MEASURING EMERGING SCIENTIFIC IMPACT AND CURRENT RESEARCH TRENDS: A COMPARISON OF ALTMETRIC AND HOT PAPERS INDICATORS

DR. EVANGELIA A.E.C. LIPITAKIS
evangelia.lipitakis@thomsonreuters.com
BIBLIOMETRIE2014 CONFERENCE SEPTEMBER 2014
Academic Research Performance Assessment in Interdisciplinary Environments

**Qualitative:** Peer review – subjective judgements by experts

**Quantitative:** Metrics – measuring the reactions of other academics quantitatively by their behaviour.

Basic metric unit is the citation

It can occur at different levels:
- A single output, e.g., a paper
- An academic
- A department
- A journal
- A university

Why measuring research quality is important?
- Allocating funds e.g. public/private funding, grants
- University Rankings, League tables (THE, ARWU, Leiden Ranking)
- Jobs and promotion
Applications of Bibliometrics and Citation Analysis

Bibliometric Methodologies and Citation Analysis

- Number of Documents
- % Open Access Journals
- Citation Impact
- h-index
- Advanced normalized bibliometric indicators
- Normalized Citation Impact
- Percentiles
- Journal Normalized Citation Impact
- THE Ranked
- ESI Most Cited
- Highly Cited Papers
- Hot Papers
- Support Funding
- Monitor productivity and impact
- Advanced normalized bibliometric indicators
- Identify hot topics and top performances
- Assess collaborations
- International Collaborations
- Industry Collaborations
- Author Collaborations
- Visualization of Science

Support Funding

Monitor productivity and impact

Advanced normalized bibliometric indicators

THE Ranked

ESI Most Cited

Highly Cited Papers

Hot Papers

Support Funding

Identify hot topics and top performances

Assess collaborations

International Collaborations

Industry Collaborations

Author Collaborations

Visualization of Science
Citation network and new data formats

- Citations traditionally come from online citation databases
- Various new formats of scientific and scholarly output outside the citation indices

**Input**
- Journals, Conference Proceedings, Books (online citation databases)
- Research Datasets and Data Studies (e.g. Data Citation Index)
- Patents (e.g. Derwent Innovation Index), licensable technology
- Software
- e-thesis and dissertations
- Lecture slides, e-tutorials, blogs, presentations
- Performances in arts, videos, etc.

**Outcome**
- Research Advancement
- Socio-Economic benefits
- Research policy making
- Public engagement

**Track**

**Link**
Altmetrics: A class of new web-based quantitative indicators

- Altmetrics: “The study and use of scholarly impact measures based on activity in online tools and environments.” (Priem et al., 2012)

- What do altmetrics measure?
  - **Usage** (views, downloads, hits, holdings)
  - **Captures** (bookmarks, favorites, shares, added)
  - **Mentions** (blogs, news, reviews, comments, links)
  - **Social Media** (mentioned, shared, liked, recommended)
  - **Citations** (online citation databases)
Rise of Altmetrics and ALUMs

• Universe of web-based scholarly resources, data, usage statistics for predicting user behaviour
• Wide variety of publication types (pdfs, xml, videos, slides, blogs, etc.)
• Reflect real time scholarly and public post-publication attention, trends and visibility

However,
• Altmetrics measure immediacy and emerging/current trends, not the same as scientific impact (number of downloads=intent, not actual use)
• No qualitative differentiation of the user (Researcher or Robotic Activity?)
• No qualitative differentiation of data (A controversial paper might accumulate high number of comments/views/tweets)
• No solid theoretical framework in the use of altmetrics and ALUMs in research performance evaluation
# Measuring Emerging Research Trends: A comparison of 2013 Top 100 Altmetrics and Hot Papers indicators

**Hot Papers:** The top 0.1% most cited documents normalized per category, publication year and publication type based on the last 2 years of publications ([https://esi.incites.thomsonreuters.com](https://esi.incites.thomsonreuters.com))

<table>
<thead>
<tr>
<th>Citation Percentile</th>
<th>Data years examined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot Papers</td>
<td>0.1%</td>
</tr>
</tbody>
</table>

**Altmetric Score:** Weighted ranking algorithm based on web-based scholarly activity of online users ([www.altmetric.com](http://www.altmetric.com))

<table>
<thead>
<tr>
<th>Volume</th>
<th>Sources</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altmetric Score</td>
<td>Times mentioned</td>
<td>Social Media</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Online reference managers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Downloads</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mainstream media</td>
</tr>
</tbody>
</table>

**Top 100 Hot Papers 2013** ([http://apps.webofknowledge.com](http://apps.webofknowledge.com))

**Top 100 Altmetric papers 2013** ([http://www.altmetric.com/top100](http://www.altmetric.com/top100))
Citation Distributions of Altmetric and Hot Papers

88% Altmetric papers, have received less than 50 citations.

98% Hot Papers have received between 500-100 citations.

Bibliometric data can be highly skewed.

<table>
<thead>
<tr>
<th></th>
<th>Altmetric Papers</th>
<th>Hot Papers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Citations</td>
<td>2,570</td>
<td>18,414</td>
</tr>
<tr>
<td>Average Citations</td>
<td>27.93</td>
<td>184.14</td>
</tr>
<tr>
<td>Median Citations</td>
<td>7.5</td>
<td>140.5</td>
</tr>
<tr>
<td>h-index</td>
<td>22</td>
<td>100</td>
</tr>
</tbody>
</table>
Differences in average citation rates

**Citation Impact** can vary significantly across different disciplines and time periods.

Cannot be compared without some form of normalization to allow for the differences in fields and time

Do Altmetric indicators need to be normalized for different fields?
Which are the 10 most popular Subject Categories?

**HOT PAPERS**
- GENERAL INTERNAL MEDICINE: 28
- BIOCHEMISTRY MOLECULAR BIOLOGY: 13
- CARDIOVASCULAR SYSTEM CARDIOLOGY: 6
- BIOTECHNOLOGY APPLIED MICROBIOLOGY: 6
- MULTIDISCIPLINARY SCIENCES: 18
- CHEMISTRY: 14
- PHYSICS: 6
- NEUROSCIENCES NEUROLOGY: 4
- CELL BIOLOGY: 3
- MATERIALS SCIENCE: 6

**ALTMETRIC PAPERS**
- MULTIDISCIPLINARY SCIENCES: 49
- GENERAL INTERNAL MEDICINE: 17
- ENVIRONMENTAL SCIENCES ECOLOGY: 3
- INFECTIOUS DISEASES: 2
- SPORT SCIENCES: 2
- CARDIOVASCULAR SYSTEM CARDIOLOGY: 1
- BIOCHEMISTRY MOLECULAR BIOLOGY: 4
- CELL BIOLOGY: 4
- PSYCHOLOGY: 2
- GENETICS HEREDITY: 2

Altmetric and Hot Papers Subject Areas

*WoS Subject Categories

*Thomson Reuters*
In which Subject Categories Altmetric and Hot Papers have the biggest impact?

HOT PAPERS

- ONCOLOGY: 1,529 (9.7%)
- MATERIALS SCIENCE: 1,269 (8.1%)
- CHEMISTRY: 1,263 (8.1%)
- MULTIDISCIPLINARY SCIENCES: 981 (6.3%)
- BIOCHEMISTRY & MOLECULAR BIOLOGY: 872 (5.6%)
- NANO SCIENCES & NANOTECHNOLOGY: 718 (4.6%)
- PHYSICS APPLIED: 946 (6%)
- CELL BIOLOGY: 544 (4.1%)
- GENETICS HEREDITY: 615 (3.9%)

Which Subject Categories are citing the Top 100 Hot Papers?

ALTMETRIC PAPERS

- MEDICINE GENERAL INTERNAL: 282 (11.6%)
- NEUROSCIENCES: 116 (4.8%)
- CARDIAC CARDIOVASCULAR SYSTEMS: 114 (4.7%)
- BIOCHEMISTRY & MOLECULAR BIOLOGY: 102 (4.2%)
- MULTIDISCIPLINARY SCIENCE: 190 (7.8%)
- PUBLIC ENVIRONMENT OCCUPATION: 153 (6.3%)
- ENVIRONMENTAL SCIENCES: 95 (4.1%)
- CELL BIOLOGY: 87 (3.6%)
- NUTRITION DIETETICS: 156 (6.4%)
- ENDOCRINOLOGY METABOLISM: 129 (5.3%)
Where do Top 100 Altmetric and Hot Papers 2013 get published?

Top Publication Outlets

<table>
<thead>
<tr>
<th>Journals</th>
<th>Altmetric Papers</th>
<th>Hot Papers</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLOS Journals Collection</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>NATURE Journals Collection</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>LANCET Journals Collection</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>NEW ENGLAND JOURNAL OF SCIENCE</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>PNAS</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>SCIENTIFIC REPORTS</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>BMJ</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>JAMA</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>NUCLEIC ACIDS RESEARCH</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>SCIENCE</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>CHEMICAL REVIEWS</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Open Access Journals

- Altmetric Papers: 37%
- Hot Papers: 7%
Which are the Top 10 countries publishing Altmetric and Hot Papers?

Higher percentages may mean higher collaborations between countries. International collaborations are considered to be a drivers of scientific impact.
In which countries Altmetric and Hot Papers have the biggest impact?

Which Countries are citing the Top 100 Hot Papers?

Which Countries are citing the Top 100 Altmetric Papers?
## 2013 Global Productivity and Impact Landscape

<table>
<thead>
<tr>
<th>Rank</th>
<th>Web of Science Documents</th>
<th>WoS Citations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>562,351</td>
<td>297,783</td>
</tr>
<tr>
<td>2</td>
<td>274,742</td>
<td>107,366</td>
</tr>
<tr>
<td>3</td>
<td>140,858</td>
<td>81,811</td>
</tr>
<tr>
<td>4</td>
<td>132,414</td>
<td>87,424</td>
</tr>
<tr>
<td>5</td>
<td>100,492</td>
<td>44,077</td>
</tr>
<tr>
<td>6</td>
<td>89,740</td>
<td>56,336</td>
</tr>
<tr>
<td>7</td>
<td>83,511</td>
<td>47,527</td>
</tr>
<tr>
<td>8</td>
<td>79,893</td>
<td>48,265</td>
</tr>
<tr>
<td>9</td>
<td>70,682</td>
<td>40,344</td>
</tr>
<tr>
<td>10</td>
<td>69,402</td>
<td>37,948</td>
</tr>
<tr>
<td>13</td>
<td>49,078</td>
<td>35,382</td>
</tr>
<tr>
<td>15</td>
<td>34,472</td>
<td>28,301</td>
</tr>
<tr>
<td>19</td>
<td>29,962</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>14,168</td>
<td></td>
</tr>
</tbody>
</table>
Future Research

• Conduct more research
• Define impact of web-based social interactions
• Explore normalization per discipline, country, time, etc.
• Identify which metrics are more appropriate in different levels of aggregation (paper/author/institution/journal/etc.)
• Classification of different types scholarly output that need to be taken into account (relevancy with fields and scholarly process)
• Develop strategy about alternative metrics in discovery and research performance evaluation process
• Explore further uses for article level usage and altmetrics