The role of bibliometrics in research evaluation

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Vilnius SSH Teaching
Vilnius, 09-01-2019
Overview lecture

• Sketching the scenery ...
• The origin of the “Publish or Perish” culture
• Context of using/applying research metrics
• Questioning the universality of research metrics
• Infamous bibliometric indicators: JIF and h-index
• Wrapping it all up
Reactions on the increasing influence of research metrics
The San Francisco DORA Declaration (2012)

• Meeting of the American Society for Cell Biology
• Mainly editors and publishers that called for action.
• Misalignment between contributions to journals, and journal’s JIF-values
• Halt the practice of using research metrics (Read: JIF)
  – Correlating JIF to individual’s contributions, ...
  – ... which creates biases and inaccuracies in research assessments
  – JIF not to be used as (partial) substitute measure for quality of the oeuvre of an individual
• Signed by learned societies, individual universities, research institutions, and research councils
Science in Transition (2013)

• Started in the Netherlands

• Re-establishing the interaction between universities and society

• Issues that ignited SiT are:
  – The flood of scientific publications, becoming simply too much, but incentivized by politico-economic reasoning within academia.
  – Universities turned into PhD factories (PhD = € 70,000,-), as well as Ma factories, with little job perspective in academia.
  – Research agenda building misaligned with needs by academia and society

• Image of universities:
  – What is driving academics, truth or careers?
  – Myth of disinterested academics, fraud and argument show otherwise!
  – How are scholarly results produced and communicated?

Nobel laureate bashing publication culture (2013)

• Randy Schekman (Nobel prize in Physiology in 2013) stated “... my lab will no longer send papers to Nature, Cell and Science as they distort the scientific process”

• Next, he stated “… the pressure to publish in "luxury" journals encouraged researchers to cut corners and pursue trendy fields of science”

• The prestige of appearing in the major journals has led the Chinese Academy of Sciences to pay successful authors the equivalent of $30,000.

• Furthermore, Schekman stated that “…just as Wall Street needs to break the hold of the bonus culture, so science must break the tyranny of the luxury journals”
How to define bibliometrics?

- Quantitative analysis of science and technology, including its’ cognitive and organizational structure
- Scientific communication - journal publications
- **Output** and **Impact**, as measured through publications and citations
- Scientists express, through references, a certain degree of influence of others on their own work
- Citations indicate influence or (inter)national visibility
  - Does not equal ‘**quality**'
A less neutral approach ...

- Bibliometric measures tend to shape what they measure.
- Bibliometrics has some serious shortcomings.
- Better not be used as a stand-alone tool in assessments of research.
- There is a firm academic debate on the meaning of references (Bornmann & Daniel, 2008).
- Research metrics have seriously contributed to the “Publish or Perish” culture in academia.
The origin of the “Publish or Perish” culture
Reviewing is part of daily scholarly life

- Very old tradition
  - From 17th century onwards: peer review central
  - Mid-20th century: rise of performance indicators & bibliometrics

- A regular academic working day consists of:
  - educational tasks
  - research
  - clinical tasks
  - management and administrative tasks

- Reviews relate to:
  - scientific/scholarly publishing and public appearances
  - appointment and promotion
  - research grants and proposals
  - periodical reviewing of research performance

Focus on research evaluation
Application of research metrics
The knowledge production process, aka the Credibility cycle

Credibility cycle (adapted from Latour and Woolgar (1979) & Rip (1990))
1 - Rise of performance indicators & research metrics: External pressure

Need for formalised measures

• ‘Push’ from science policy  (from 1970s onwards)

• Independent of peer review

• New Public Management / Neo-liberalism (from ‘80s onwards)

• NPM as the management system derived from private sector
Adding credibility to the research metrics used

- At first, only **output** numbers played a role (1970s/early 1980s)


- Citation scores used to indicate ‘**quality**’ of research output (from late 1980s onwards)
3 - Rise of performance indicators & research metrics: Internal pressure

Matrix-like structure of science (Whitley, 2002 *)

- Researchers part of international community  (Peer review)
- But also part of local institutions  (specific management practices, e.g. yearly appraisals, external evaluations)
- Institute managers not always part of international expert community
- Tighter forms of management  (from the 1990s onwards)

→ Distance between governance and lab/work floor levels

* Richard Whitley, The social and intellectual organization of the sciences, 1984, 2002
Extended credibility cycle

‘Citation score’ is here sort of a metaphor

In a **direct** sense, we measure real impacts, comparing *actual* and *expected* values

In an **indirect** sense, derivatives such as JIF and h-index, are used ...
NPM and the university as market bureaucracy

• Enterprises were driven by the Anglo-Saxon shareholders model => maximalization of profits, aspect of cutting of costs!

• Increasingly, universities started to see themselves as private enterprises, with faculties as business units or divisions within these larger enterprises.
  – Intensifying of management practices in universities (in 1990s)

• Some key characteristics of NPM:
  – Strict planning, with target setting, as can be controlled and monitored by quantitative means
  – Accounting coupled to a clear system of rewards and punishments
  – Entry of a new terminology: clients/customers, efficiency, incentives, accounting, etc.

• Other (semi-)public entities affected by NPM:
  – Healthcare system,
  – Secondary education,
  – Civil services e.g. community council settings
Working of the academic market bureaucracy

- Management operates with ‘visible hands’
- Dealing with clearly defined products
  - *Education with its’ supply-demand situation, seeing students as clients on the demand side*
- In research, *quantity* is defined by output or products
- Publications are measured as products, in a nominal sense
- Impacts connected to products indicate the *quality* of the products
- In the end, we have the ‘*countable academic*’
So then we end up with ...

- Focus only on visible/measurable products
- Immaterial products/processes are made invisible
  - Seminars and informal meetings
  - Supervision meetings
  - Conference visits, etc.
- For the outside world, the **quantity** and **quality** of publications is made visible!
- Important in the academic market bureaucracy, delivery of the **form**
- Thereby making **form** more important than the **contents**
- **Outside** has become more important than **Inside**
So far, we can say ....

• Witness a penetration of research metrics in academic life over last 20-30 years

• Stimulation of neoliberal market thinking in academia
  – active stimulation of competition, both internally and externally

• Increasing influence of audit and performance measures.
  – university rankings as league tables/performance grids

• Prioritizing of research over education in building academic careers
  – struggle for external funding, its’ relation to teaching

• ‘Metricization of academia’ (Burrows, 2012)
Context of using/applying research metrics
Problems, research and indicators

Space of problems
Problems, research and indicators

Space of problems

Space of research
Problems, research and indicators

- Space of problems
- Space of research
- Space of STI indicators
Streetlight effect of STI indicators

Space of problems

Space of research

Research well-illuminated by current STI indicators
Streetlight effect in indicators: mistaking light with “problems”
Questions dealt with by research under the streetlight will be better rewarded.

Reduced diversity of research efforts ...

... reduced coverage of societal problems and needs

So what about:
- Social sciences & humanities
- Non-English language outputs
- Topics outside the mainstream?
Space of problems

Space of research

Space of STI indicators
This is the move we should facilitate:
... after which the STI indicators can potentially expand their outreach as well!
With respect to context, we can say ....

• Research metrics seriously suffer from what is commonly denoted as “the street light effect”

• Various assessment systems try to expand the reach of assessments, such as the REF in the UK, the SEP in the Netherlands
  – By inclusion of other elements, such as societal relevance

• More recent are attempts to even expand further on those national systems
  – QRiH in the Netherlands, or ‘Evaluative Inquiry’ concept (Fochler & de Rijcke)
THIS IS WHERE YOU LOST YOUR WALLET?

NO, I LOST IT IN THE PARK. BUT THIS IS WHERE THE LIGHT IS.
Questioning the universality of research metrics
Introduction

- How do we deal with the increasing demand for research metrics by research management?
- Not all scholarly outputs are equally well covered in the bibliometric databases
- Coverage in relation to creation and usage of research metrics => problematic !!!
- Mostly focused on outputs from STEM domains
- Coverage analyses contextualize the research metrics
  - Internal coverage analysis: starts from within WoS
  - External coverage analysis: starts from an outside dataset
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WoS Coverage = 5/7 = 71%
WoS Coverage in 2010 across disciplines

- **Black=Excellent coverage (>80%)**
- **Blue= Good coverage (between 60-80%)**
- **Green= Moderate coverage (but above 50%)**
- **Orange= Moderate coverage (below 50%, but above 40%)**
- **Red= Poor coverage (highly problematic, below 40%)**
Difference between the internal registration system METIS & representation in WoS

- Dominance university hospital in WoS realm extremely visible
- Law and Humanities ‘disappear’ in WoS realm

Van Leeuwen et al, 2016, Scientometrics
Composition of the output of the university in METIS

- The category General is in some cases voluminous
- All units **do** have journal publications!
Here, we can say ....

• In the case of application in the SSH, the current set of research metrics are completely inadequate.

• A broader variation of substantiations of activities is needed, therefore scholars have to register more broadly.

• But be aware: don’t make that immediately another form of accounting and/or numbers & indicator game!
Infamous bibliometric indicators

Journal Impact Factor & h-index
On micro level: Rankings of individual researchers

- *Clarivate Analytics* Science Watch: overview of Highly Cited Individuals in the sciences, biomedicine and engineering

- In the Netherlands, economists do create a league table of most productive researchers (*ESB, “De Economen Top-40”*)

- Many research organizations rank staff for funding and promotion with bibliometric indicators

- For this purpose, easy-to-find quantitative indicators are often misused ...
Journal Impact Factor: A bit of history

• The Science Citation Index (SCI) was founded in 1961 by Eugene Garfield.

• The Journal Impact Factor (JIF) was introduced as a tool for determining which journals to include in the SCI

• Over time, the impact factor has become primarily a research evaluation tool
Journal Impact Factor

• Best-known indicator of journal impact
• Reported yearly in Thomson Reuters’ Journal Citation Reports
• Extensively used by:
  – Researchers
  – Journal editors
  – Publishers
  – Librarians
  – Science policy makers
Definition of Journal Impact Factor

• Definition of JIF:
  – The mean citation score of a journal, determined by dividing all citations in year T by all citable documents in years T-1 and T-2.

• Ingredients:
  – Number of publications (here defined as citable documents: Art & Rev);
  – Number of received citations

• Example:
  – A journal has a total of 100 publications in 2008 and 2009
  – In 2010, these publications were cited 200 times
  – The impact factor then equals 200 / 100 = 2
The Journal Impact Factor
### Journal Citation Reports

**ISI Web of Knowledge℠**

**Journal Citation Reports®**

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### Biochemistry & Molecular Biology

#### Journal Summary List

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# Political science

## Journal Summary List

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<td>1354-0688</td>
<td>1199</td>
<td>1.830</td>
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Citations for free
The Lancet is committed to applying scientific knowledge to improve health and advance human progress and this is as true today as it was when the first issue was published on October 5 1823.

Reputation and impact
The Lancet has an Impact Factor of 45.217. The journal is currently ranked second out of 150 journals in the general medicine category (2014 Journal Citation Reports®, Thomson Reuters 2015).

At the heart of The Lancet are core editorial values that underpin its commitment:
With a voice for all people
When you publish with The Lancet you’re joining a community that believes that everyone has the right to the highest attainable standard of health and that care should be equitable and just.

With high-impact content that changes medical and public health practice
Whether it’s with our general medicine or specialty titles, your paper will sit alongside articles on the cutting edge of science published by leading international researchers.

With global reach and visibility
We are committed to maintaining and extending the long-standing tradition of publishing articles from all corners of the world and disseminating them just as widely.

With state-of-the-art platforms and channels
We invest in technology that makes your paper accessible, easy to use, and readily available.

With thought provoking news and comments
We make the experience of reading more fulfilling by enriching content with editorial, news, letters, commentary, and reviews.
<table>
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<th>Publications</th>
<th>2012+2013</th>
<th>2014</th>
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</thead>
<tbody>
<tr>
<td>Items published</td>
<td>589</td>
<td>26,633</td>
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<tr>
<td>Art+Rev</td>
<td>1.600</td>
<td>22,828</td>
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<tr>
<td>Art+rev+Let</td>
<td>4.100</td>
<td>25,862</td>
</tr>
</tbody>
</table>

- **CA Method:**
  - Citable documents in ‘12 and ‘13: 26,633 / 589 = JIF=45,217

- **CWTS Method:**
  - Citations to Art/Rev in 2014: 22,828 / 1.600 = JIF=14,268
  - Citations to Art/Let/Rev in 2014: 25,862 / 4.100 = JIF=6,438

In Blue= Clarivate Analytics JCR scores

In Green= CWTS calculations
Problems with JIF

• Methodological issues
  – Was/is calculated erroneously (Moed & van Leeuwen, 1996)
  – Not field normalized
  – Not document type normalized
  – Underlying citation distributions are highly skewed (Seglen, 1994)

• Conceptual/general issues
  – Inflation (van Leeuwen & Moed, 2002)
  – Availability promotes journal publishing
  – Is based on expected values only
  – Stimulates one-indicator thinking
  – Ignores other scholarly virtues (sharing, funding capacity, teaching)
What to do if ....

• Sometimes, for example when submitting a research grant proposal to a research council, scholars are asked to deliver their own bibliometric scores.

• What could be your reaction to this?
Would you know how to ....

- Determine your own position in the field(s) in which you are active?
  - What field are you in?
  - What are general citation characteristics that apply on your field?
  - Can you determine average scores for your own work?
Would you know how to ....

• Select JIF-values for your list of publications?
  – Do you know where to look for these?
  – Which years do you take?
    • The current year for all publications?
    • The year the paper appeared in the journal?
    • The year you made up your mind where to publish?
Definition of Hirsch Index

• Definition of h-index:
  – The ‘impact’ of a researcher, determined by the number of received citations of an oeuvre, sorted by descending order, where the number of received citations equals the rank order position.

• Ingredients:
  – The number of publications by a ‘unit’;
  – The number of citations on each individual publication.

• Example:
  – An author has published 75 papers, of which the 35th ranked paper received 35 citations
  – Hence, this author’s h-index is 35
Normalization issue
The Question raised ...

- NWO annually organizes the Spinoza Award.
- Universities list candidates for this prestigious prize.
- Spinoza candidates, across all domains ...

- Use output, normalized impact, and h-index
• Actual versus field normalized impact displayed against the output.

• Large output can be combined with a relatively low impact
• H-Index displayed against the output.

• Larger output is strongly correlated with a high H-Index value.

• High impact authors get low H-index values.
The problem of fields and h-index ...
The author selection issue
What is an author?  
What is an oeuvre?

• Thed N van Leeuwen at CWTS at FSW at Leiden University
  – TN VAN LEEUWEN *(uses all capitals, and is completely separate from the other variations)*
  – T.N. van Leeuwen
  – Thed N. van Leeuwen
  – Thed van Leeuwen

• Theo van Leeuwen also at FSW at Leiden University
  – T. van Leeuwen *(his first name is Theo)*

• ... and several more ‘T van Leeuwen-s’ elsewhere in the world ...
Database environment issue
Different databases for bibliometric analysis

• We distinguish three main databases:
  
  – **Web of Science**, internet version of the Citation Indexes.
    – since 1963
    – ca. 18,000 Journals are indexed
    – additional indexes (conferences, books, data etc.)

  – **Scopus**, the Elsevier Science answer to the WoS
    – launched by Elsevier in 2004
    – ca. 21,000 journals and proceedings are indexed

    – launched in 2004 by Google
    – coverage unclear
In what database context ...

Selected my own publications in WoS and Scopus, Google Scholar has a pre-set profile.

<table>
<thead>
<tr>
<th>Database</th>
<th>H-index</th>
<th>Based upon ...</th>
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</thead>
<tbody>
<tr>
<td>Web of Science</td>
<td>29</td>
<td>Articles in journals</td>
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<tr>
<td>Scopus</td>
<td>35</td>
<td>Articles, book (chapters), and conference proceedings papers</td>
</tr>
<tr>
<td>Google Scholar</td>
<td>41</td>
<td>All types, incl. reports</td>
</tr>
</tbody>
</table>
Problems with H-index

• Bibliometric-mathematical issues
  – mathematically inconsistent (*Waltman & van Eck, 2012*)
  – Conservative (*life-time achievement, it only increases*)
  – Not field normalized (*van Leeuwen, 2008*)

• Bibliometric-methodological issues
  – How to define an author?
  – In which bibliographic/metric environment? (*Bar-Ilan, 2008*)

• Conceptual/general issues
  – Favors age, experience, and high productivity (*Costas & Bordons, 2007*)
  – No relationship with research quality
  – Ignores other elements of scholarly activity
  – Promotes one-indicator thinking
Wrapping it all up
Measuring is changing

• What counts as quality, is shaped by how we define and measure ‘**quality**’, and …

• … what counts as impact, is shaped by how we define and measure ‘**impact**’.

• We need different indicators at different levels in the scientific system, to inform wise management that strikes the right balance between **trust** and **control**

• Contextualisation is crucial for proper embedding of research metrics
Context counts

• Responsible metrics are *not* supposed to be reflected by one universal standard (e.g., JIF and H-index)

• Responsible metrics should be responsive and inclusive metrics

• The context shapes what responsible metrics means:
  – the urgency of social problems (e.g. poverty, inequality, unemployment and corruption)
  – local research and educational missions
  – the local appropriation of “the global”
  – the values embedded in policies and communities
Is there a role for research metrics?

• Within the right context, we still consider bibliometric techniques as helpful **supportive** tools in the assessment of research performance, informing peers on structures and patterns otherwise hidden.

• However, this can only be done in conjunction with peer/expert opinions, never as a stand alone tool!

• And try to apply other forms of research metrics, of a more descriptive nature, rather than the evaluative metrics so commonly used, to inform research assessment procedures.
Goodhart’s Law

“When a measure becomes a target, it ceases to be a good measure” (M. Strathern, 1997, phrasing C. Goodhart, 1981)

(this follows from individuals trying to anticipate the effect of a policy and then taking actions which alter its outcome)

The end

Any questions ?

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My gratitude goes to Ismael Rafols, Paul Wouters and Sarah de Rijcke