

Evaluation of
research results
around the globe

Change in science from mode 1 to mode 2

Mode 1	Mode 2
Problems set and solved in the context of the (academic) concerns of the research community	Problems set and solved in the context of application
Disciplinary	Transdisciplinary
Homogeneous	Heterogeneous
Hierarchical, tending to preserve existing forms of organization	Heterarchical, involving more transient forms of organization
Internal quality control	Quality control is more socially accountable

“Science takes place within a social context”

Evaluation of publicly funded research has become a central concern of policy makers for two main reasons:

1. there is growing demand for evidence-based policies and for evaluation of the results of public investments
 - a. seek to determine how much they should invest in science and technology (S&T), research and development (R&D), and innovation.
 - b. know where to invest and what society gets in return
 - c. evaluation should help determine the economic effects of both public investment in R&D and innovation and the social impacts.
2. public investment in R&D despite budget constraints

Challenges for institutions that foster science

- Efficient allocation of scarce resources
 - Mechanisms that support research with priority within a discipline, university or government
- Reaching out to wider society
 - Develop evidence to the wider public of the social and economic benefits of supporting research

The evaluation is the 1st step to meet these challenges

Research funds for top universities

- UK: Research Assessment Exercise (RAE), started in 1986 – allows a focusing of funds in the research-intensive universities
- Australia: Excellence in Research for Australia (ERA) started in 2008, following a program similar with RAE – allows to attach funding to outcomes which will determine some of the university block grants for infrastructure, training and research
- Germany: Excellence Initiative, introduced in 2005 – promoting top-level research at universities and raising their international profile (currently 9)

Research funds for top universities

- France: Initiatives d'Excellence -- establish a number of world class universities (currently 8) capable of competing internationally for the best students and academics
- Italy: an increasing part of the state support to universities is distributed based on research parameters
- USA: STAR METRICS – measure the impact of science investment on economic growth/workforce/scientific knowledge/social outcomes

Research productivity – an Italian example

Labor productivity at the individual level

At micro-unit level (the individual researcher level, R) we measure FSS_R , a proxy of the average yearly productivity over a period of time, accounting for the cost of labor. In formula:

$$FSS_R = \frac{1}{w_R} \cdot \frac{1}{t} \sum_{i=1}^N \frac{c_i}{\bar{c}} f_i$$

Where:

w_R = average yearly salary of the researcher ;

t = number of years of work of the researcher in the period of observation;

N = number of publications of the researcher in the period of observation;

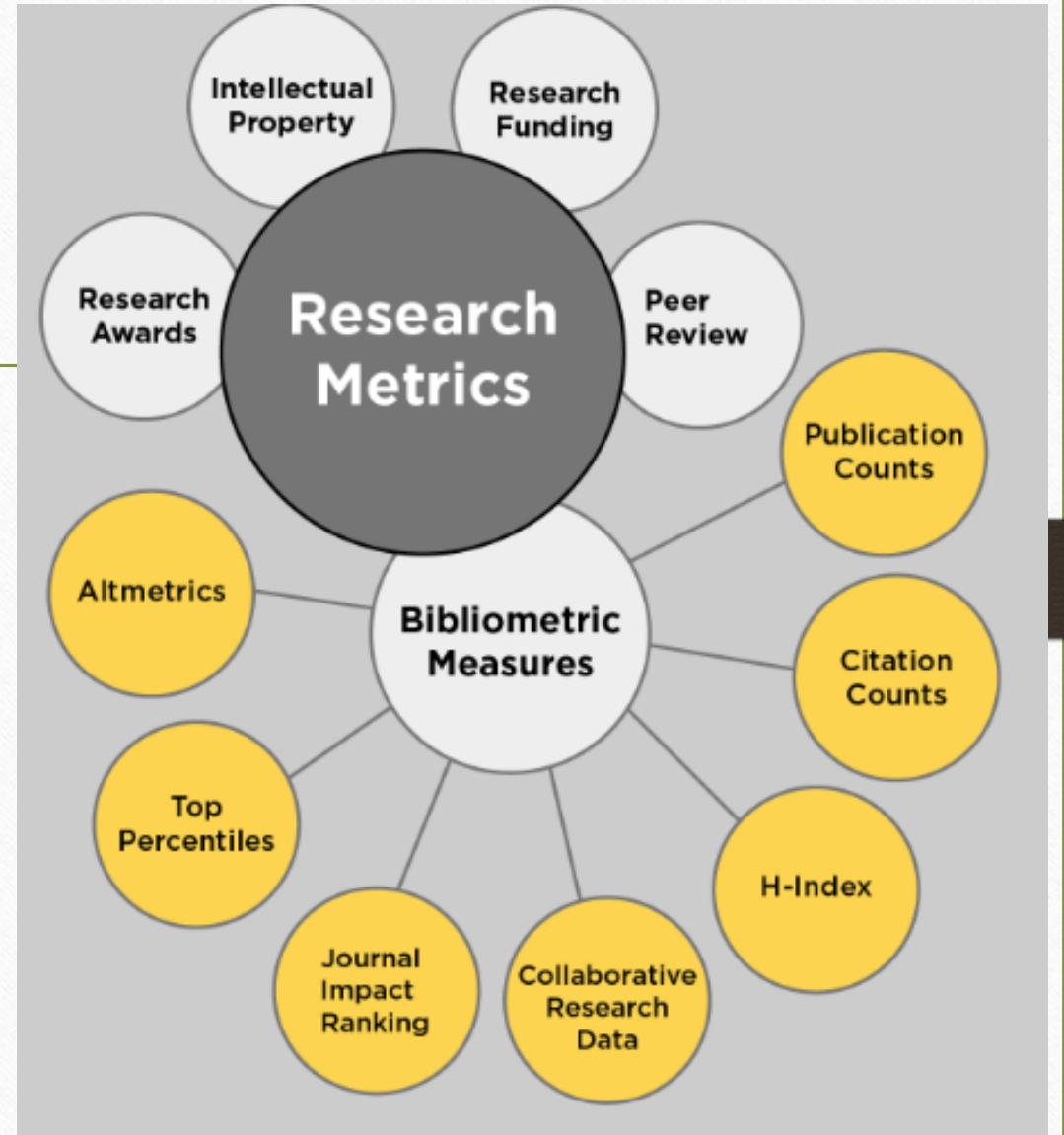
c_i = citations received by publication i ;

\bar{c} = average of the distribution of citations received for all cited publications of the same year and subject category of publication i ;

f_i = fractional contribution of the researcher to publication i .

Source: <http://doi.org/10.1007/s11192-014-1269-8>

Relationship between Measures of Research Productivity and Impact



Bibliometrics

- Are employed to assess and rank the research outputs of individuals, institutions and countries
- It is used in evaluation and decision making by universities and their senior academic administrators, policy makers and researchers themselves.
- Bibliometric outputs/outlets differ between disciplines.
 - in natural and life sciences publish mostly journal articles;
 - engineers publish journal articles and conference proceedings;
 - social scientists and humanities scholars focus on journal articles, book chapters, monographs and books

Pitfalls

about the blanket application of bibliometrics

- How to cope with papers with multiple authors (e.g. in high-energy physics)
- Variations in how the names of researchers and institutions appear
- Over-citations of articles describing methodologies
- Self-citation
- “Grey” literature – reports from governments, NGOs etc
- Appearance in electronic and open-access journals

Bibliometrics should be complement with human judgement!

Discipline dependence

Coverage of publications in WoS

Discipline	Coverage
Biochemistry Biological Sciences (humans & clinical medicine) Chemistry Molecular Biology Physics	Excellent
Applied engineering & engineering sciences Biological sciences (animals & plants) Geosciences Mathematics Psychology Social sciences (related to medicine & health)	Good
Anthropology Computer science Educational sciences and humanities Political science Sociology	Moderate

(Moed, 2005)

Publication behavior

Neuroscience Life Science Pharmacy & Toxicology Chemistry & Chemical Engineering Physics	High
Environmental Sciences Health Sciences Earth Sciences Biological Sciences Social Sciences	• Frequency of publication • Length of reference list • Number of co-authors
Materials Science & Engineering Mathematics & Computer Sciences Arts & Humanities	Low

(Colledge & Verlinde, 2014)

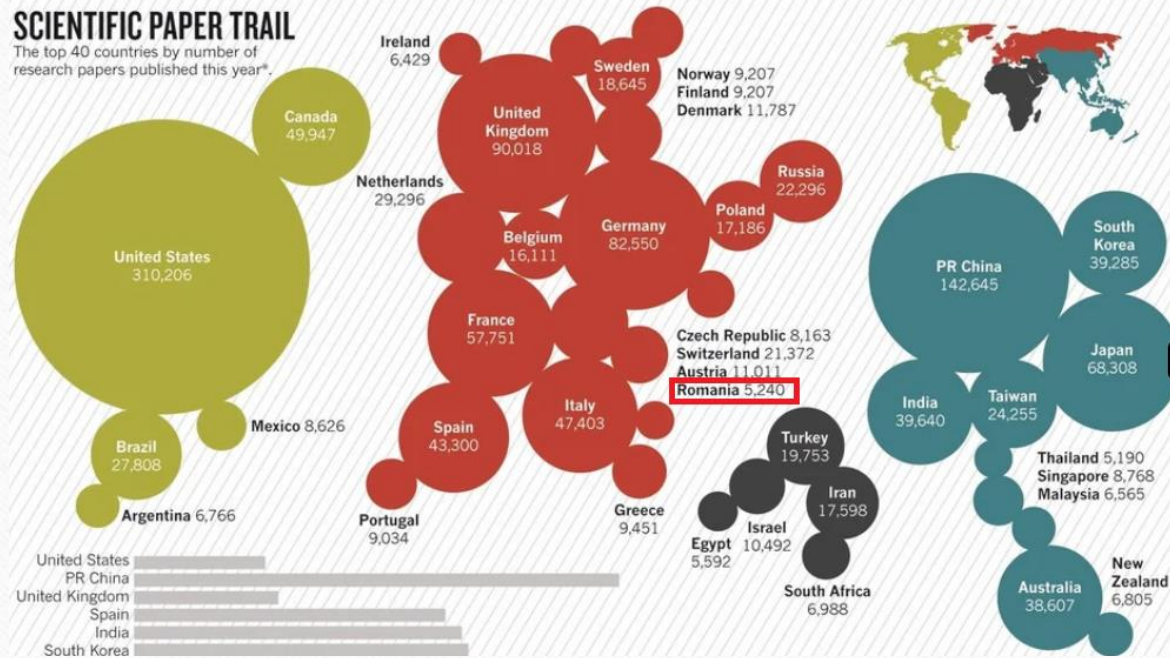
2014: No. of scientific papers

Top 40 countries by the number of scientific papers published

i.imgur.com/g5sdKF...

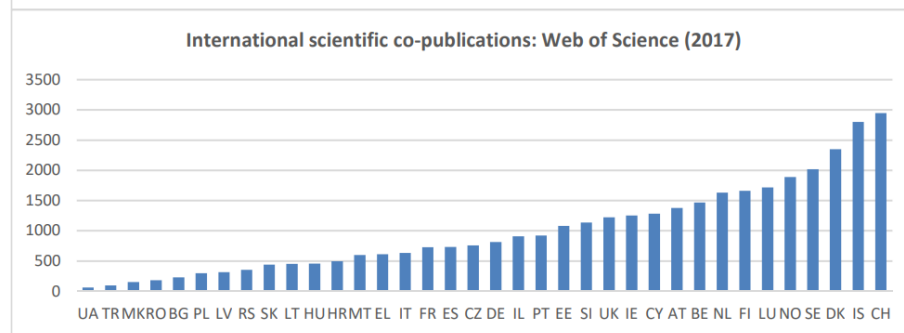
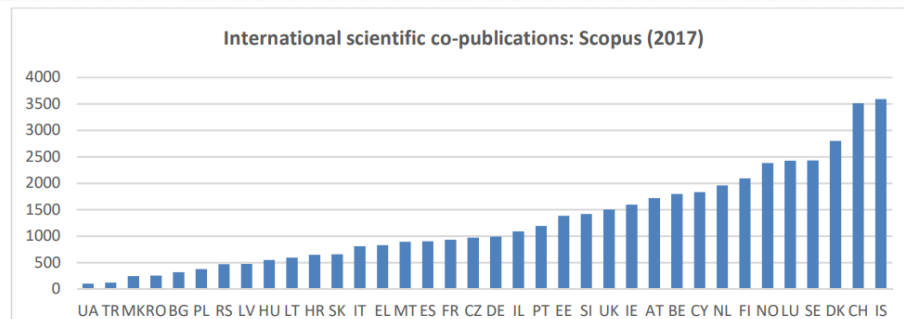
SCIENTIFIC PAPER TRAIL

The top 40 countries by number of research papers published this year*.

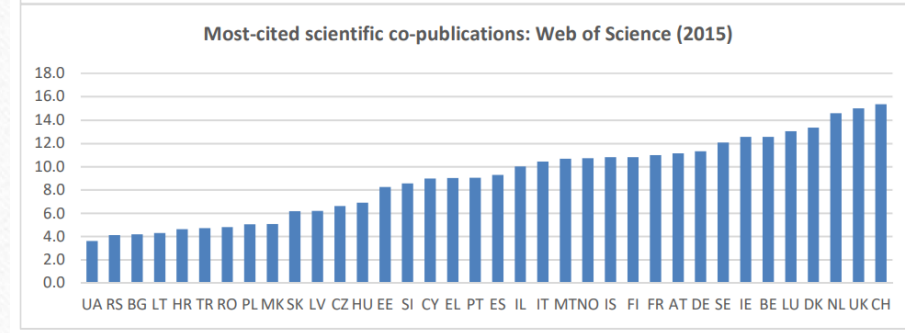
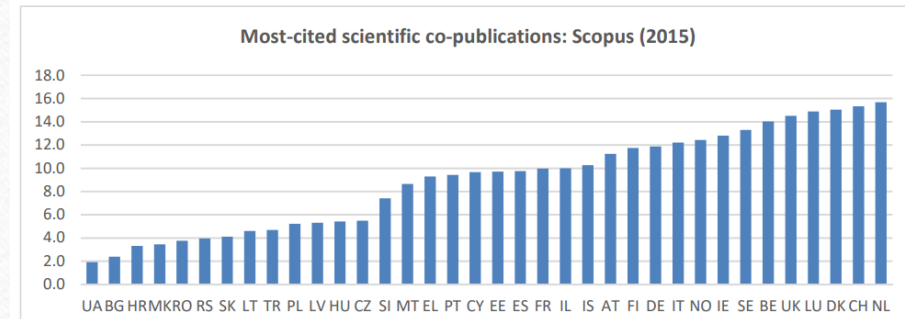


European Innovation Scoreboard 2019

Scientific publications per million population



Top 10% most cited publications

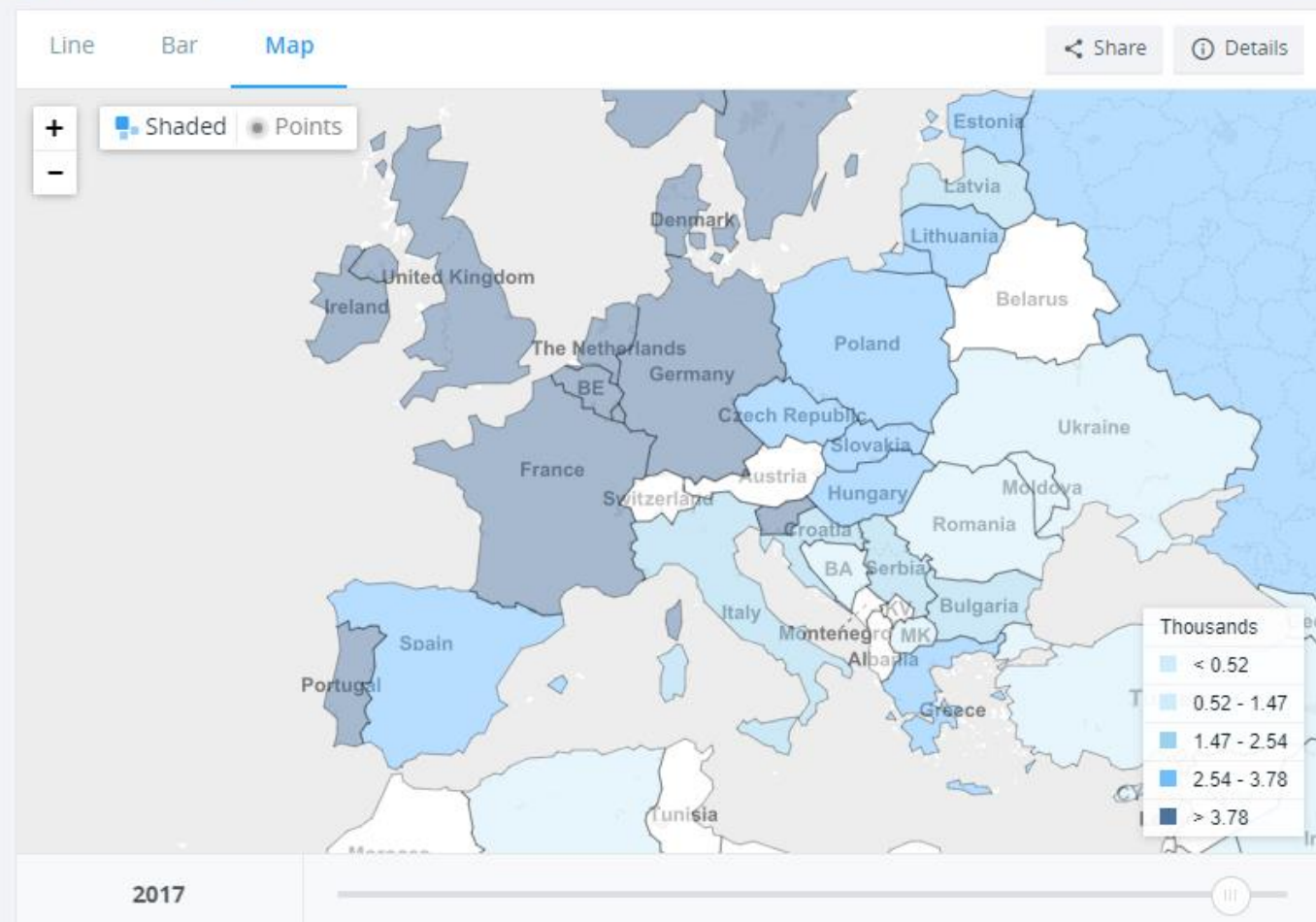


Data from World Bank

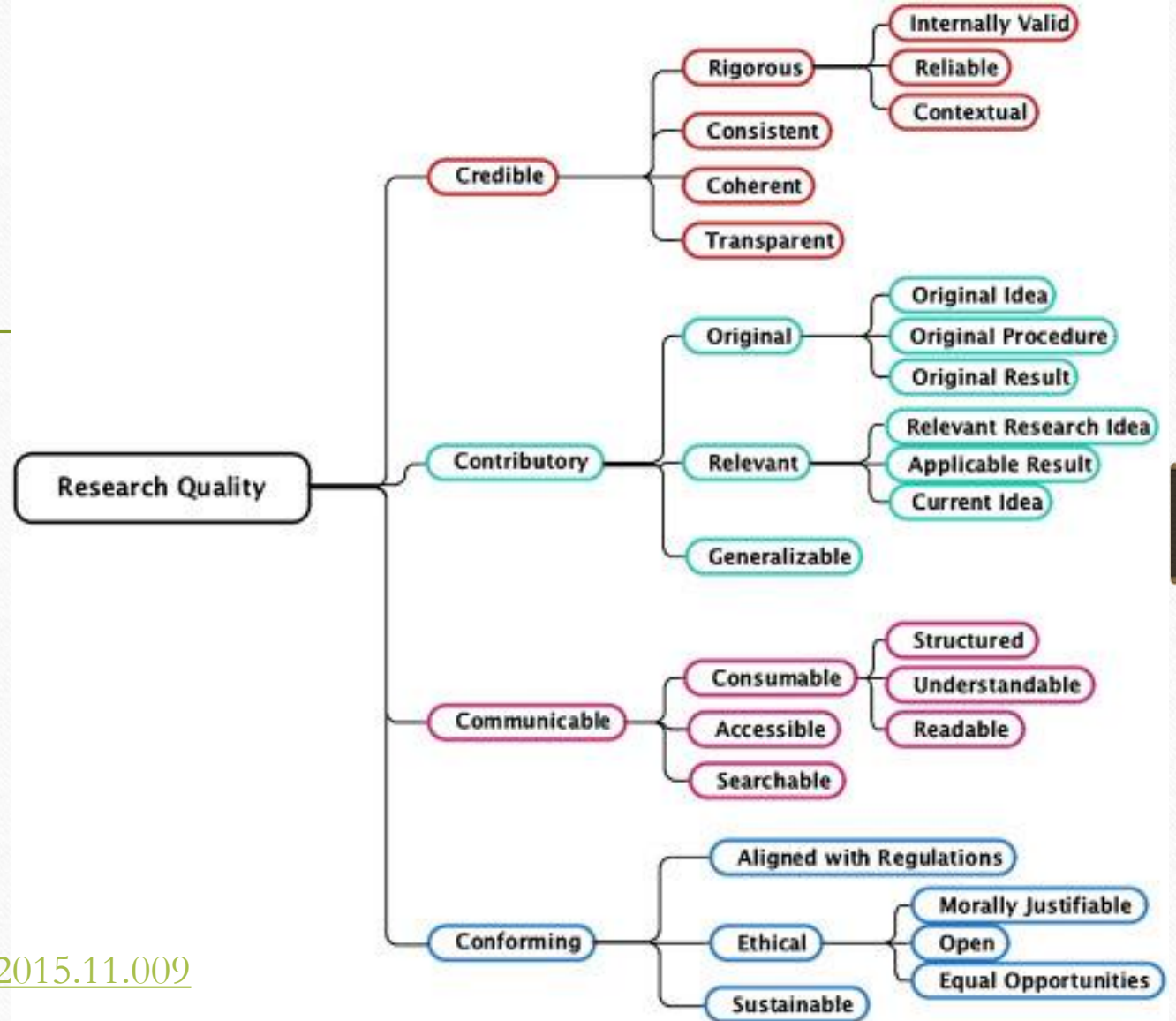
Researchers in R&D (per million people)

UNESCO Institute for Statistics (uis.unesco.org)

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Beyond quantity: research quality



Source: <https://doi.org/10.1016/j.respol.2015.11.009>

Example of quality research influence in Ireland

- Evaluation of universities based on the best papers of the individuals analyzed by human experts from other nationalities
- Employments: take into account recommendations from experts who have work or know the candidate