Horizon 2020
Policy Support Facility

Bibliometrics in PRFS
Topics in the Challenge Paper

Mutual Learning Exercise on Performance Based Funding Systems
Third Meeting in Rome 13 March 2017
Gunnar Sivertsen
Agenda for this session

1. Bibliometric indicators in PRFS
2. Bibliometric data sources
3. Models for the use of bibliometrics
4. The importance of field normalisations
5. Discussion
Agenda for this session

1. **Bibliometric indicators in PRFS**
2. Bibliometric data sources
3. Models for the use of bibliometrics
4. The importance of field normalisations
5. Discussion
Bibliometrics - a field of research

- International journals
- International conferences
Bibliometrics - a commercial field

The Australian Research Council Selects Scopus for the evaluation of the Australian research landscape

Scopus Custom Data will be the sole provider

Amsterdam, 20 February 2009 – Elsevier announced today that Scopus®, its flagship product and world’s largest abstract and citation (A&C) database, was chosen by the Australian Research Council (ARC) for its Excellence in Research for Australia (ERA) initiative.

The ERA initiative will assess research quality within Australia’s higher education institutions using a combination of indicators and expert review by committees comprised of experienced, internationally-recognized experts.

Scopus Custom Data will be the sole provider used to assess the country’s higher education research output for the ERA’s first group of science disciplines: Physical, Chemical and Earth Sciences (PCE).

By leveraging the broad and rich content available in Scopus the ARC’s ERA initiative will evaluate 41 Higher Education Providers (HEPs) using international and national benchmarks.

“The ARC is committed to the development of a world-class research quality and evaluation system” Professor Shell, CEO of the ARC said.

“Identifying research excellence in this global environment is incredibly complex, which is why we are proud that the ARC will utilize Scopus to reach its ERA goals,” added Herman Van Campenhout, CEO Science & Technology for Elsevier. “Through this relationship, we hope to open doors for Australian universities by giving them a better understanding of where they stand in the research playing field, and where to invest scarce resources.”

More information available at www.arc.gov.au

**h-index**

**h-index per discipline**

**Metric definition**

The metric calculated the h-index, as defined by Professor Jorge Hirsch, for institutional disciplines. To quote from this paper that defines the h-index in terms of researchers: “A scientist has index h if h of his or her N_h papers have at least h citations each and the other (N_h – h) papers have ≤h citations each.”

In other words, a group of papers has an h-index of 17, if 17 of these papers have each received at least 17 citations, and 18 of these papers have not each received at least 18 citations.

![h-index graph](image)

h-index is influenced by both the quantity (Scholarly Output) and publication impact (Citation Count) of the outputs per institutional discipline.

- It can never be higher than the output regardless of that output's impact. The h-index of 1 paper that has received 1,000 citations is 1.
- It can never be higher than the number of citations received by the most cited paper, regardless of the amount of output. The h-index of 1,000 papers that have each received 1 citation is 1.

**UK application**

Denominator:

- HESA cost centre, via assignment of a researcher associated with an output to a HESA cost centre

Use outputs from 2008 to the current year.

---

Most used bibliometric indicators

1. **Impact indicators**
   a. Total number of citations
   b. Number of citations compared to average in the field
   c. Proportion of publications among the most cited in the world
THE MEASUREMENT OF INTERNATIONAL SCIENTIFIC COLLABORATION

By: LUUKKONEN, T (LUUKKONEN, T), TUITSEN, R.J.W (TUITSEN, R.J.W), PERSSON, O (PERSSON, O), SIVERTSEN, G (SIVERTSEN, G)

Abstract
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Keywords
KeyWords Plus: COOPERATION

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[3] UMEA UNIV, INFORSK GRP, S-90187 UMEA, SWEDEN

Publisher
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Categories / Classification
Research Areas: Computer Science, Information Science & Library Science
Web of Science Categories: Computer Science, Interdisciplinary Applications, Information Science & Library Science

Document Information
Document Type: Article
Language: English
Accession Number: WOS:A1993LW52100002
ISSN: 0138-9130

131 Times Cited
119 Cited References
View Related Records
View Citation Map
Create Citation Alert
(data from Web of Science™ Core Collection)

All Times Cited Counts
141 in All Databases
131 in Web of Science Core Collection
32 in BIOSIS Citation Index
7 in Chinese Science Citation Database
0 in Data Citation Index
0 in Russian Science Citation Index
4 in SciELO Citation Index

Usage Count
Last 180 Days: 8
Since 2010: 39
Learn more

Most Recent Citation
View All

This record is from:
Web of Science™ Core Collection

Suggest a correction
If you would like to improve the quality of the data in this record, please suggest a correction.
Most used bibliometric indicators

1. Impact indicators
   a. Total number of citations
   b. Number of citations compared to average in the field
   c. Proportion of publications among the most cited in the world

- Always relate to:
  - The year of the publication (time to get cited)
  - The type of publication (e.g. review articles are more cited than original research articles)
  - The field of research (field normalization to be discussed later on)
**CWTS Leiden Ranking 2015**

**Size-independent ranking**
In this ranking the performance of a university does not depend on the size of its publication output.

**Size-dependent ranking**
In this ranking universities with a larger publication output generally perform better than universities with a smaller publication output.

### Select field and region/country
- **Field:** All sciences
- **Region:** All regions
- **Country:** Denmark

### Select indicators
- **Type of indicators:** Impact
- **Ranking indicator:** PP(top 10%)

### Advanced parameters

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2. **Productivity indicators**
   1. Total number of publications
   2. Total number of publications compared to input variables (resources for research)
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By: LUUKKONEN, T (LUUKKONEN, T); TUSSSEN, RUIJW (TUSSSEN, RUIJW); PERSSON, O (PERSSON, O); SIVERTSEN, G (SIVERTSEN, G)

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Other often used bibliometric indicators

1. Research profile: Number of publications per field compared to the general distribution in the database or in other units of assessment
2. Share of publications with co-authors in certain relations
3. Frequencies of co-authored publications in certain relations
THE MEASUREMENT OF INTERNATIONAL SCIENTIFIC COLLABORATION

by: Luukkonen, T (Luukkonen, T); Tjusse, RJW (Tjusse, RJW); Persson, O (Persson, O); Siwertson G (Swertson G)

Scientometrics

Volume: 26 Issue: 1 Pages: 15-36
DOI: 10.1007/BF02016202
Published: SEP 1993

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   1. Total number of publications
   2. Total number of publications compared to input variables (resources for research)

   Always relate to:
   a. Total number of authors/institutions per publication
   b. Share of authors from evaluated unit
   c. The field of research (field normalization to be discussed later on)
Often used, but not recommended

1. Journal Impact Factor, when used to evaluate individual researchers and their output
2. H-index, when used for the same purpose
40 articles (10 per cent) have received half of the citations. The JIF measures the average for all articles.
Education and debate

Why the impact factor of journals should not be used for evaluating research

Per O Seglen, professor a

a Institute for Studies in Research and Higher Education (NIFU) Hegdehaugsveien 31 N-0352 Oslo Norway

Introduction

Evaluating scientific quality is a notoriously difficult problem which has no standard solution. Ideally, published scientific results should be scrutinised by true experts in the field and given scores for quality and quantity according to established rules. In practice, however, what is called peer review is usually performed by committees with general competence rather than with the specialist's insight that is needed to assess primary research data. Committees tend, therefore, to resort to secondary criteria like crude publication counts, journal prestige, the reputation of authors and institutions, and estimated importance and relevance of the research field, making peer review as much of a lottery as of a rational process.

On this background, it is hardly surprising that alternative methods for evaluating research are being sought, such as citation rates and journal impact factors, which seem to be quantitative and objective indicators directly related to published science. The citation data are obtained from a database produced by the Institute for Scientific Information.
Distribution of 8,215 citations to 162 publications by one author (Per O. Seglen)

H-index = 49
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1. Bibliometric indicators in PRFS
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1. **Understanding Patterns of International Scientific Collaboration**
   By: Luukkonen, T.; Persson, O.; Svvertsen, G.
   *Science Technology & Human Values* Volume: 17 Issue: 1 Pages: 101-126 Published: WIN 1992
   [Web of Science](http://www.scopus.com)

2. **The Measurement of International Scientific Collaboration**
   By: Luukkonen, T.; Tijssen, R.; Persson, O.; et al.
   *Scientometrics* Volume: 28 Issue 1 Pages: 15-36 Published: SEP 1993
   [Web of Science](http://www.scopus.com)

3. **The Effect of Highly Cited Papers on National Citation Indicators**
   By: Aksnes, D.W.; Svvertsen, G.
   *Scientometrics* Volume: 59 Issue 2 Pages: 213-224 Published: 2004
   [Web of Science](http://www.scopus.com)

4. **The Representation of the Social Sciences and Humanities in the Web of Science: A Comparison of Publication Patterns and Incentive Structures in Flanders and Norway (2005-9)**
   By: Ossenblok, T.; Vranken, L.; Engels, T.; Svvertsen, G.
   [Web of Science](http://www.scopus.com)

5. **Comprehensive Bibliographic Coverage of the Social Sciences and Humanities in a Citation Index: An Empirical Analysis of the Potential**
   By: Svvertsen, G.; Larsen, B.
   *Scientometrics* Volume: 91 Issue 2 Pages: 567-575 Published: MAY 2012
   [Web of Science](http://www.scopus.com)

6. **Are Female Researchers Less Cited? A Large-Scale Study of Norwegian Scientists**
   By: Aksnes, D.W.; Røstad, K.; Krøfter, P.; Fredrik; et al.
   *Journal of the American Society for Information Science and Technology* Volume: 62 Issue 4 Pages: 626-636 Published: APR 2011
   [Web of Science](http://www.scopus.com)
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<td>The measurement of international scientific collaboration</td>
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Add co-authors

- Terttu Luukkonen
- Olle Persson
- Robert J.W. Tijssen
- Tim Engels
- Birger Larsen
- Hanne Foss Hansen
- Antti Pelkonen
- Jesper W. Schneider
- Staffan Karlsson
- Truyken Ossenblok

No co-authors

Understanding patterns of international scientific collaboration
T Luukkonen, O Persson, G Sivertsen
Science, Technology & Human Values 17 (1), 101-126

The measurement of international scientific collaboration
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G Sivertsen
ISSI newsletter 6 (1), 22-28

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Research Evaluation 21 (4), 280-290

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G Sivertsen, B Larsen
Scientometrics 91 (2), 567-575

NaEr er tidsskrift internasjonalt
G Sivertsen
Det vitenskapelige tidsskrift, 37-51
## Harzing's Publish or Perish

### Google Scholar query

Author: gunnar.divetsen

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### Statistics

- **Publication years:** 1974–2010
- **Citation years:** 42 (1974–2010)
- **Papers:** 94
- **Authors:** 59
- **Cited by:** 31,17
- **First appeared:** 1974
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- **g-index:** 10
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### Citations

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### Most Cited Works

1. Understanding patterns of international scientific collaboration
2. The measurement of international scientific collaboration
3. The effect of highly cited papers on national citation indicators
4. A performance indicator based on complete data for the scientific publication output at research institutions
5. Are female researchers less cited? A large-scale study of Norwegian scientists
6. Comprehensive bibliographic coverage of the social sciences and humanities in a citation index: an empirical analysis of...
Results: 7

1. Development of clinically meaningful complex interventions - the contribution of qualitative research
   Ludvigsen MS, Meyer G, Hall E, Fegrinan L, Aagaard H, Uhrenfeldt L.
   PMID: 23732316 [PubMed - indexed for MEDLINE]
   Related citations

2. A qualitative meta-synthesis of patients' experiences of intra- and inter-hospital transitions
   Uhrenfeldt L, Aagaard H, Hall EO, Fegrinan L, Ludvigsen MS, Meyer G.
   PMID: 23509965 [PubMed - in process]
   Related citations

3. Adolescents' and young adults' transition experiences when transferring from paediatric to adult care:
   A qualitative metasynthesis.
   Fegrinan L, Hall EO, Uhrenfeldt L, Aagaard H, Ludvigsen MS.
   PMID: 23450370 [PubMed - as supplied by publisher]
   Related citations

   Fegrinan L, Helseth S.
   PMID: 1900088 [PubMed - indexed for MEDLINE]
   Related citations

5. Development of parent-nurse relationships in neonatal intensive care units - from closeness to detachment
   Fegrinan L, Fagemoen MS, Helseth S.
   PMID: 18783472 [PubMed - as supplied by publisher]
   Related citations

6. A comparison of mothers’ and fathers’ experiences of the attachment process in a neonatal intensive care unit.
   Fegrinan L, Helseth S, Fagemoen MS.
   PMID: 18279284 [PubMed - indexed for MEDLINE]
   Related citations

7. Nurses as moral practitioners encountering parents in neonatal intensive care units.
   Fegrinan L, Helseth S, Stetelbø A.
   Nurs Ethics, 2006 Jan;13(1):52-64.
   PMID: 16425802 [PubMed - indexed for MEDLINE]
   Related citations
Local or national Current Research Information Systems (CRIS) may give ... 

... a more complete picture ...

Coverage of 70,500 scholarly publications from the higher education sector in Norway 2005-2012.

- Incomplete coverage of international journals in the SSH.
- Very limited coverage of books.
- Random or no coverage of the national level (books and journals)
An integrated national CRIS – Norway’s solution

Principles behind the use of institutional data in a shared national Current Research Information System

- **Completeness:** All scholarly publications and other results from research are included.

- **Transparency:** Every institution can see and check all other institutions’ data. The national database is also online and open to society at large.

- **Multiple use of the data:** CV’s, applications, evaluations, annual reports, internal administration, bibliography for Open Archives, links to full text, etc.
Croatian Scientific Bibliography CROSBI

>20,000 full-text deposited

>30,000 links to the full-text

377,758 bibliographic records
The project Who is Who in Croatian Science is the attempt to collect, at one place, the information about Croatian scientists. This e-project of the Ministry of Science, Education and Sport intends to promote Croatian scientists in Croatia and abroad, and to foster the communication and information exchange among the scientists themselves.

25.09.2013
Do you want to be included in Who is Who? Ask here for your password in order to add or edit your data!

Search by surname

Newest scientist in Who is who: Snježana Dubovicki

Croatian scientists on the world map

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Aggregated data from local CRIS – Denmark’s solution

- Each university has a local Pure system.
- Annually, data from the local systems are exported to, and integrated in, a national database owned by the Government.
Aggregated data from local CRIS – Finland’s solution

- The universities have **different** systems
- Annually, data from the local systems are exported to, and integrated in, a national database owned by the Government
Commercial CRIS-solutions for institutional purposes

What is PURE?

PURE is the University's Current Research Information System (CRIS). Information held in PURE relates to research-active staff and their projects and collates research activity information (mainly publications but also other types of output such as professional activities, impacts and press clippings). PURE allows for relationships and associations to be created between research inputs and outputs, thus providing a broad picture of research activity at the individual, research unit, School, College, and University levels.

In addition to providing many of the University's current research management and reporting needs, data from PURE is also used to populate the Edinburgh Research Explorer (http://www.research.ed.ac.uk) which provides a public view on the University's research activity. Units are also able to access data held in PURE to feed information into their own local web presence, such as publication lists and staff profiles.

PURE is also used to aid delivery of the University's submissions to external exercises such as the Research Excellence Framework (REF). Through the Research Explorer, PURE also acts as the University's Open Access repository.
Agenda for this session

1. Bibliometric indicators in PRFS
2. Bibliometric data sources
3. Models for the use of bibliometrics
4. The importance of field normalisations
5. Discussion
Models for the use of bibliometrics in PRFS

A. Used only to inform peer review by expert panels
B. Used directly in the funding formula
C. A+B (mixed)
D. Not categorized: Austria, Cyprus, Moldova, Spain

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>A+B (mixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scopus/WoS</td>
<td>Portugal, Turkey</td>
<td>Sweden</td>
<td>Estonia</td>
</tr>
<tr>
<td>CRIS (+Scopus/Wos)</td>
<td>Croatia, Czech Republic, Norway</td>
<td>Armenia, Italy Slovenia</td>
<td></td>
</tr>
</tbody>
</table>
PRFS in international practice – REF review

**Hybrid systems**

- **Peer review-based**
  - Australia
  - Belgium (FL)
  - Czech Republic
  - Denmark
  - Finland
  - Italy
  - New Zealand
  - Norway
  - Sweden
  - UK

- **Informed peer review**
  - NERO (2017)? → Metodika (2013)
  - 1990s
  - 2009
  - 2009
  - 2015
  - 2006

- **Mix peer review-bibliometrics**
  - 2013
  - 2008

- **Metrics-based**
  - Metodika (2009)
  - 2009
Additional metrics often used as information for panels or as input to the formula in PRFS

- External competitive funding
- External revenues
- Prizes
- Doctoral degrees
- Educational statistics
Agenda for this session

1. Bibliometric indicators in PRFS
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5. Discussion
Why is a balanced representation of fields needed?

- Bioengineering and Aerospace Engineering
- Business Administration
- Computer Science and Engineering
- Continuum Mechanics and Structural Analysis
- Criminal Law, Procedural Law and History Law
- Economics
- Electrical Engineering
- Electronic Technology
- Humanities: History, Geography and Art
- Humanities: Philosophy, Language and Literature Theory
- International Law, Ecclesiastical Law and Philosophy of Law
- Journalism and Audiovisual Communication
- Library and Information Science
- Materials Science and Engineering and Chemical Engineering
- Mathematics
- Mechanical Engineering
- Physics
- Private Law
- Private Social and International Law
- Public State Law
- Signal Theory and Communications
- Social Analysis
- Social Sciences
- Statistics
- Systems Engineering and Automation
- Telematic Engineering
- Thermal and Fluids Engineering
Universities have different research profiles
Large variations in average number of citations per field

- CELL BIOLOGY: 20 citations
- NUCLEAR PHYSICS: 20 citations
- IMMUNOLOGY: 17 citations
- BEHAVIORAL SCIENCES: 16 citations
- GEOLOGY: 11 citations
- PSYCHOLOGY: 10 citations
- ECONOMICS: 9 citations
- MATHEMATICS: 7 citations
- POLITICAL SCIENCE: 7 citations
- CELL BIOLOGY: 4 citations
- IMMUNOLOGY: 3 citations
- PSYCHOLOGY: 2 citations
- ECONOMICS: 2 citations
- MATHEMATICS: 2 citations
- POLITICAL SCIENCE: 1 citation
- HISTORY: 1 citation
Field differences in the use of publication types

Publication formats
Based on 125,950 scholarly publications in Cristin (Current Research Information System in Norway)
Variations in the average number of authors per publication

"Welcome to the co-author’s party! You’re number twenty-one!"
Variations in the average number of authors per publication

<table>
<thead>
<tr>
<th>Co-authorship practices</th>
<th>Researchers</th>
<th>Publications per researcher</th>
<th>Authors per publication</th>
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<tr>
<td>Humanities</td>
<td>1074</td>
<td>3,7</td>
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<td>Social Sciences</td>
<td>1882</td>
<td>4,5</td>
<td>2,4</td>
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<tr>
<td>Engineering Sciences</td>
<td>2157</td>
<td>5,5</td>
<td>4,8</td>
</tr>
</tbody>
</table>
Fractional counting

Fractional counting

Publication

Author 1
Institution A

Author 2
Institution B
Institution C

Author 3
Institution C
Fractional counting with balance

The Norwegian publication indicator uses the square root of fractions when crediting institutions

<table>
<thead>
<tr>
<th></th>
<th>Researchers</th>
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<th>Former Publication points</th>
<th>New Publication Points</th>
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For Breakout 1:
Most used bibliometric indicators

1. Impact indicators
   a. Total number of citations
   b. Number of citations compared to average in the field
   c. Proportion of publications among the most cited in the world

2. Productivity indicators
   1. Total number of publications
   2. Total number of publications compared to input variables (resources for research)
For breakout 2: Additional metrics often used as information for panels or as input to the formula in PRFS

- External competitive funding
- External revenues
- Prizes
- Doctoral degrees
- Educational statistics