Approaches to Evaluating Research Performance: Peer Review and Scientometrics -The Case of the UK Research Evaluation Framework (REF)

Professor John Mingers, Kent Business School

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1. The UK Research Assessments

1. 1986: Started small with a “Research Selectivity Exercise” simply to allocate research funding
    - Each department submitted just FIVE papers and a description of research
    - Ranked from “below average” to “outstanding” by peer review
    - Little interest until league tables were produced by *THE*
2. 1989 – 2104: Six more, ever more complex, expensive and time consuming.
    - The 2014 REF was estimated to have cost £250m
    - The biggest driver of university behaviour and huge effects on university staff

2. Overview of the 2014 REF

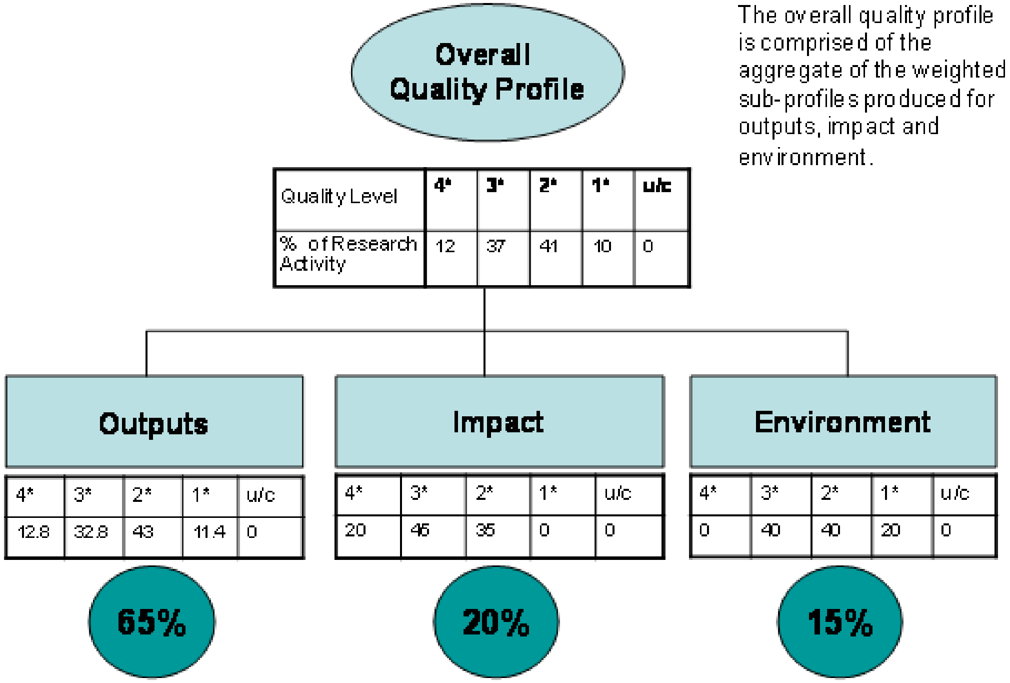
1. Each department makes a submission based on a selection of academics
    - Four research outputs per academic (less are scored zero)
    - A “Research Environment Statement” describing their research strategy, processes and management, PhD students and research income
    - Non-academic impact case studies – 1 per 10 staff
2. Each output, the research environment and the case studies are all graded from 0 – 4 in terms of research quality
3. The results are presented in a profile – the % judged to be in each category.
4. This is quickly converted into a (grade point) average (GPA) by the *Times Higher* and used to create a league table for each university and each subject
5. The quality profile ignores the number of staff submitted but the funding is related to volume, as well as being heavily weighted to 4* work

The Quality Scale

4*	Quality that is world-leading in terms of originality, significance and rigour.
3*	Quality that is internationally excellent in terms of originality, significance and rigour but which falls short of the highest standards of excellence.
2*	Quality that is recognised internationally in terms of originality, significance and rigour.
1*	Quality that is recognised nationally in terms of originality, significance and rigour.
Unclassified	Quality that falls below the standard of nationally recognised work. Or work which does not meet the published definition of research for the purposes of this assessment.

Components of the REF

- Components of the submission
  - Staff data
  - Research Output data (65%)
  - Impact case studies and contextual narrative (20%)
  - Research environment narrative, income and PhD data (15%)
- Outcome reported as a ‘quality profile’



Quality Level	4*	3*	2*	1*	u/c
% of Research Activity	12	37	41	10	0

The overall quality profile is comprised of the aggregate of the weighted sub-profiles produced for outputs, impact and environment.

Outputs

4*	3*	2*	1*	u/c
12.8	32.8	43	11.4	0

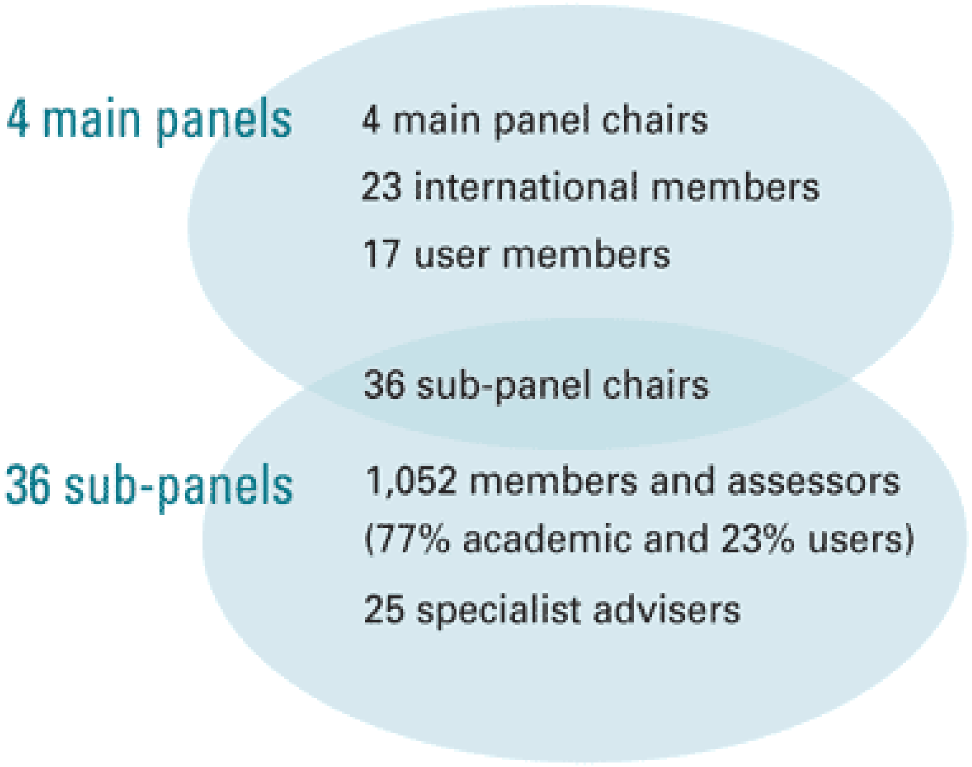
Impact

4*	3*	2*	1*	u/c
20	45	35	0	0

Environment

4*	3*	2*	1*	u/c
0	40	40	20	0

The Extent of the Exercise



4 main panels

4 main panel chairs

23 international members

17 user members

36 sub-panel chairs

36 sub-panels

1,052 members and assessors (77% academic and 23% users)

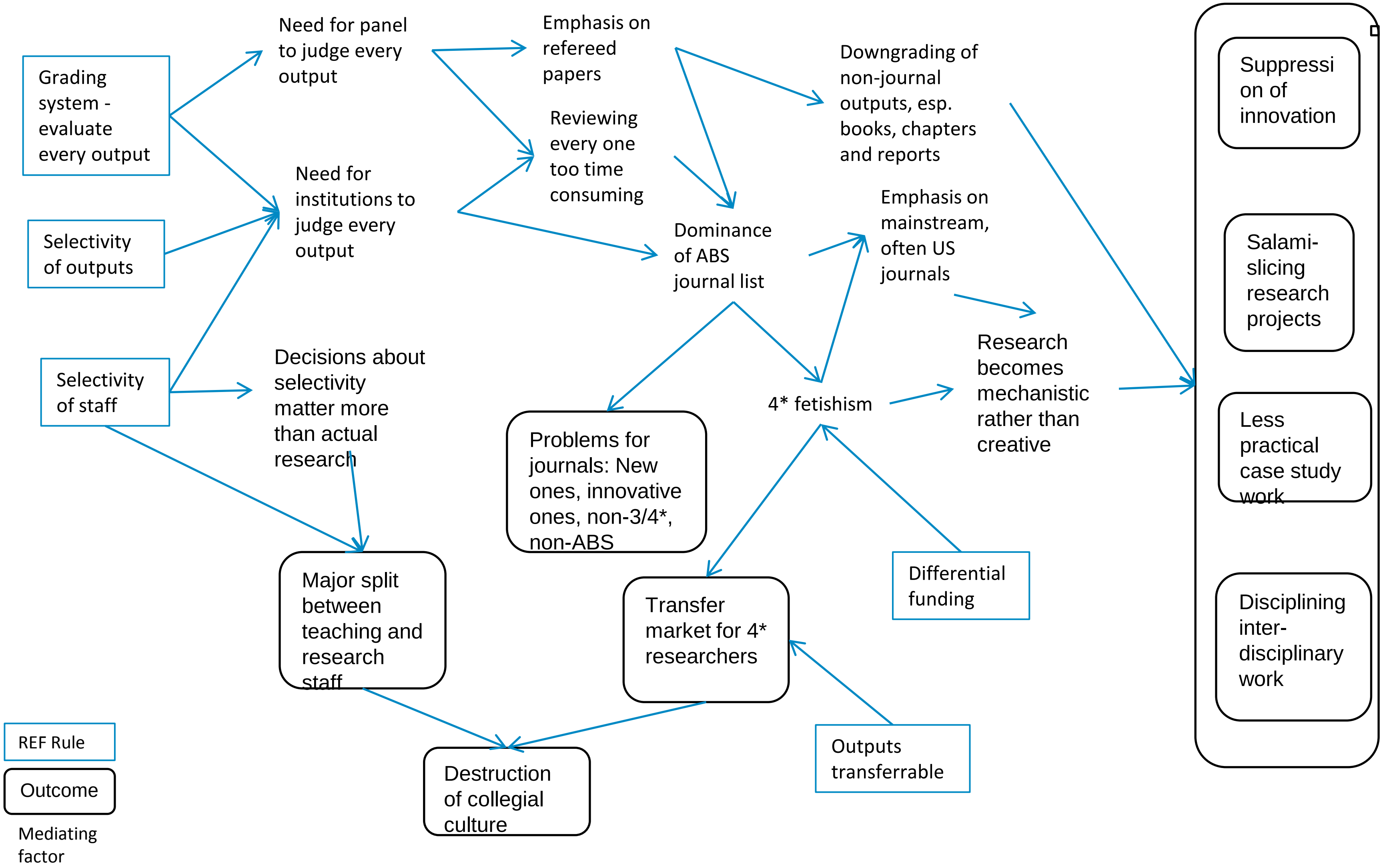
25 specialist advisers

Institutions	154
Submissions	2,363
Staff	57,523
ECRs	10,815
Special circumstances	16,361
Outputs	215,507
Papers	157,021
Books/chapters	28,628
Impact cases	6,975

3. The Dysfunctions of the REF

- Was it properly constituted peer review (Sayer, "*Rank Hypocricies*")?
  - The secretive and opaque nature of the appointment of Panel members
  - The extent to which Panels merely represented the established pecking order
  - Problems with the Panel having the necessary expertise to properly evaluate all the areas of the submissions
  - The huge workload which meant that in practice, whatever the rhetoric, often only the titles and abstracts of papers were read and reliance was placed on things like journal ranking lists
  - The refusal to use external indicators such as citations
  - The lack of international members when it was supposed to be an international benchmark.
  - The effects of the changes to the funding formula in favour of only 4* papers which pushed universities in to being highly selective in staff submitted.
  - The secretive and opaque nature of staff selection within universities

Influence Diagram for Business and Management



Grading system - evaluate every output

Selectivity of outputs

Selectivity of staff

Need for panel to judge every output

Need for institutions to judge every output

Decisions about selectivity matter more than actual research

Emphasis on refereed papers

Reviewing every one too time consuming

Dominance of ABS journal list

Downgrading of non-journal outputs, esp. books, chapters and reports

Emphasis on mainstream, often US journals

4* fetishism

Research becomes mechanistic rather than creative

Problems for journals: New ones, innovative ones, non-3/4*, non-ABS

Major split between teaching and research staff

Transfer market for 4* researchers

Differential funding

Outputs transferrable

Destruction of collegial culture

Suppression of innovation

Salami-slicing research projects

Less practical case study work

Disciplining inter-disciplinary work

REF Rule

Outcome

Mediating factor

- Selectivity of staff and outputs
  - Perhaps *the* major problem – any number of staff may be entered and the fewer the number the higher the GPA
  - In 2008 most research intensive departments submitted upwards of 80% but those who were highly selective were rewarded
  - In 2014 most had a threshold of 4x3* papers, i.e., 12 points – but how is this to be judged?
  - There is an alternative measure – “power” – which is the GPA x Staff submitted and another – “intensity” which is GPA x % staff submitted
  - Examples:

    Cardiff Metropolitan University came 41st overall with only 35 staff

    LSE came 3rd overall but 28th on power

    In B&M, submissions were low: Aston (43%), Cardiff (56%), Oxford (51%), Reading (61%), Sheffield (55%)

    Cardiff Business School was 6th on GPA but 32nd on intensity; Brunel was 65th on GPA but 20th on intensity
  - The *THE* later produced a Table based on intensity and said that GPA alone was a poor measure

- The Taylorization of research
  - The hegemony of the ABS list
  - Dominance of (US) 3* and 4* journals
- Suppression of innovation
- Salami-slicing projects
- Disciplining inter-disciplinary work
- Marginalising practical engagement
  - Two track researchers
- Destruction of the journal ecosystem
- Fragmentation of the academic community

Recommendations

- Assess ALL staff and research outputs over a particular time window
- This would require bibliometrics subject to peer review
- Perhaps different arrangements for science/ social science/ arts because of the quality of citation data
- Establish a national database of all research outputs from institutional repositories

4. Overview of Scientometrics

- Generally, the quantitative study of published or recorded information. In terms of evaluating research it takes the number of times a paper has been cited as a surrogate for its quality.
  - Citations really concern *impact* which is not quite the same. A paper could be cited because it is wrong
  - Many papers are never cited – are they therefore worthless?
  - There are problems with recording or measuring citations, especially in the social sciences and humanities (Harzing)
  - Scientometrics started with Eugene Garfield establishing the Science Citation Index in the 1950's. Current developments are in altmetrics

Where do Citations Come From?

1. **Citation databases – *Thompson-ISI Web of Science* (used to be SCI, SSCI) or *Elsevier Scopus***

These record all the references for a given set of journals (WoS - 12,000) and then allow them to be searched by key words or cited authors

They also now do citation analyses for both individuals and journals.

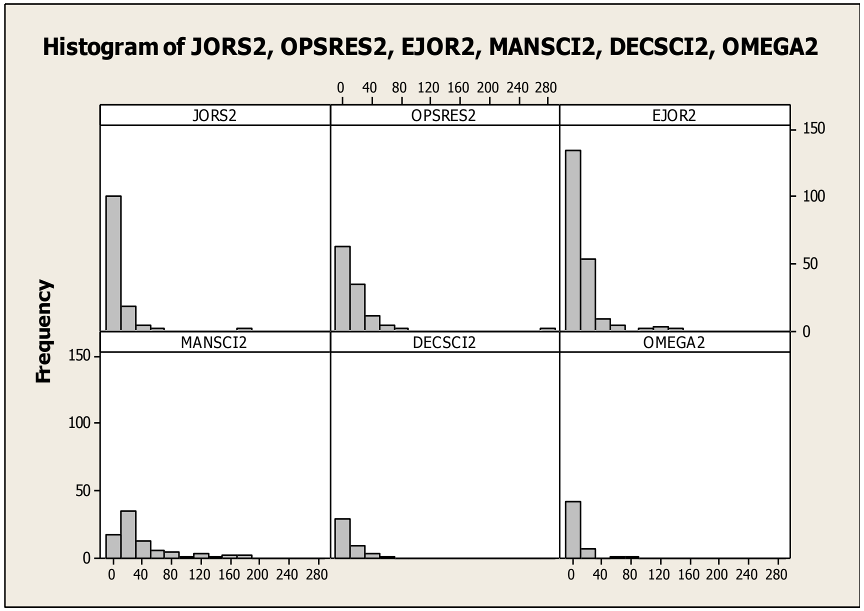
They are rigorous and generally reliable but limited in coverage, especially in the social sciences (40% - 70%) and humanities (20% - 50%)

They have started covering books and some conferences

2. ***Google Scholar*** – this searches the web, like Google, looking for references to academic papers and books
   - Covers all kinds of outputs other than journals
   - Generally finds many more citations
   - Is equally good for all disciplines (about 90%)
   - But, it is not rigorous picking up references from teaching material, home pages etc not just research journals or books
   - The data is poor quality – spelling errors etc. – the same paper may occur many times and the authors' names may be wrong
   - Best accessed through *Publish or Perish* *(*http://www.harzing.com/pop.htm)

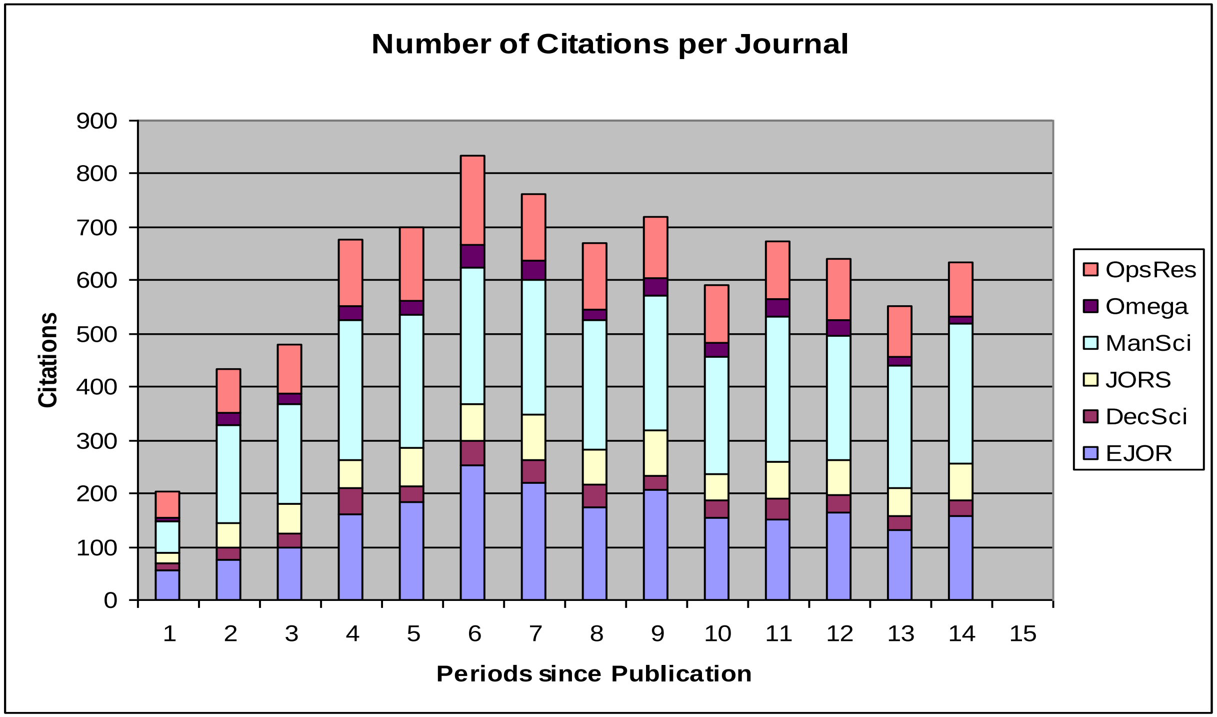
Citation Behaviour – the Skewness of Science

	*JORS	Omega	EJOR	Dec Sci	Ops Res	Man Sci
Actual mean	7.3	7.2	11.3	11.1	14.6	38.6
Actual sd	17.9	15.5	19.0	14.0	28.6	42.4
% zero cites	18	22	14	12	10	5
Max cites	176	87	140	66	277	181



Citations in 6 good quality journals over a 15 year (1990-2005) period for 600 papers

Dynamics



Citations in 6 good quality journals over a 15 year (1990-2005) period for 600 papers

5. Basic Citation Metrics

1. **Total citations** for a collection of papers (TC)
   - Very crude. Needs to be corrected (normalised) for: no. of papers, field, prestige of citing papers, time frame
2. **Cites per paper** (CPP), impact per paper (IPP)
   - Most common. Normalises completely for volume/productivity. Basis of the Journal Impact Factor (JIF)
   - Heavily dependent on field and time window
   - Affected by skewness
3. **h-index** (h papers with at least h citations)
   - Combines both impact and productivity
   - Very time dependent (poor for new researchers)
   - Not very discriminatory (integer, ignores high citaions)
   - Poor for high citations/low volume (e.g., Thomas Kuhn)
   - Robust to poor data (e.g., Google Scholar)

Forms of Normalization

Differences in the numbers of citations can be huge across fields, e.g., tenfold between biology and computing

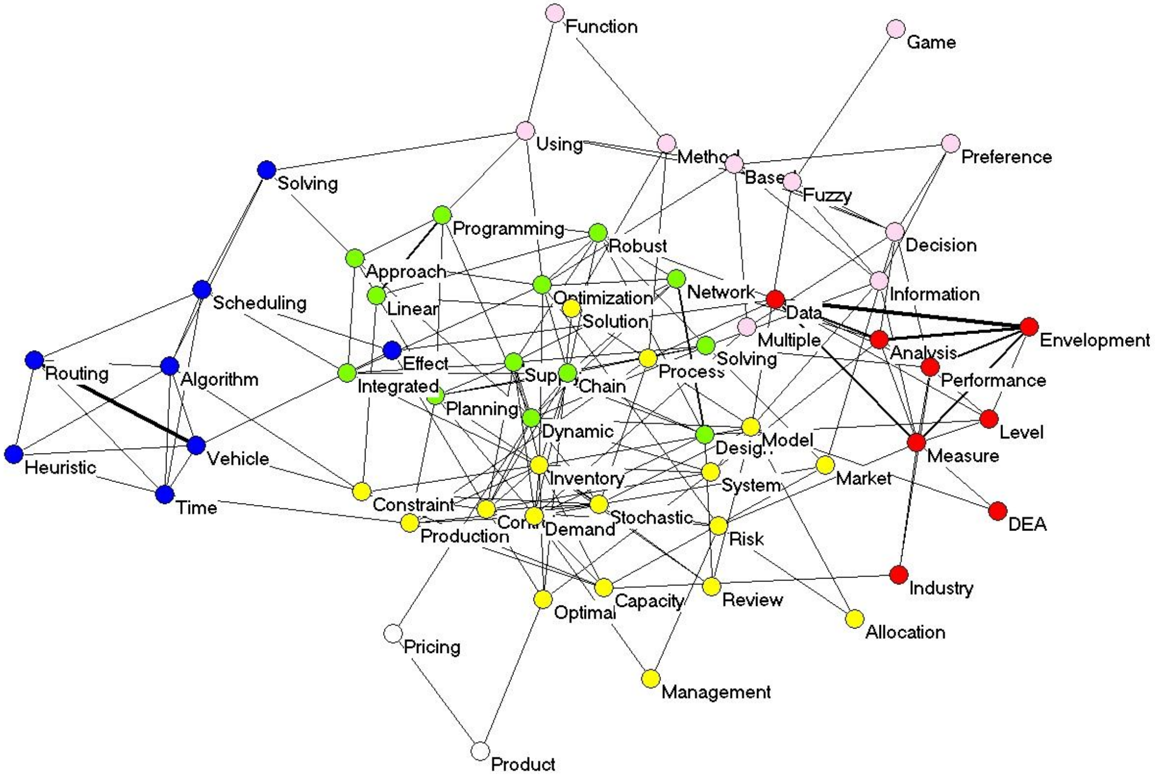
- Field normalization, e.g., Leiden CWTS
  - Compares citations received to the world-wide average CPP for the field (generally defined by WoS fields)
  - Problems with the calculations and also the field lists. Also cross-field work
- Source normalization (citing-side)
  - Uses the set of actual citing journals rather than an a priori field list
  - Uses the number of references in these papers rather than the number of citations received
  - Different methods e.g., fractional counting, audience factor, SNIP
- Percentiles
  - Uses journals from the field and calculates the proportion of papers in a particular percentile, e.g., top 1%, 5%, 10% …

6. Journal Citation Metrics

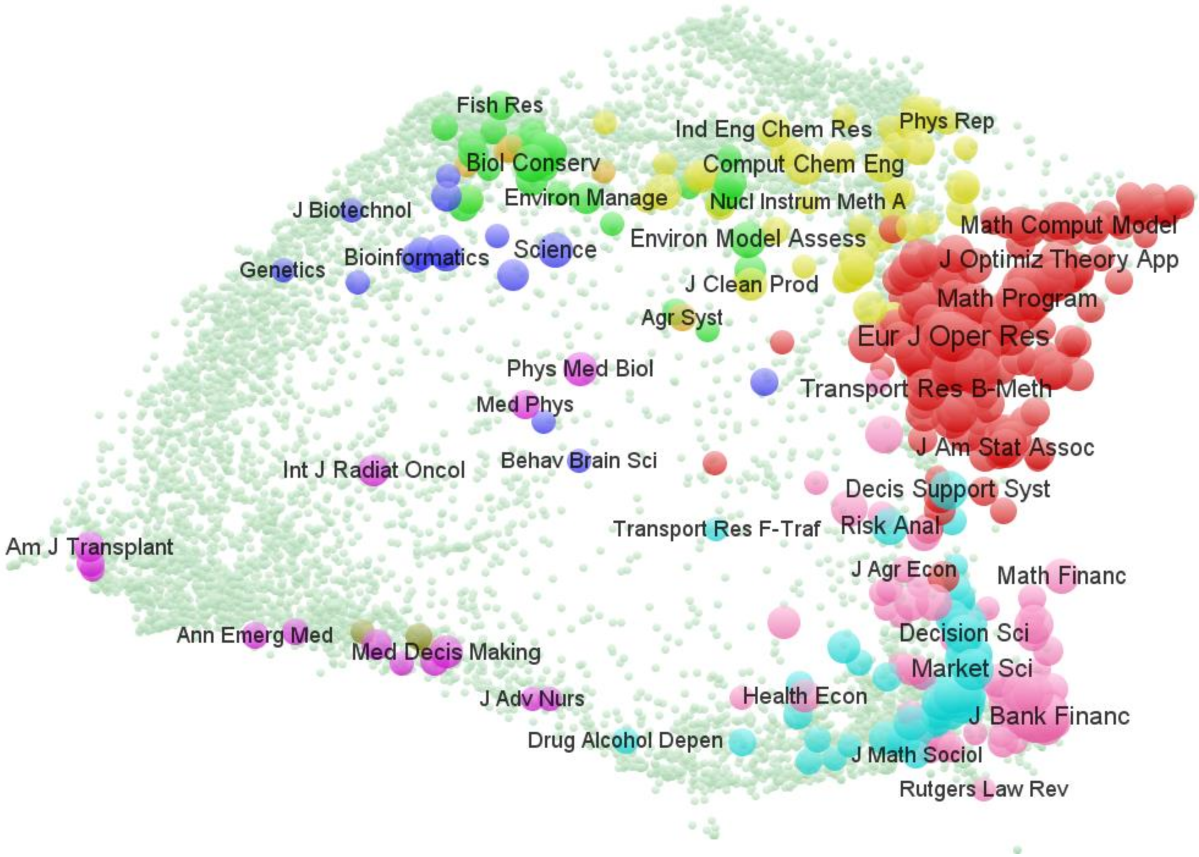
1. Journal Impact Factor (JIF)
   - A 2-year CPP. The number of citations in year n to papers published in years n-1 and n-2.
     e.g., *Acad Mgt Review* has IF 6.169 so this is the average citations in 2011 to papers published in 2009 and 2010. For management this is very high – many journals are less than 1.0.
   - But, in science we can get much higher figures: *Ann Rev Immun* – 52, *Physiol Rev* 36, *Nature* 31
   - There are many criticisms: very short term, there is 5-year IF but in social science citations may not reach their peak until up to 10 years; not transparent, un-normalized; can be manipulated by journals
2. Metrics including the prestige of the citation
   - These weight more highly citations from highly cited journals – e.g., *Eigenfactor* and *Article Influence Score* (in WoS). *Eigenfactor* is not normalised for number of papers. And *ScImago Journal Rank* (SJR) in Scopus which is normalised
   - These 2nd generation measures are complex, difficult to interpret and not field-normalised

3. The h-index
    - This can be used for the papers in a journal over a particular time period.
    - It has the same pros and cons as with an individual researcher. It favours journals that publish a lot of papers, and it is not field normalised
4. Source-normalised impact per paper (SNIP)
    - This is based on impact per paper (IPP) but normalised it by comparing it with the mean number of references in citing journals.
    - SNIP therefore normalises for both papers and field without having to use the WoS field categories
    - There have been criticisms of the form of calculations
5. Two others are fractional counting of citations and percentile measures (I3)

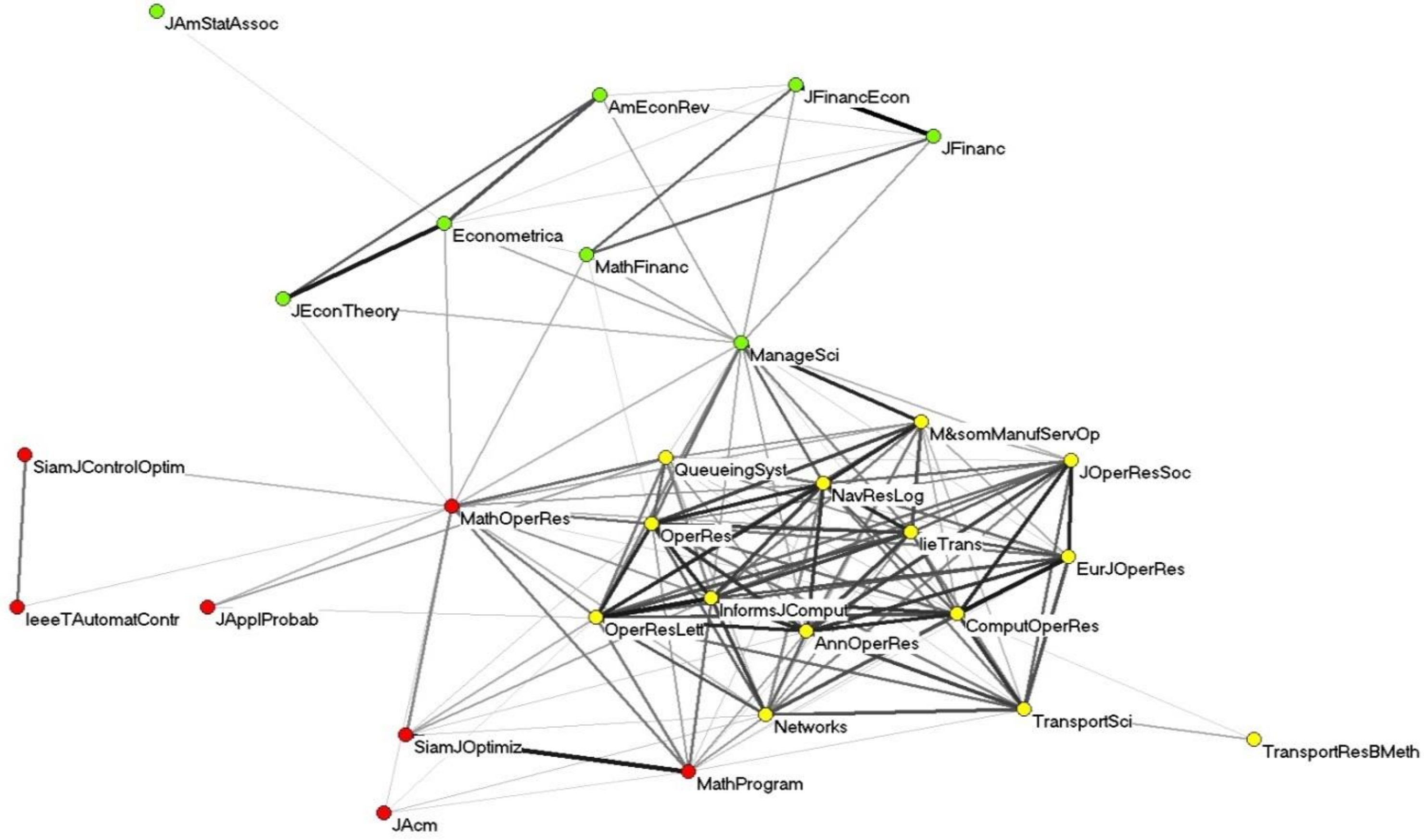
7. Visualizing Science



Cosine-normalized map of the 58 title words which occur ten or more times in the 505 documents published in EJOR during 2013. (cosine > 0.1; modularity Q = 0.548 using Blondel et al.., (2008); Kamada & Kawai (1989) used for the layout; see http://www.leydesdorff.net/software/ti.)



613 journals cited in 505 documents published in EJOR during 2013, overlaid on the global map of science in terms of journal-journal citation relations. (Rao-Stirling diversity is 0.1187; Leydesdorff et al.. (in press); see at http://www.leydesdorff.net/journals12).



Local map of the 29 journals cited in articles of Operations Research in 2013 (1% level; cosine > 0.2; Kamada & Kawai, 1989; Blondel et al.., 2008; Q = 0.213).

8. Alt Metrics

Viewed: institutional repositories, publishers, PLoS, Academia.com, ResearchGate. Perneger (2004) found a weak correlation with citations.

Downloaded/**Saved**: as viewed plus CiteUlike, Mendelay .

Used (WoS): downloaded paper or citation

Discussed: Wikipedia, Facebook, Twitter, Natureblogs, ScienceSeeker, general research blogs. Eysenbach (2011) suggested a “twimpact factor” based on the number of tweets

Recommended (peer review): F1000Prime

Cited: Wikipedia CrossRef, WoS, Scopus, Google Scholar

http://blogs.nature.com/
http://scienceseeker.org/
http://f1000.com/prime

9. Use for Evaluation and Policy

There are certain minimal requirements which are not yet met in some areas

- Robust and comprehensive data
- Unbiased and effective metrics
- Inter-disciplinary or practice-based work
- Measurement always changes behaviour
- Inappropriate use of metrics

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