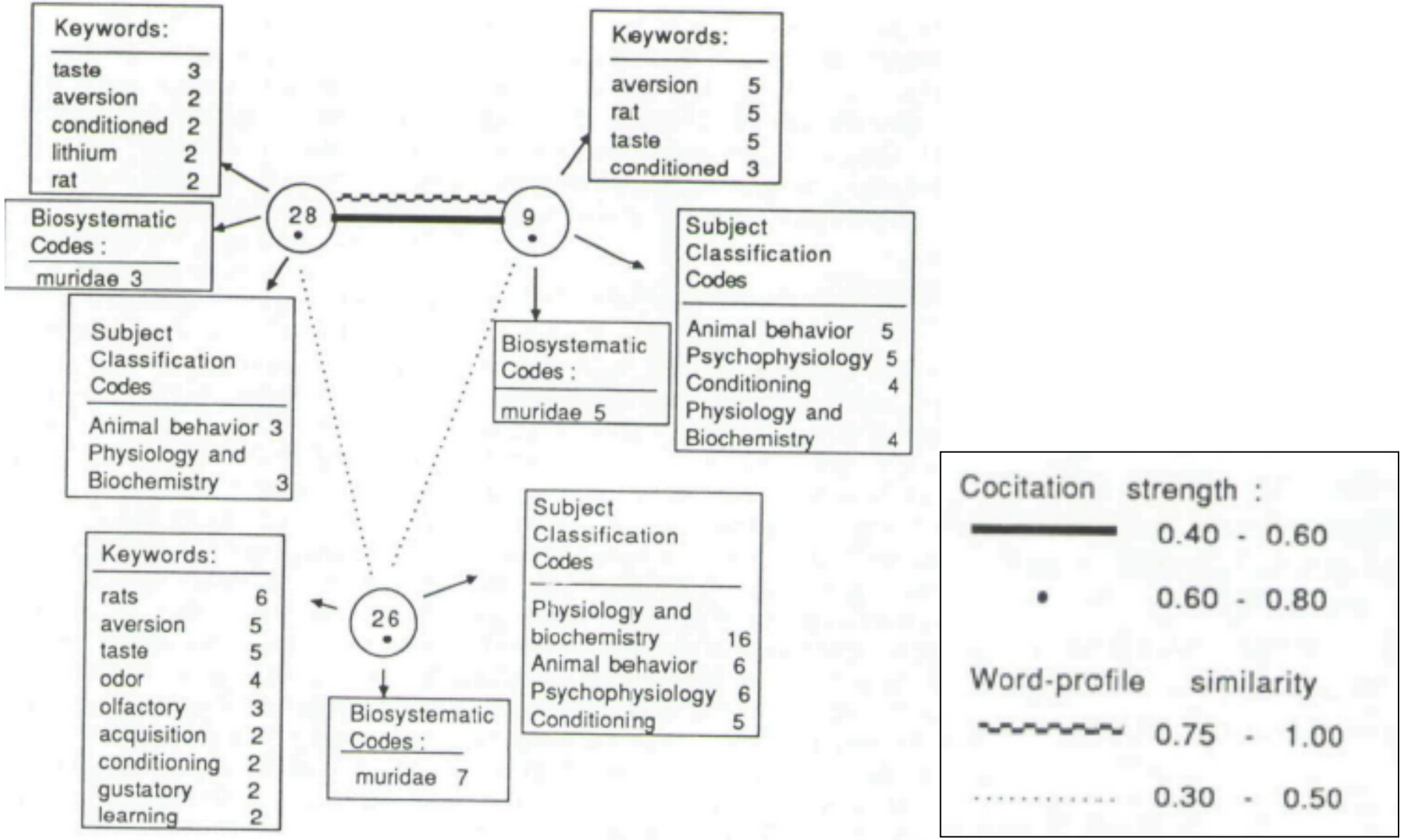

Qualitative and Quantitative Analysis of Scientific and Scholarly Communication
Henk F. Moed
Applied Evaluative Informetrics
Springer

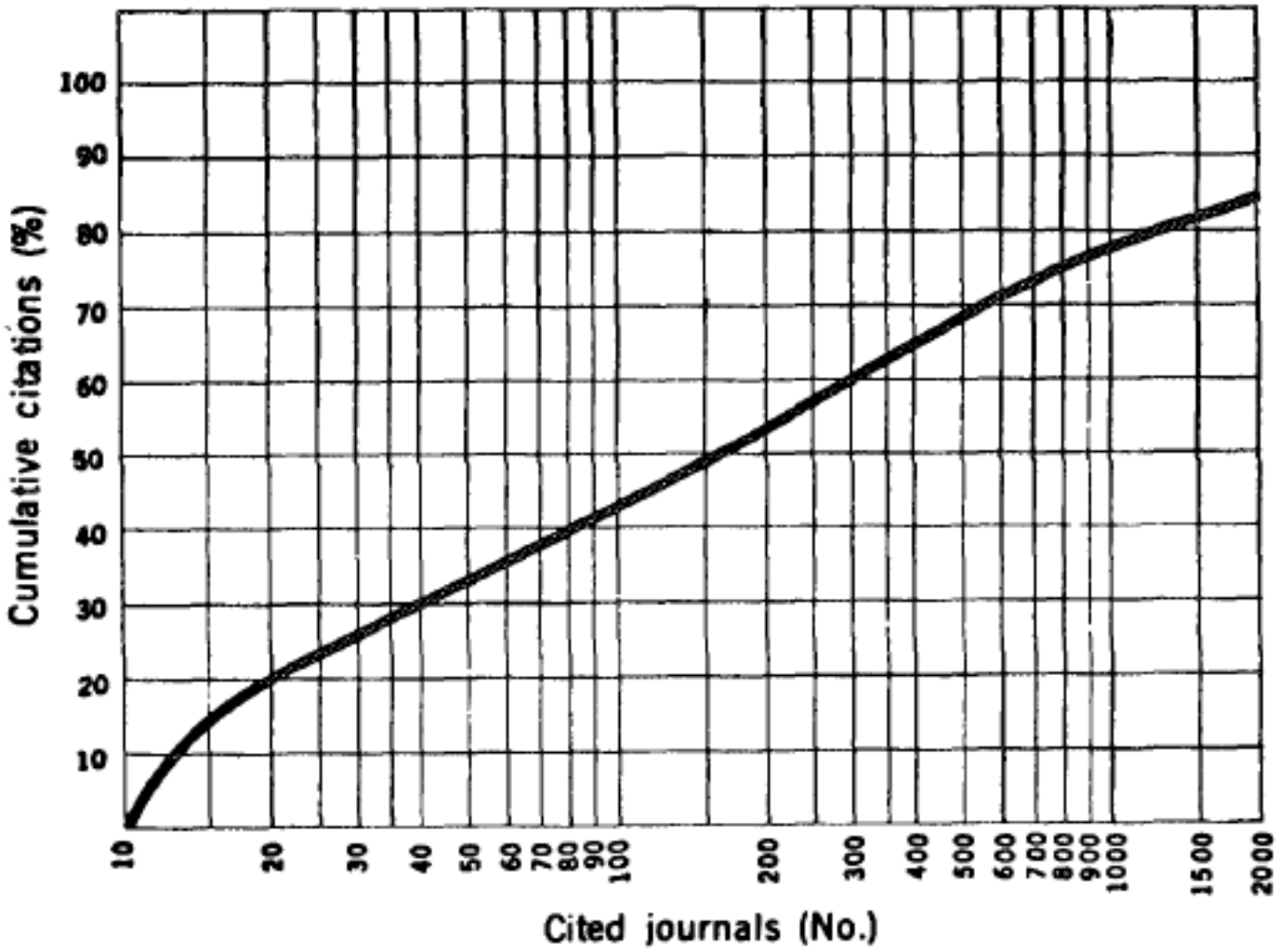
# Part 1
# The influence of Eugene Garfield

# Five influences
# (Eugene Garfield Memorial Event, Philadelphia, 15 Sept 2017)

1. An analysis of citation practices of biological scientists
2. Assessing a citation index' "internal" source coverage
3. The book coverage of the ISI citation indexes (SCI, SSCI, A&HCI)
4. Citation potential as a critical factor affecting journal impact factors
5. How to evaluate faculty: the need for an author self-assessment tool

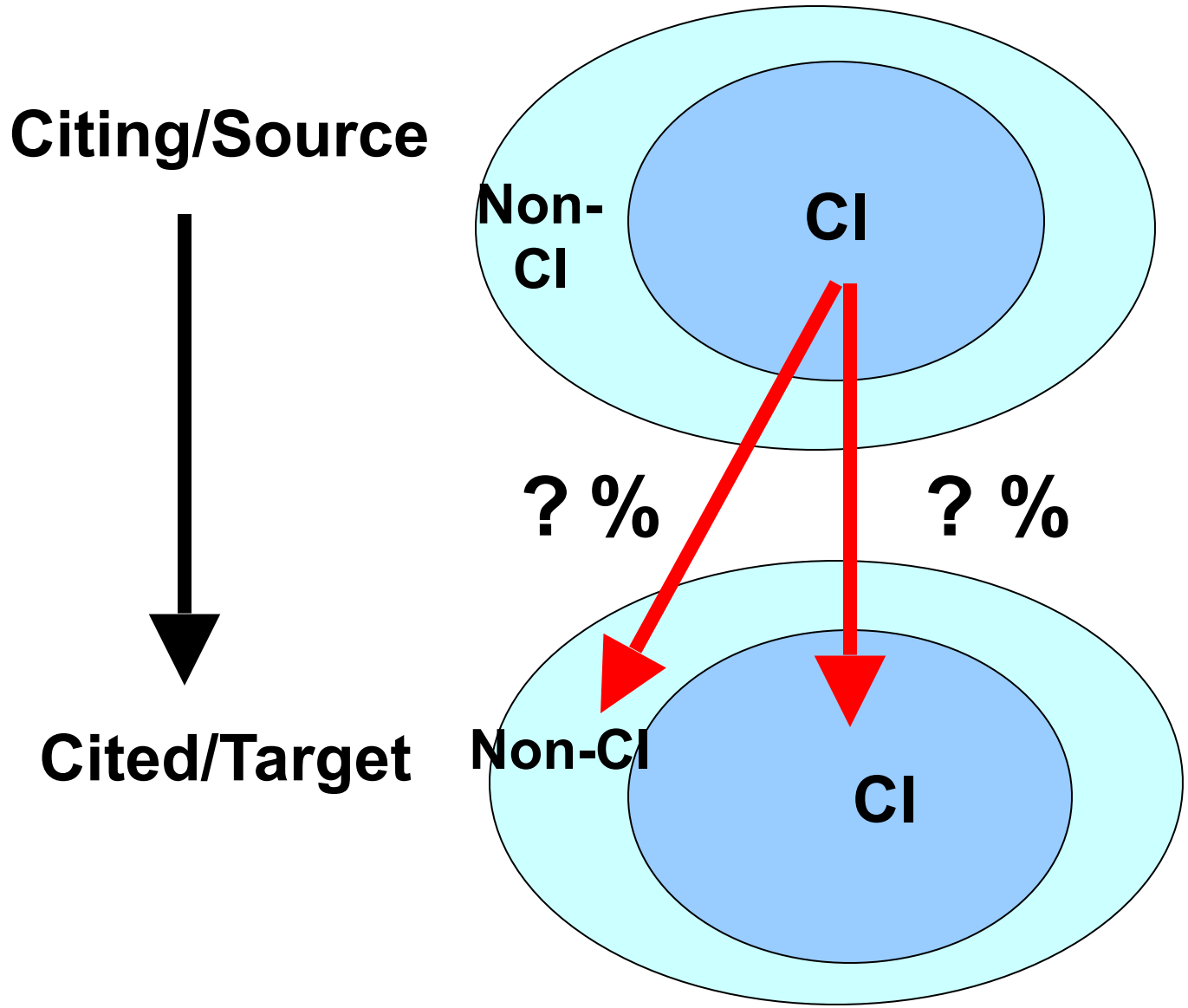
# Split up of a specialty: three different co-citation clusters indicating the same specialty [Braam et al., 1991]



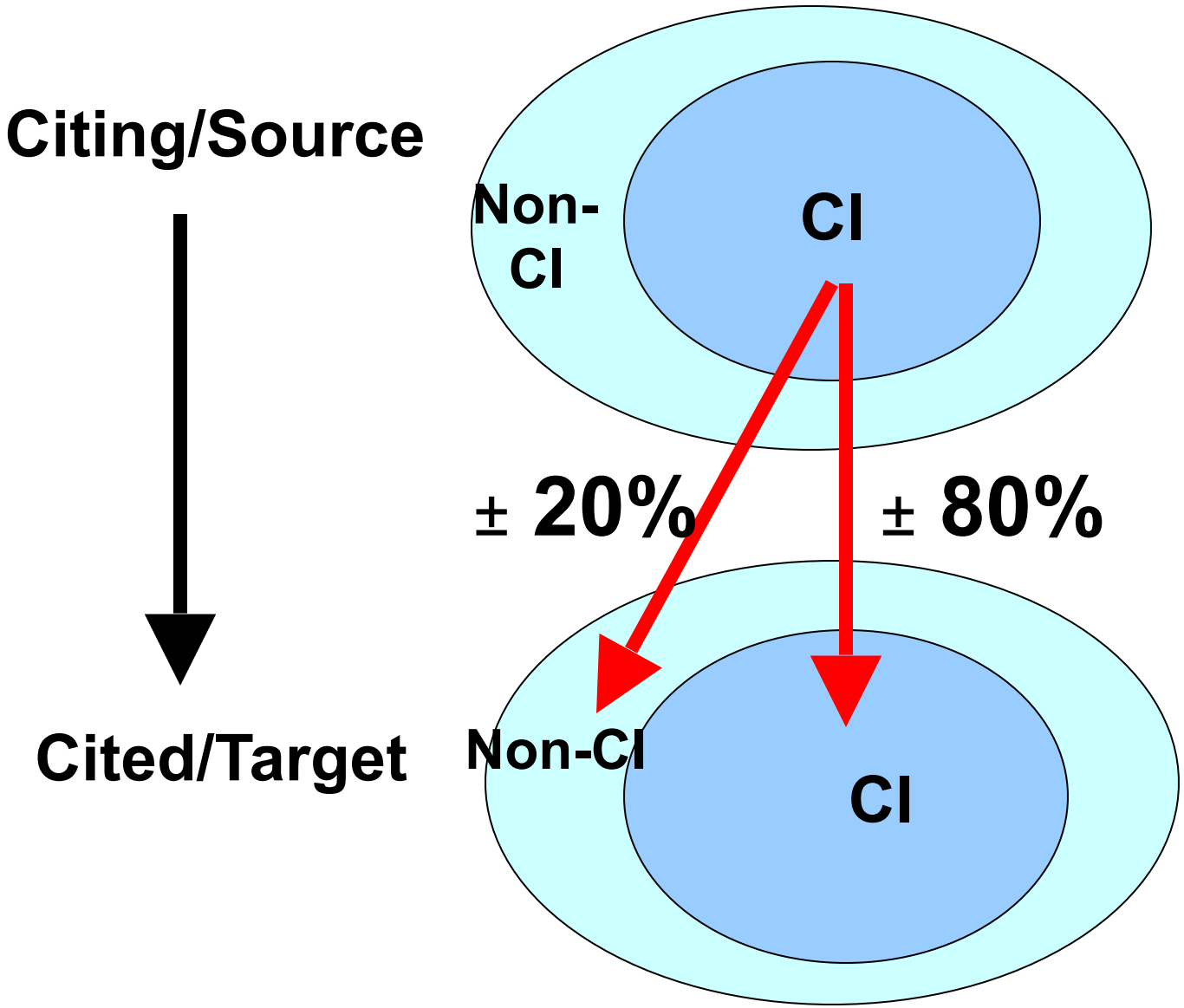



"Fig. 5. Distribution of citations among cited journals. The curve shows that a relatively small core of 152 journals accounts for about half of all citations and that only 2000 or so journals account for 84 percent of all citations." (Garfield, 1972, p.535)

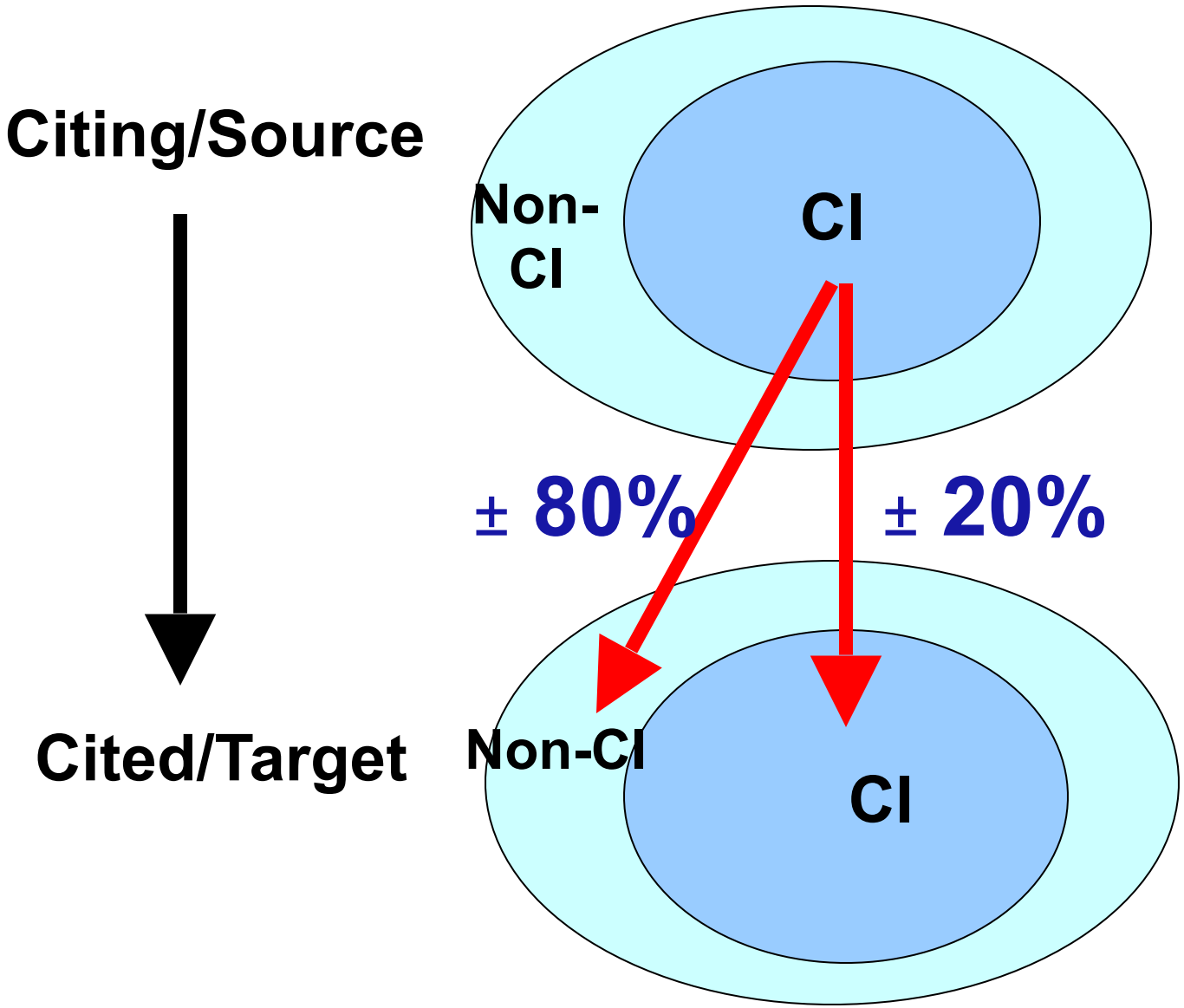
# Coverage of journal-based citation index (CI)



# 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 | | |

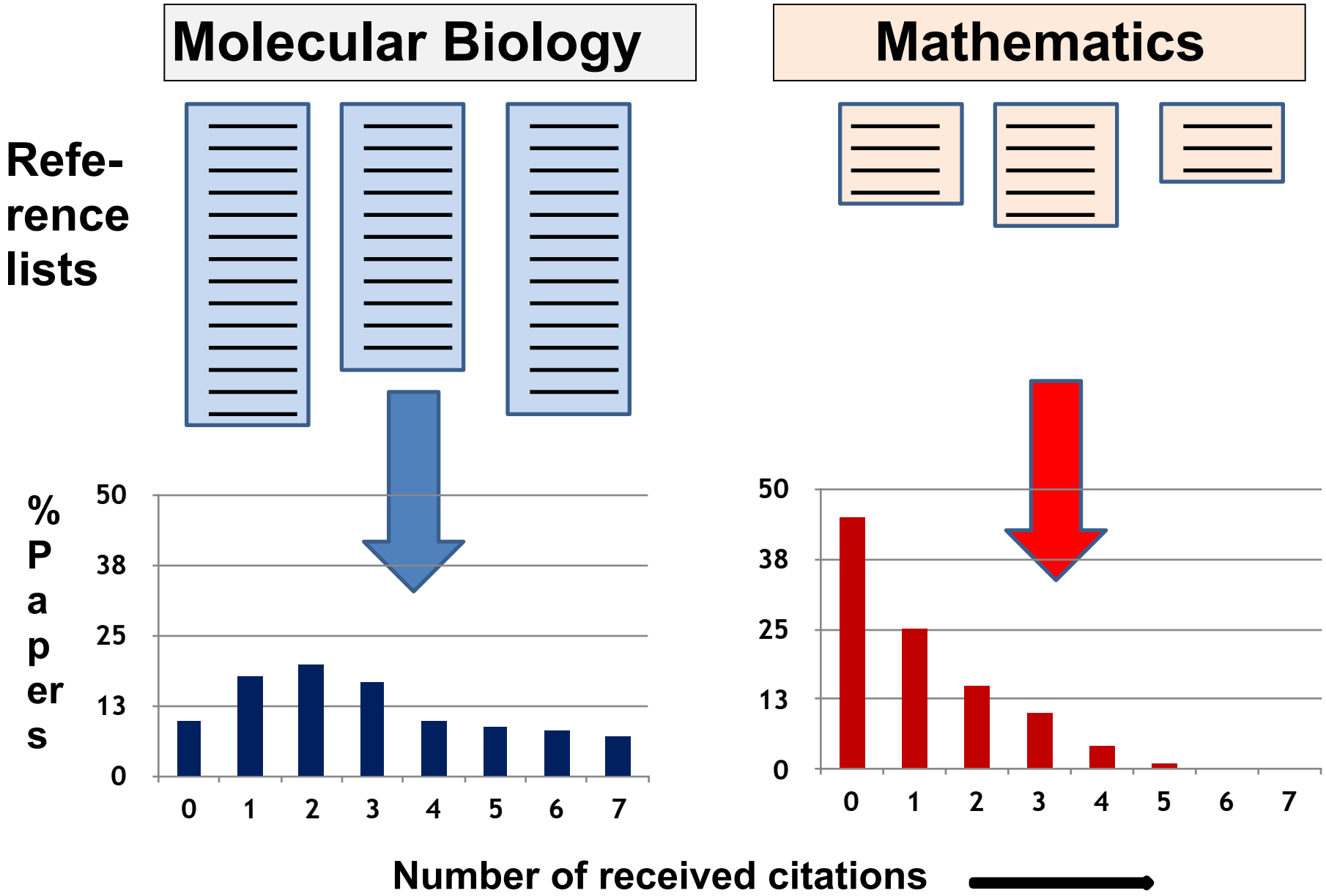
# 3. The book coverage of the ISI citation indexes

- In discussions about ISI overage, Eugene firmly criticized the claim that the ISI indexes (Web of Science) do not cover books
- "The ISI indexes contain millions of citations to books", he said.
- This observation opens up a perspective towards enhancement of not-covered cited references to enhance their utility in literature retrieval
- Currently, books are added as sources to Web of Science.
- Perhaps, we should also put more efforts into exploiting the "millions of citations to books" already available.

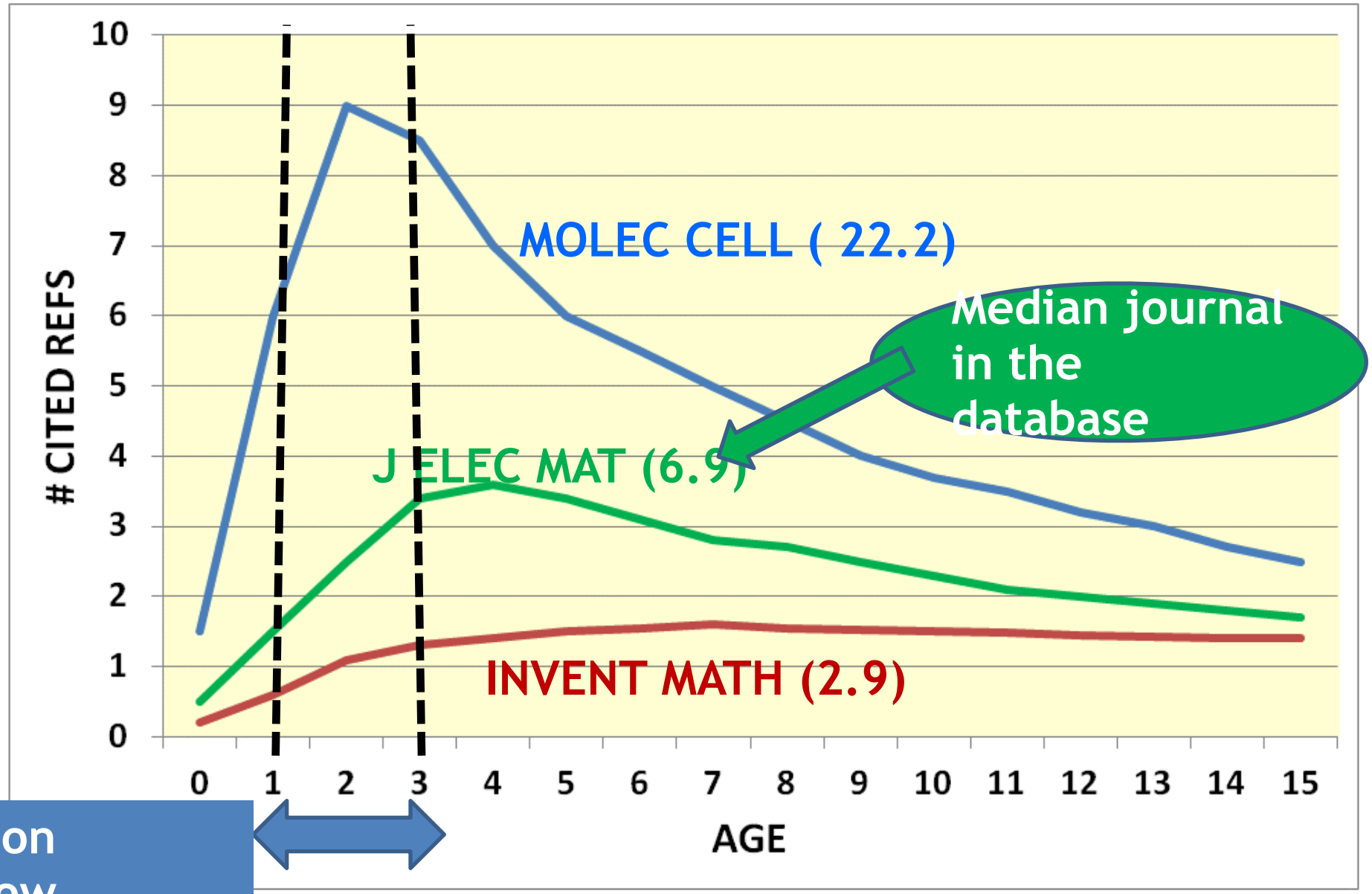
# 4. Citation potential as a critical factor affecting journal impact factors

- Garfield (1979) underlined that it is improper to make comparisons between citation counts generated in different research fields.
- The "citation potential" can vary significantly from one field to another.
- He suggested that "the most accurate measure of citation potential is the average number of references per paper published in a given field".
- The SNIP journal impact indicator introduced in 2010 aims to correct for such differences.
- SNIP shows how journal rankings based on impact factors change, if the citation potential of journals' subject fields is taken into account.

# Differences in citation potential between fields



# Citation Potential for 3 journals



# Example: Molec Biol vs. Mathematics

| *Journal* | *Journal Impact Factor (RIP)* | *Citation Potential (RDCP)* | *SNIP (= RIP/RDCP)* |
|---|---|---|---|
| **INVENT MATH** | **1.5** | **0.4** | **3.8** |
| **MOLEC CELL** | **13.0** | **3.2** | **4.0** |

# 5. Author bibliometric self assessment tool

- In his well-known articles about faculty evaluation, Garfield proposed an algorithm for creating for a given author under assessment a set of 'candidate' benchmark authors who have bibliometric characteristics similar to those of the given author.
- There seems to be an increasing need among researcher for bibliometric self-assessment tools. I did some work on this myself.
- A challenge is to make optimal use of the potentialities of the current information and communication technologies....
- And to create an online application based on key notions expressed by Eugene Garfield in his algorithm, and by Robert K. Merton about the formation of a *reference group*.

# Part 2:
# Applied Evaluative Bibliometrics:
# A state of the art

# Issues discussed

- Main developments during past 2 decades
- The multi-dimensionality of research performance
- The relationship between policy, evaluation and informetrics

# Main developments during past decades

- Emphasis on societal value and value for money
- Performance-based funding
- Research in a global market; University rankings
- Internal research assessment systems
- Usage based assessments (full text downloads)
- Construction of large publications repositories
- Scientific literature databases availability
- Social media, altmetrics
- More indicators are becoming available
- Desktop bibliometrics
- More and more critique on use of bibliometric indicators

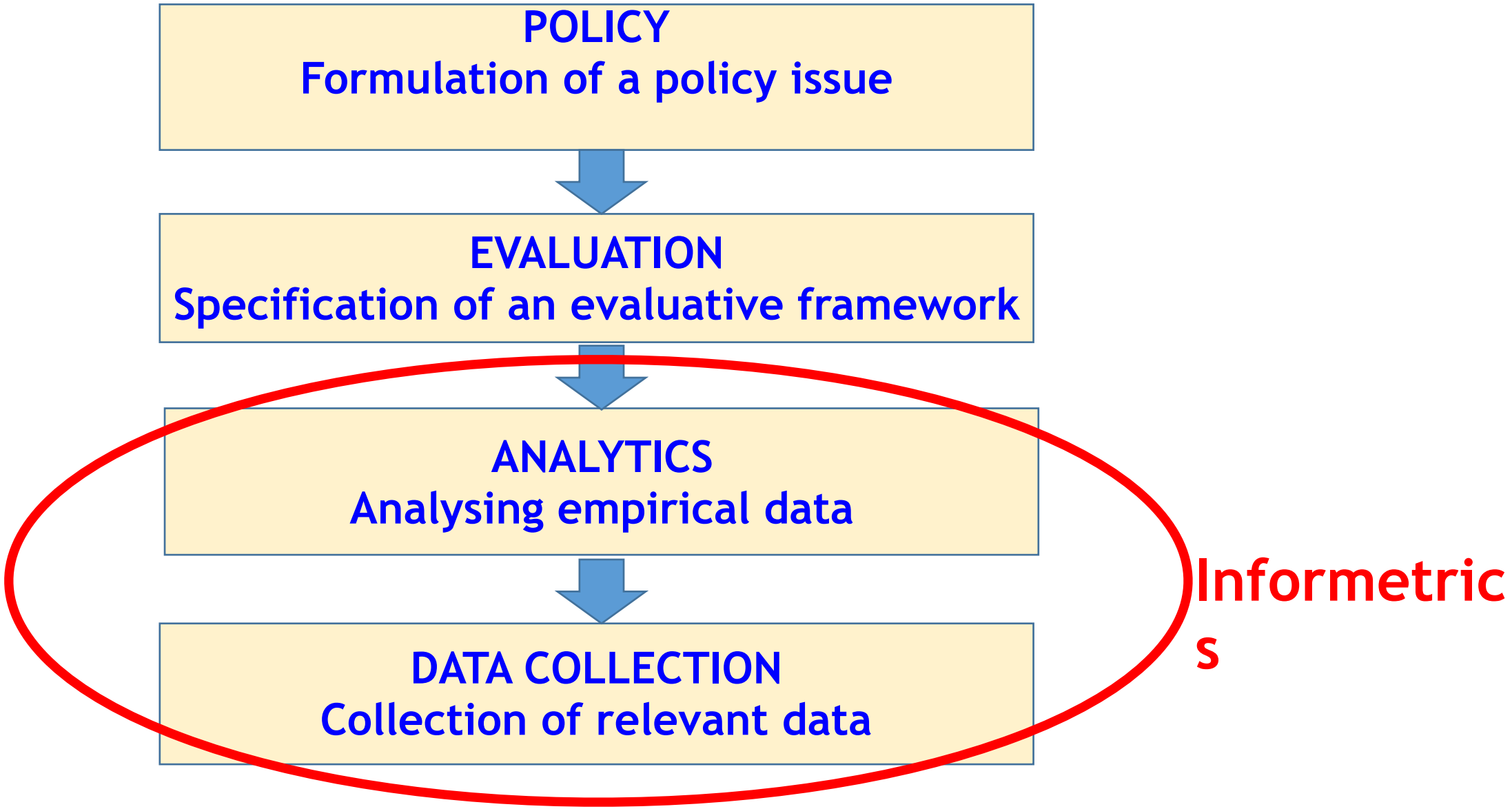
# Main types of research output and impact

| Impact | Publication | Non-publication |
|---|---|---|
| **Scientific-scholarly** | Scientific journal paper; book chapter; scholarly monograph; conference paper; editorial; review | Research dataset; software, tool, instrument; video of experiment; registered intellectual rights |
| **Educational** | Teaching course book; syllabus; text- or handbook | Online course; students completed; degrees attained (e.g., doctorates) |
| **Economic or technological** | Patent; commissioned research report | Product; process; device; design; image; spin off; registered industrial rights; revenues from commercialization of intellectual property |
| **Social or cultural** | Professional guidelines; policy documents; newspaper article; press story; encyclopaedia article; popular book or article | Interviews; events; performances; exhibits; scientific advisory work; Communication in social media, e.g., blogs, tweets |

# 6 Indicator families and 22 key indicators of research performance

| Indicator family | Indicators (typical examples) | |
|---|---|---|
| **Publication output and citation-based impact** | - Total publications; total citations<br>- Citation per publication<br>- Relative citation rate | - Top (highly cited) publications<br>- H Index<br>- Integrated Impact Indicator |
| **Journal-based** | - Journal impact factor<br>- SNIP | - SJR, Eigenfactor<br>- Glanzel's 2 parameter measure |
| **Usage-based and altmetrics** | - Full text downloads<br>- Mentions in social media | - Readership counts |
| **Reputation and esteem-related** | - Reputation survey outcomes | - Prizes and awards |
| **Technology-related and economic indicators** | - Patents<br>- Patent-paper citations | - Efficiency/productivity measures<br>- Licenses, spin offs |
| **Relational and network-based** | - Co-authorship/collaboration measures | - Cross-disciplinarity measures |

# Four types of intellectual activity in research assessment

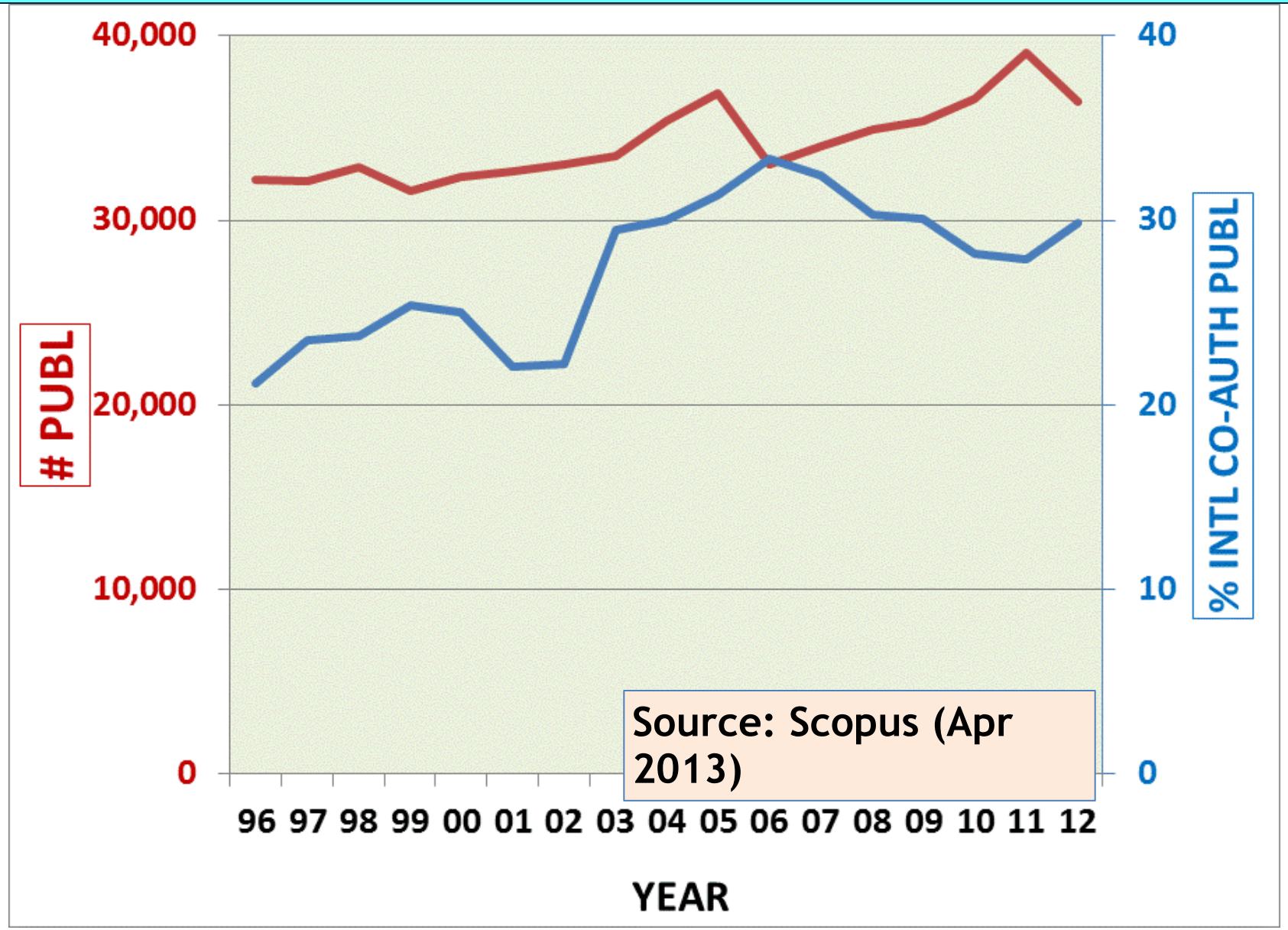


# Propositions

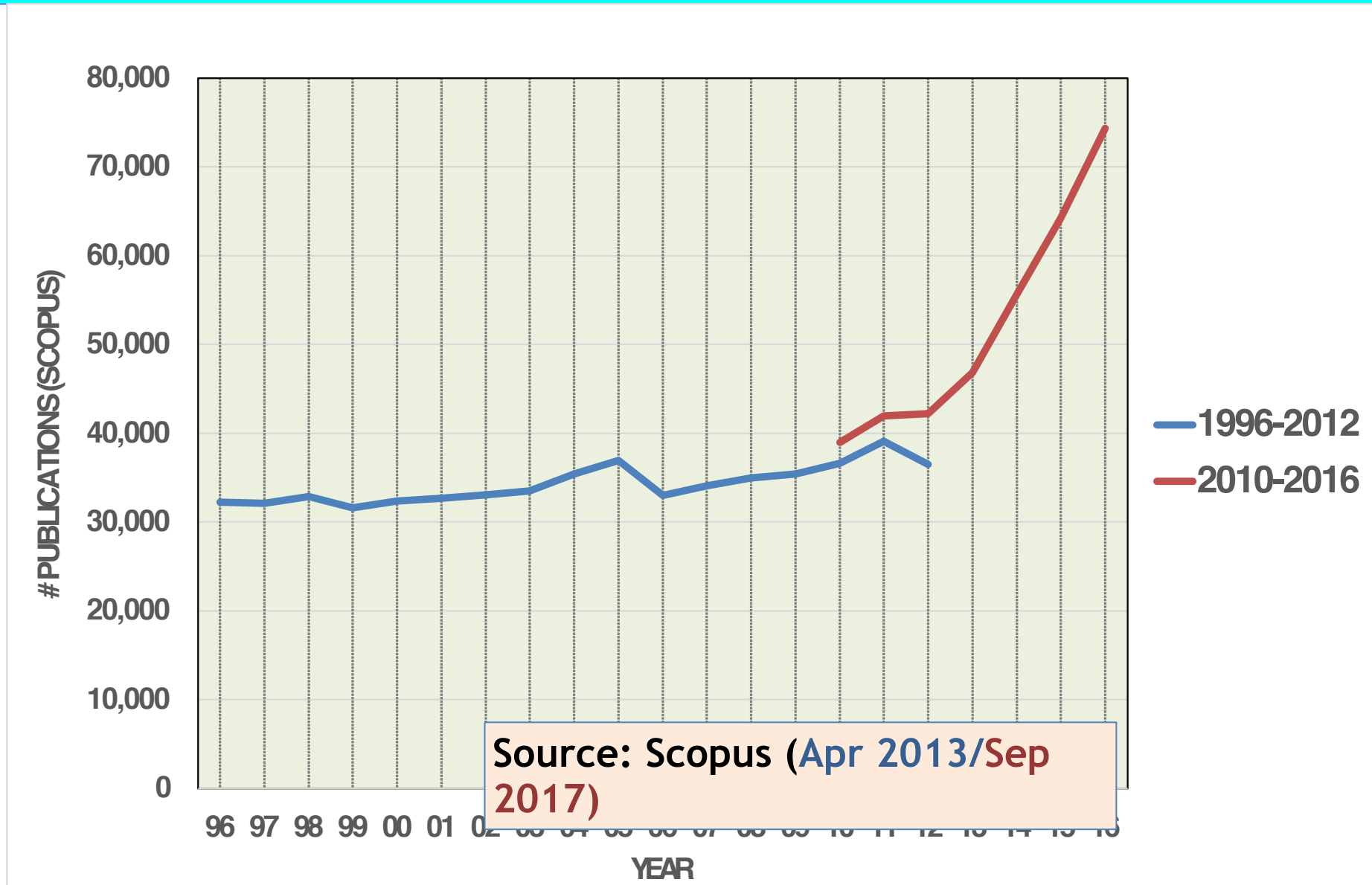
- Informetrics has a great potential; a large part is still unexplored.
- Informetrics itself does not evaluate.
- Its application requires an evaluative framework.
- Not in all assessments an evaluative framework has been developed properly.
- Its lacking has been compensated by ad-hoc arguments of evaluators ….
- …..or by un-reflected assumptions underlying informetric tools.
- Their validity cannot be established in quantitative-empirical, informetric research.
- Informetricians should make the assumptions of their tools explicit.
- Evaluative and policy assumptions influence the selection of indicators.

# Part 3:
# The informetric position of the Russian Federation

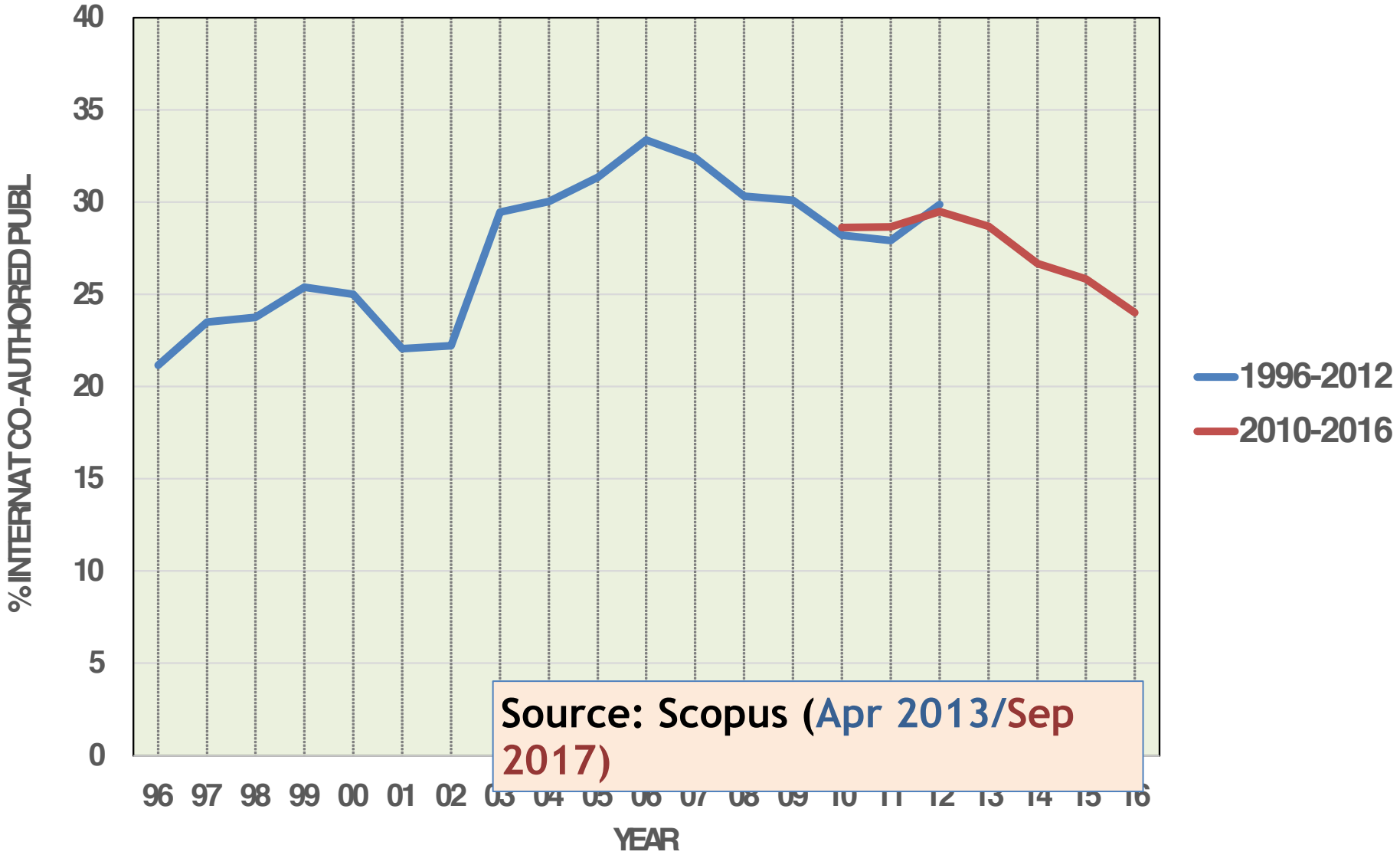
# Russian Federation 1996-2012 (Scopus)



# Russia: Strong increase in number of publications as from 2013



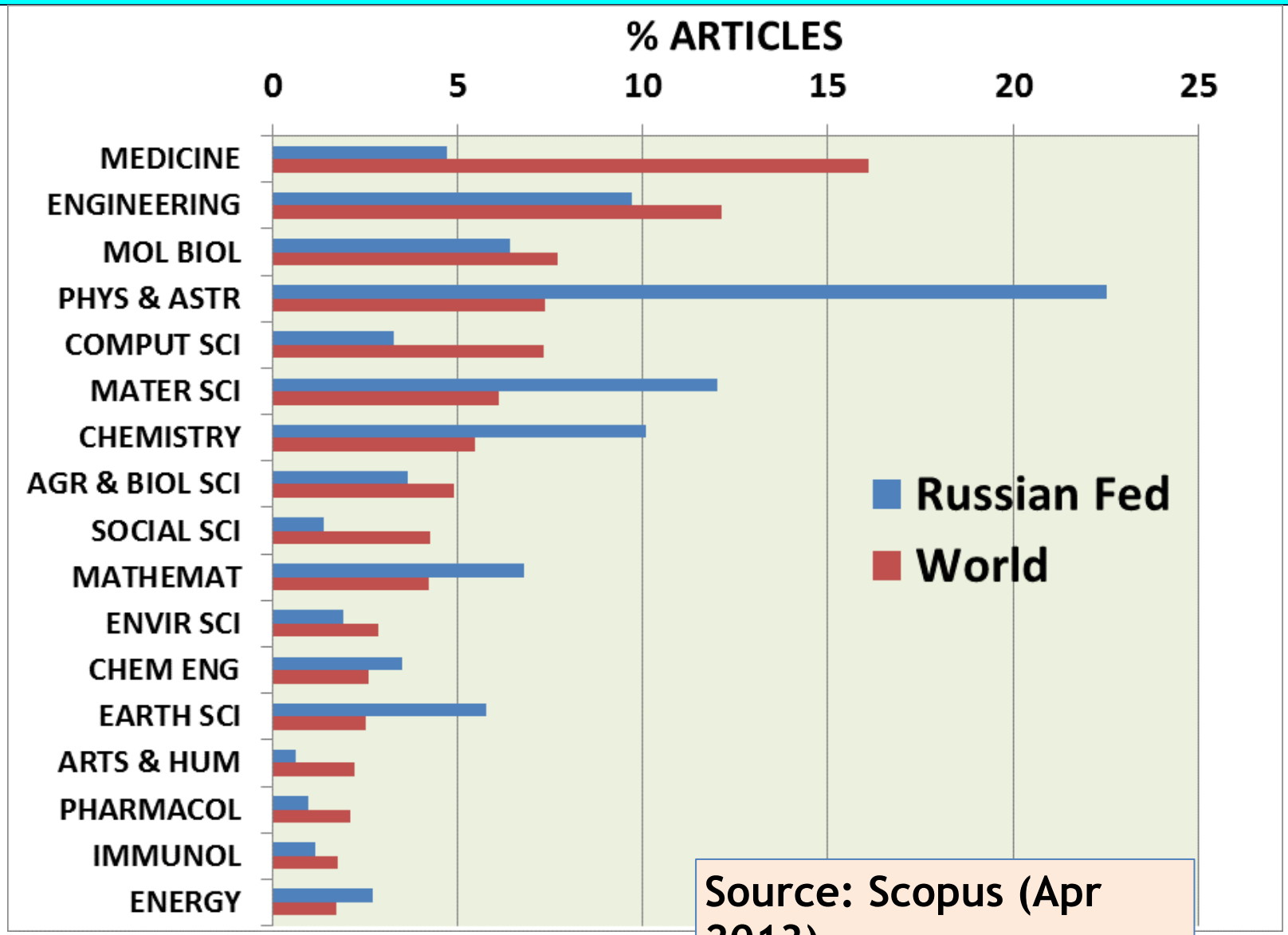
# Russia: Decline in % international co-authored papers during 2013-2016



# A bibliometric model for capturing the state of a country's scientific development

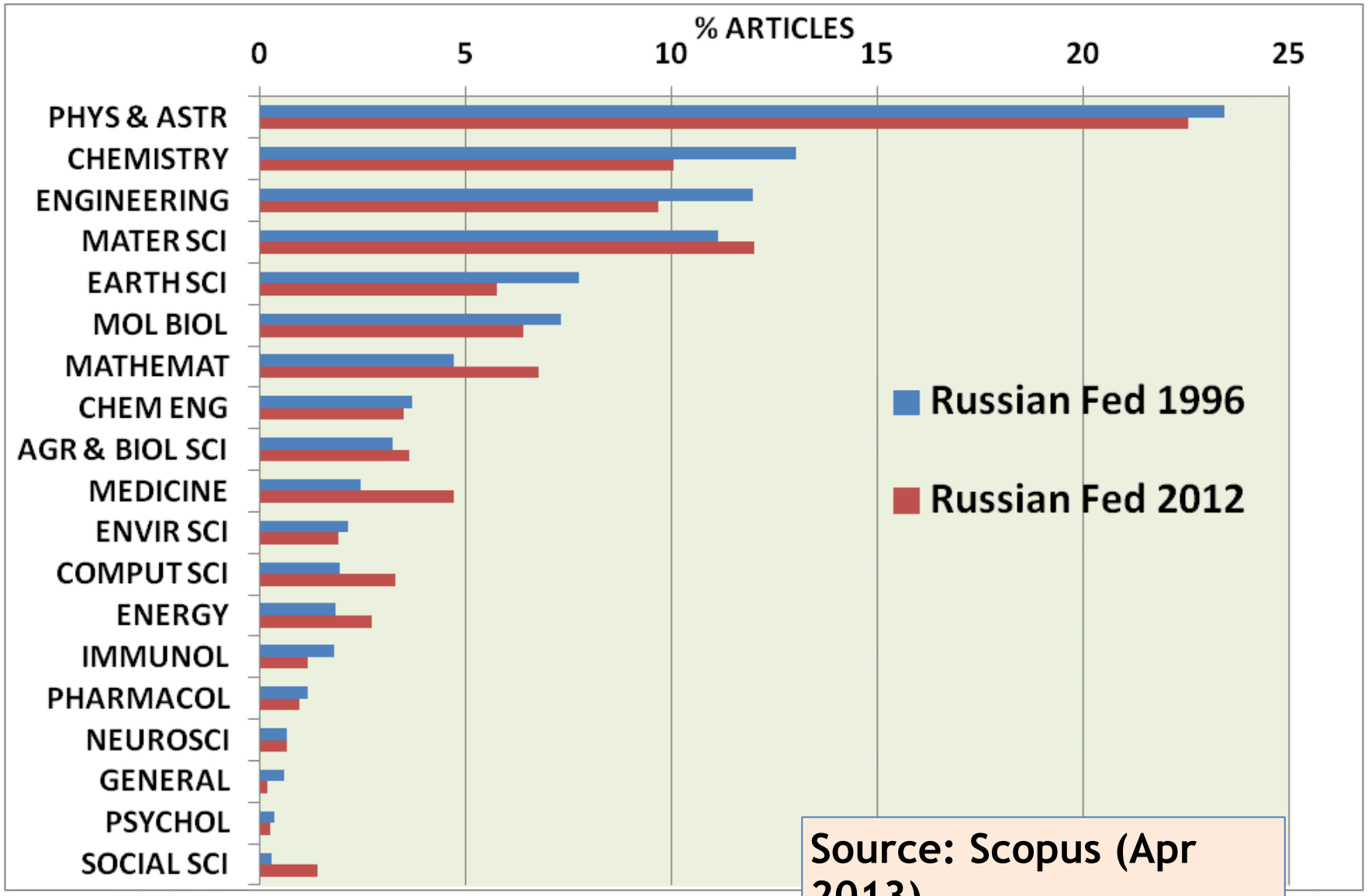
| Phase | Description | Trend in # published articles | Trend in % internat. co-auth. publ. |
|---|---|---|---|
| 1. Pre-development | Low research activity without clear policy of structural funding of research | ~ | ~ |
| 2. Building-up | Collaborations with developed countries are established; national researchers enter international scientific networks | + | ++ |
| 3. Consolidation and expansion | The country develops its own infrastructure; the amount of funds available for research increases | ++ | - |
| 4. Internationalization | Research institutions in the country start as fully-fledged partners, increasingly take the lead in international | + | + |

# Disciplinary profiles Russian Fed vs. World (Scopus, 2012)



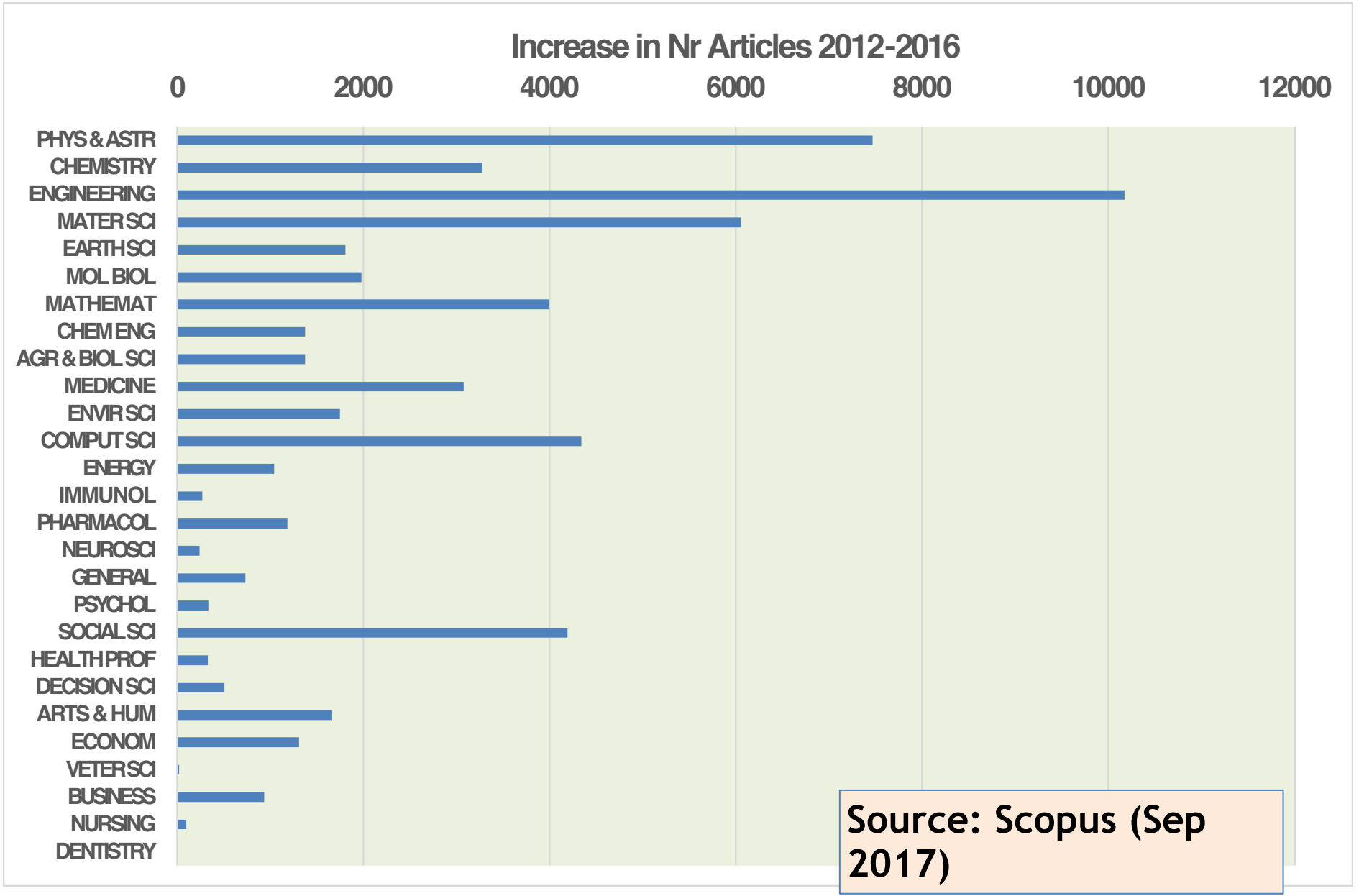

Source: Scopus (Apr 2013)

# Did the Russian profile change during the past 17 years?



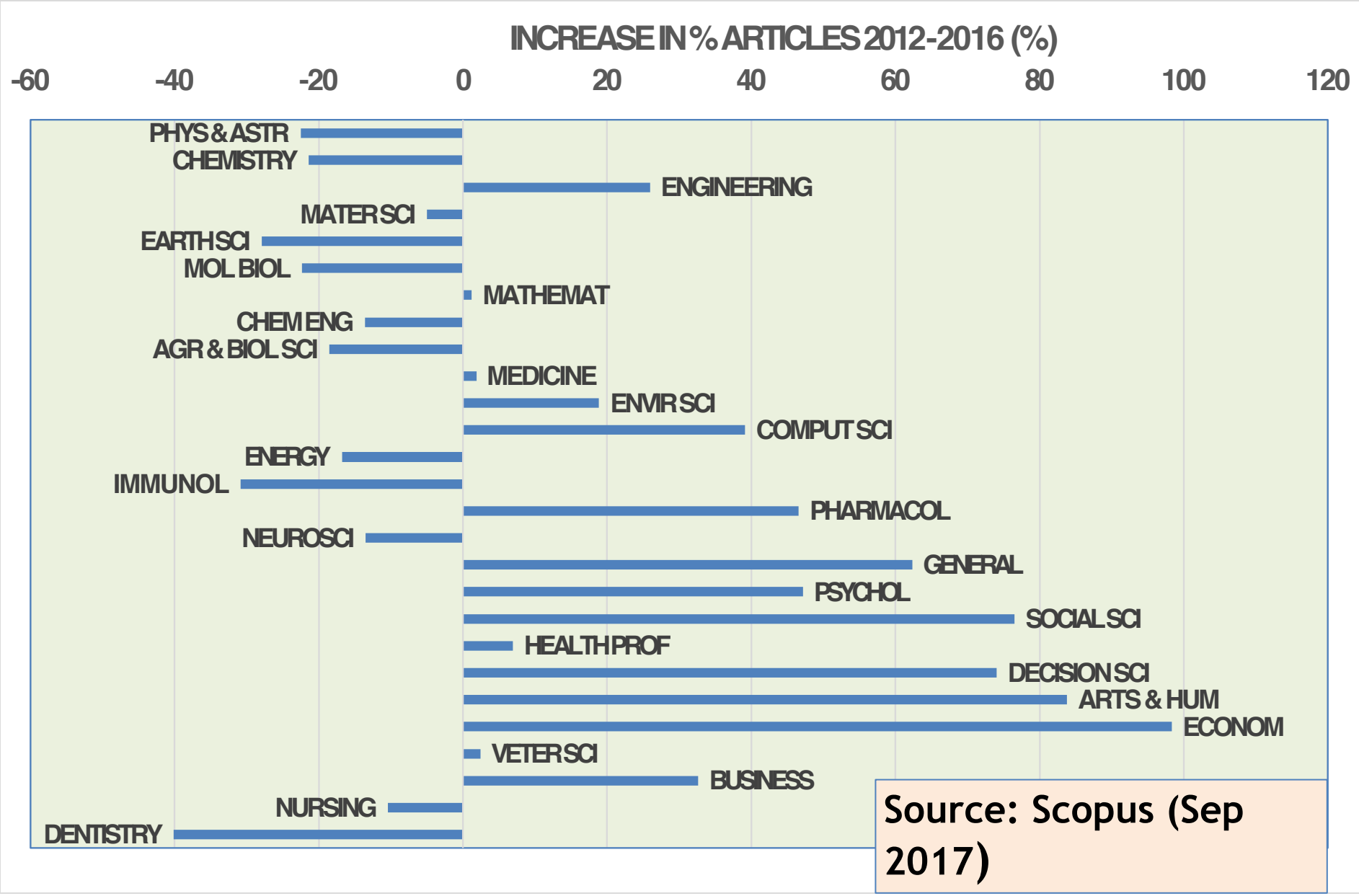

Source: Scopus (Apr 2013)

# Russia 2012-2016: Increase in abs. number of articles




Source: Scopus (Sep 2017)

# Russia 2012-2016: Increase (%) in percentage of articles




Source: Scopus (Sep 2017)

# Trends in Russian publication output during 2012-2016: Conclusions

- Exponential growth of total number of articles from Russia indexed in Scopus
- In all disciplines (except dentistry), the absolute number of published articles increased
- Engineering shows the largest increase in absolute numbers, followed by Physics & Astron, Material Sci, Computer Sci and Social Sci
- Decline of article shares in many science fields: phys & astron, chemistry, earth sci, chem eng, energy.
- "Small", social sci and Humanities disciplines (economics, arts & humanities, social sci, decision sci, psycholology, business sci) show the largest increase in article shares
- Decline of article shares in most medical and biological fields (molecular biol, immunol, agr & biol sci, neuroscience), except for medicine (small increase) and pharmacol

# Research questions

- There are at least three important factors: 1) database coverage; 2) scientific-scholarly performance; 3) publication strategies.
- To which extent are the presented outcomes influenced by changes in Scopus source coverage?
- To which extent is there a genuine increase in scientific productivity ("Russian scholars obtain more research results")?
- To which extent is there an increase in scientific quality of the papers ("Russian authors obtain more significant results and write better papers")?
- To which extent is there a shift in publication strategies from publishing in national (Russian) journal towards using "international" (English speaking, Scopus-covered) journals?

# Part 4
# Options for new evaluative-informetric applications

# Options for an academic policy towards the use of informetric indicators

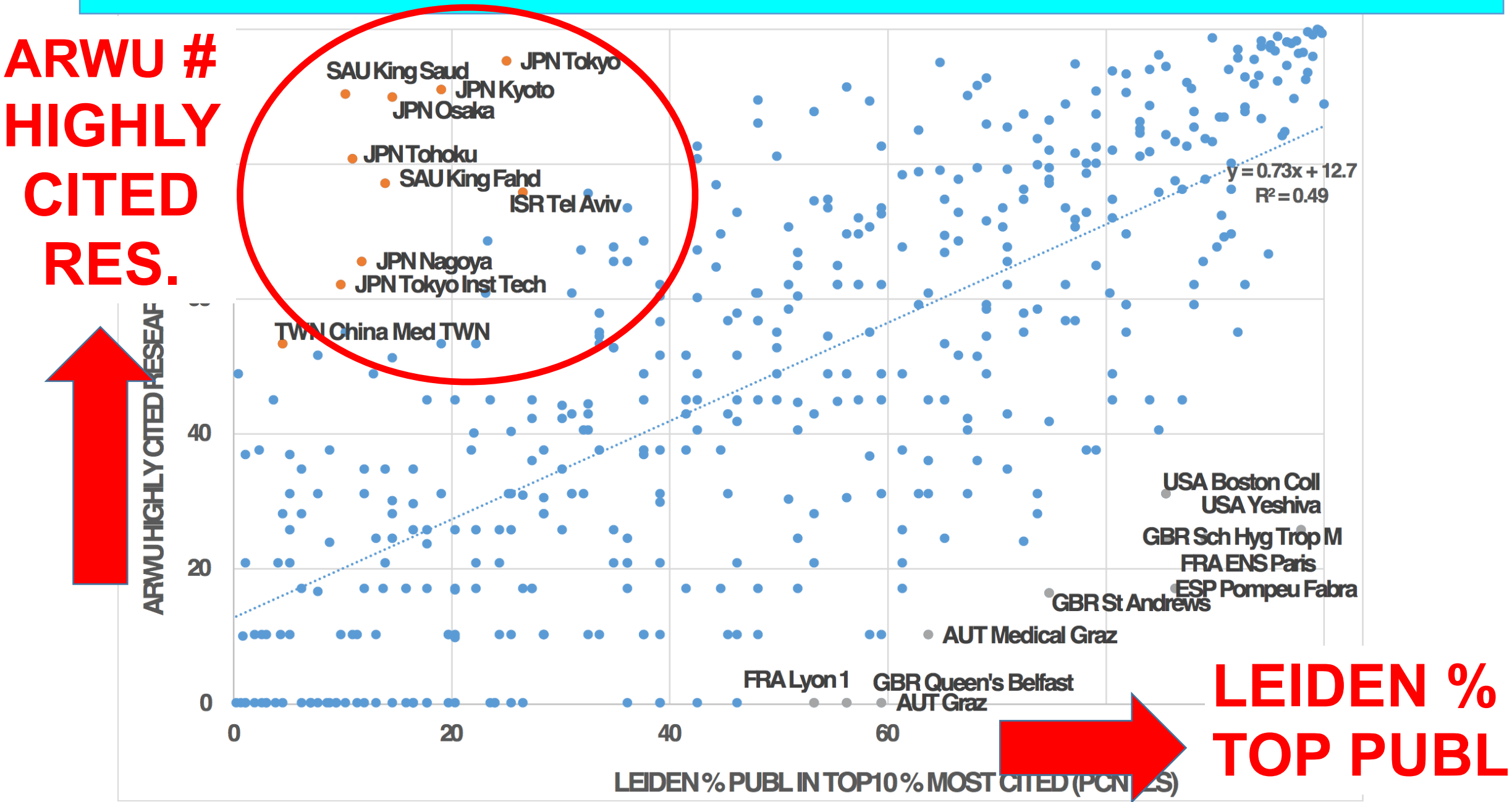
1. Informetric data mining tools ←→ set of one-dimensional rankings
2. Insight into effects of methodological decisions ←→ fake / facade exactness of rankings
3. Focus on preconditions for performance ←→ performance or importance as such
4. Minimum performance standards ←→ upper part of quality distribution
5. Focus on communication effectiveness ←→ research quality
6. Sources' communication functions and target audiences ←→ aggregate counts
7. Funding formula based on emerging groups ←→ large exercises preserving status quo

# Rankings

# A critical comparison of 5 world university rankings

- An analysis of ARWU, Leiden, THE, QS and U-Multirank, shows that each system has its proper orientation or 'profile', and there is no 'perfect' system
- Their geographical coverage, rating methods, selection of indicators and benchmarks and indicator normalizations influence the ranking positions of given institutions
- Current ranking systems are still one-dimensional in the sense that they provide finalized, seemingly unrelated indicator values in parallel…..
- …..rather than offer a dataset and tools to observe patterns in multi-faceted data.
- More insight is to be provided to users into the methodological differences between the various systems

# ARWU highly cited researchers vs. LEIDEN % Publ in top 10 most cited publ

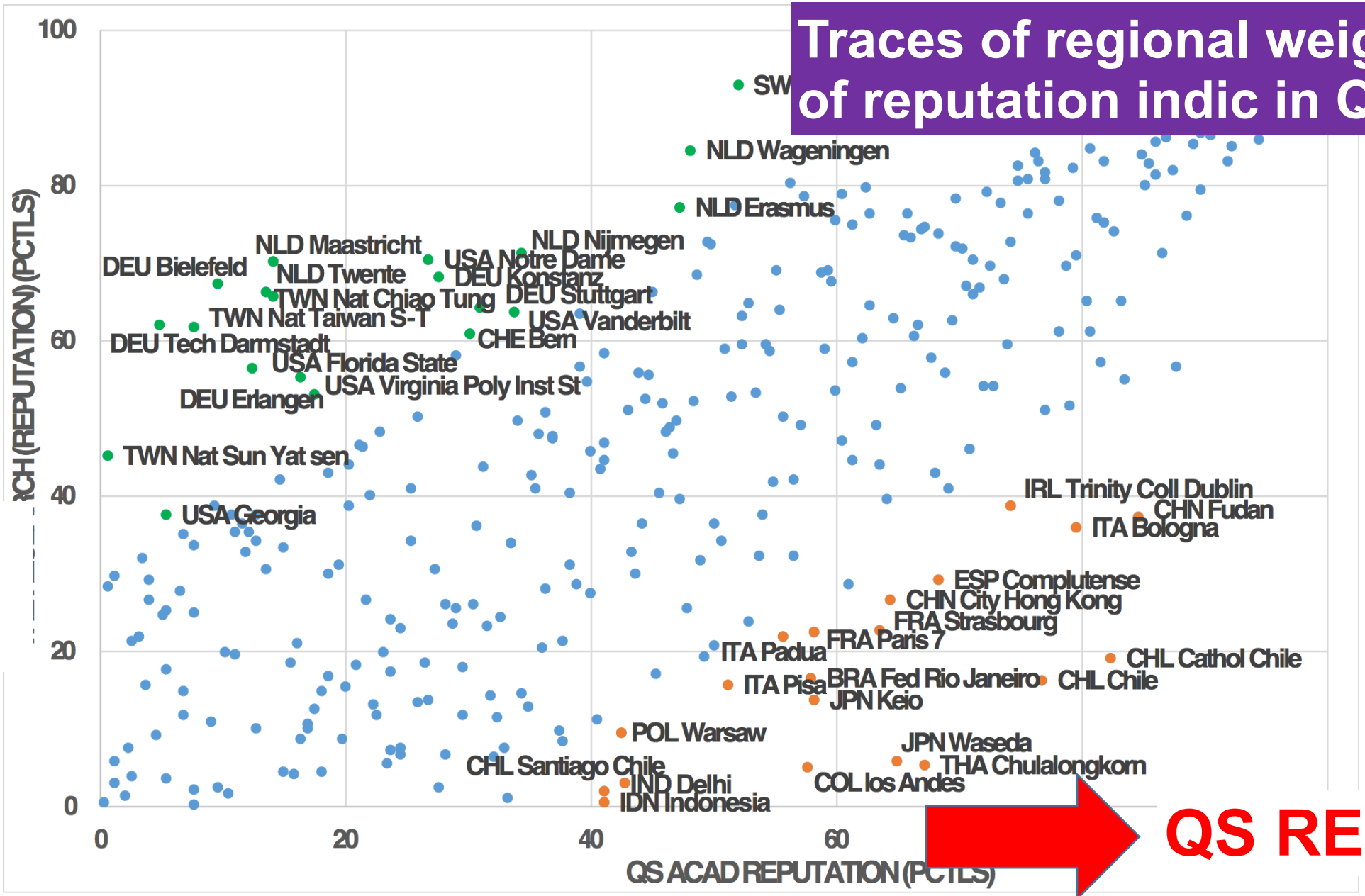


# THE Research Performance (Reputation) vs. QS Acad Reputation

**THE>> QS:**

**NLD**
**DEU**
**USA**
**TWN**

**Traces of regional weightings of reputation indic in QS?**




**THE REPUT**

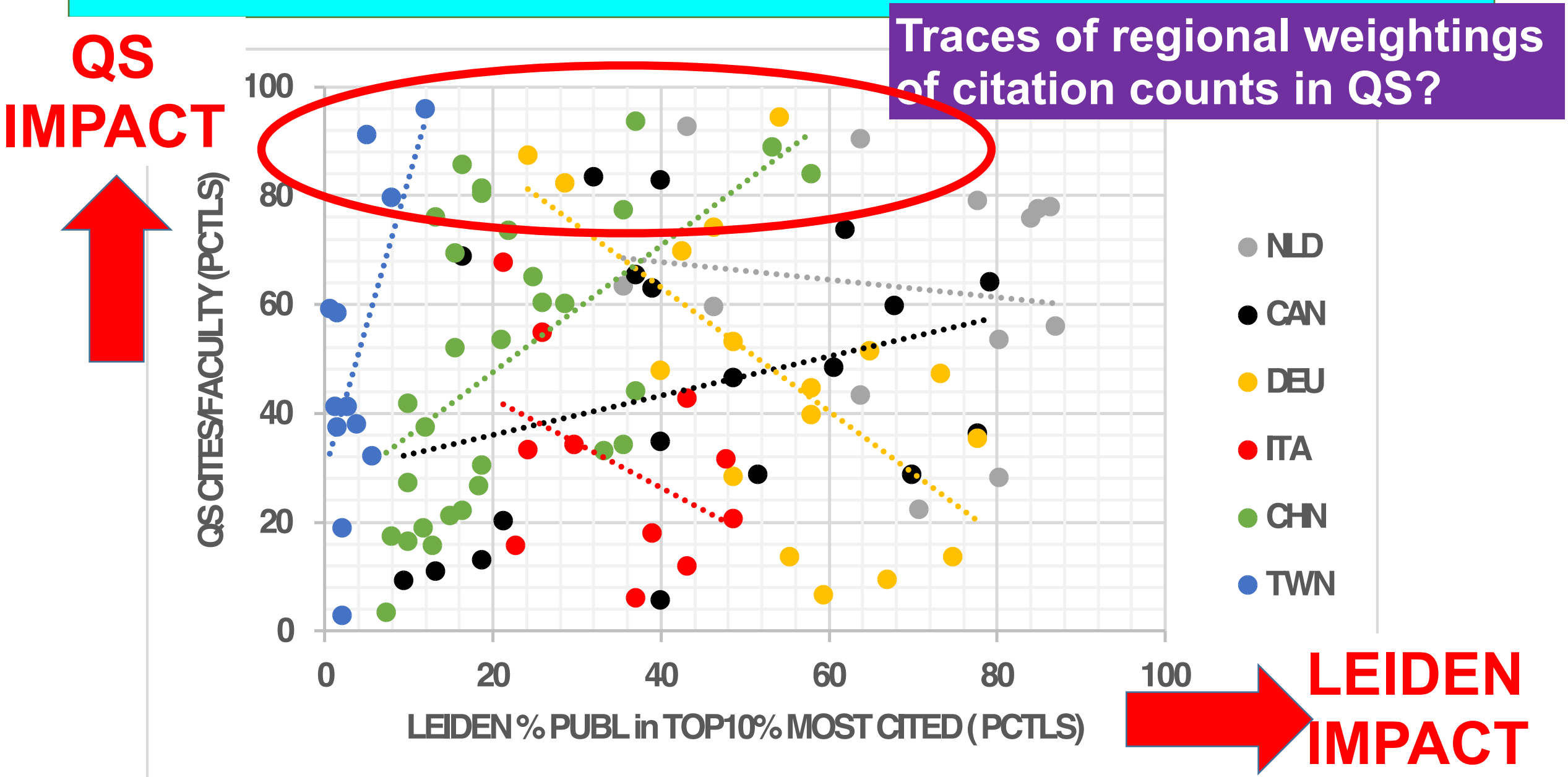
**QS REPUT**

**QS>> THE:**

**CHL**
**ITA**
**FRA**
**JPN**

# QS vs. LEIDEN Citation Impact

**Traces of regional weightings of citation counts in QS?**



# Policy towards World University Rankings

- Realistically speaking, rankings of world universities are here to stay
- Academic institutions could seek to influence the various systems:

- Systems should offer more advanced analytical tools, enabling a user for instance to cross-tabulate indicators;
- Provide more insight into how the methodological decisions of their producers influence the ranking positions of given universities.
- Enhance information of additional factors such as course language.

- Create a special university webpage providing information on a university's internal assessment and funding policies and on its various types of performance
- Request ranking producers to make these directly accessible via their systems

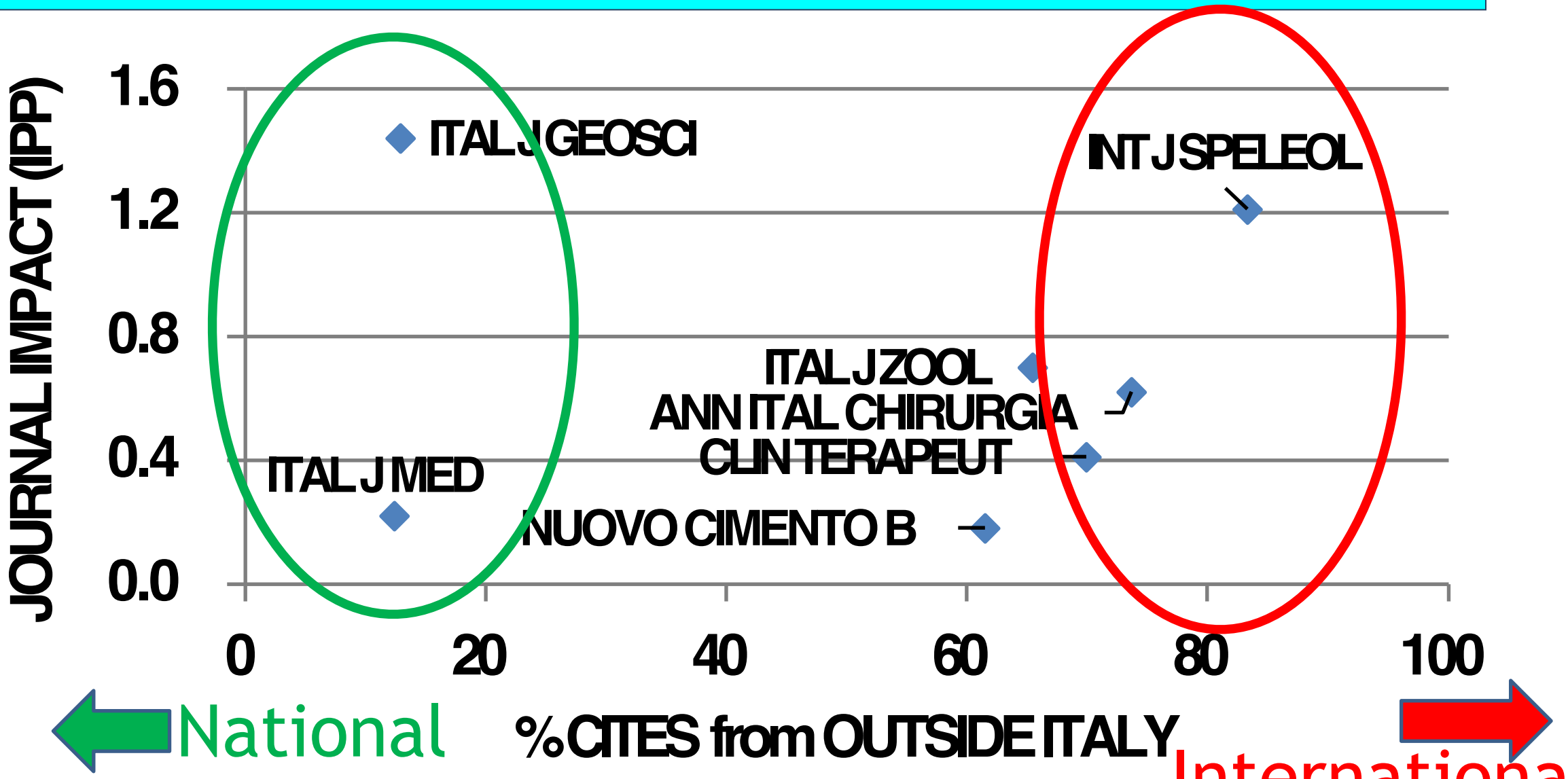
# Focus on preconditions for performance and minimum standards

# Definition of minimum performance standards

- Focus on the bottom of the performance distribution
- Analogous to introduction of having a doctoral degree as criterion for appointment as professor
- Criteria relate more to the conditions of being performant rather than to the actual performance level
- Acknowledges that performance indicators have constitutive effects
- Is related to notion of “being research active”, but its level may be somewhat higher
- To some extent research discipline-dependent
- To be established by a group of experts
- Takes into account a start-up period prior to becoming effective
- Level of minimum standard may become an institutional quality marker

# Focus on communication effectiveness

# Citation Impact vs. % International Citations for 7 Italian journals



# Use in funding formula

# The use of indicators in funding formula for performance-based funding

- Problems
- National exercises (e.g., in UK) require enormous efforts
- Formula tend to have a conservative effect (Matthew effect)

- Solutions
- Performance-based funding is feasible without large scale assessment
- It may focus on emerging research groups
- Funding allocated to institutions (partly) based on their number of emerging groups
- Combine informetric trend data and peer review

Thank you for your attention