Measurement Tools

Chris James (Chair)
Sean Newell
Susan Renoe

MacDonald Room, 11.30-12.45

Impact of Science
14-15 June 2018, Ottawa
Measurement tools

Chris James
Senior Product Manager SciVal,
Elsevier, The Netherlands
Ring growth data and methane measuring. Canada’s good at both!

Chris James, Senior Product Manager SciVal
Elsevier, Amsterdam

AESIS Ottawa – 14 June 2018
What are the latest developments on measuring impact and how do they help create more structured insight in impact-performance?

• What is research impact?
• What tools do we have to measure societal impact?
• Making granular discoveries easier
  - breaking away from subject classifications with Topic Prominence in Science for more structured insights
• Practical application on Canadian research
  - Spoiler alert – climate change is a big topic!
What is research impact?
Research Councils UK (RCUK) research impact definition

‘The demonstrable contribution that excellent research makes to society and the economy’.

This can involve one or both of:

- **Academic impact** - shifting understanding and advancing scientific, method, theory and application across and within disciplines
- **Economic and societal impact** - contribution to society and the economy, and its benefits to individuals, organisations and/or nations.

The impact of research, be it academic, economic and social can include:

- **Instrumental**: influencing the development of policy, practice or service provision, shaping legislation, altering behaviour
- **Conceptual**: contributing to the understanding of policy issues, reframing debates
- **Capacity building**: through technical and personal skill development.

http://www.esrc.ac.uk/research/impact-toolkit/what-is-impact/
The basket of metrics is diverse and available for all entities

<table>
<thead>
<tr>
<th>Theme</th>
<th>Sub-theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Funding</td>
<td>Awards</td>
</tr>
<tr>
<td></td>
<td>Can I support my research?</td>
</tr>
<tr>
<td>B. Outputs</td>
<td>Productivity of research outputs</td>
</tr>
<tr>
<td></td>
<td>How productive am I?</td>
</tr>
<tr>
<td></td>
<td>Visibility of communication channels</td>
</tr>
<tr>
<td></td>
<td>What is the impact of the channels that my outputs are published in?</td>
</tr>
<tr>
<td>C. Research Impact</td>
<td>Research influence</td>
</tr>
<tr>
<td></td>
<td>How are my outputs used in academia?</td>
</tr>
<tr>
<td></td>
<td>Knowledge transfer</td>
</tr>
<tr>
<td></td>
<td>How are my outputs used in industry?</td>
</tr>
<tr>
<td>D. Engagement</td>
<td>Academic network</td>
</tr>
<tr>
<td></td>
<td>How good is my collaboration network within academia?</td>
</tr>
<tr>
<td></td>
<td>Non-academic network</td>
</tr>
<tr>
<td></td>
<td>How good is my collaboration network outside academia?</td>
</tr>
<tr>
<td></td>
<td>Expertise transfer</td>
</tr>
<tr>
<td></td>
<td>How do I transmit knowledge to others within academia?</td>
</tr>
<tr>
<td>E. Societal Impact</td>
<td>Societal Impact</td>
</tr>
<tr>
<td></td>
<td>What is my wider impact?</td>
</tr>
</tbody>
</table>

Outputs
- e.g. article, research data, blog, monograph

Custom set of outputs
- e.g. funders’ output, articles I’ve reviewed

Researcher or group

Institution or group

Subject Area
- Serial
  - e.g. journal, proceedings
- Portfolio
  - e.g. publisher’s title list
- Country or group
What could research metrics help demonstrate?

- Social media metrics (Shares, likes, +1, Tweets)
- Downloads from Github, RePEc, IRs
- Citations (field normalised, %iles, counts)
- Collaborators on Github
- Full text, pdf, html views on ScienceDirect, Figshare etc
- Number of Library holdings (WorldCat OCLC)
- Views on Slideshare
- Plays on YouTube
- Amazon book reviews
- Clinical citations or Health policy/guideline citations
- Government policy citations
- News mentions
- Patent citations
- Academic: Industry partnerships
- Licenses
- Business consultancy activities

Types of impact:
- Educational impact
- Societal impact
- Commercial impact
- Innovation
- Informational impact
- Academic impact
- Promotion / attention / buzz
- Number of patents filed and granted

Promotion / attention / buzz

Educational impact

Societal impact

Commercial impact

Innovation

Informational impact

Academic impact

Number of Library holdings (WorldCat OCLC)
Views on Slideshare
Plays on YouTube
Amazon book reviews
Clinical citations or Health policy/guideline citations
Government policy citations
News mentions
Patent citations
Academic: Industry partnerships
Licenses
Business consultancy activities
Newsflo

Newsflo measures an academic’s societal impact by uncovering relevant mentions of their research across tens of thousands of mass media outlets around the world

- Near **real time feed** of news articles
- **45,000** (English-speaking) news outlets
- **Over 20 countries** including the USA, India, China, Brazil and all major European countries.

- Matches
  - Individual researchers (**uses Scopus author ID and affiliation**)  
  - News about academic publications (**uses DOIs and URLs to match**)

- Integrated into

  - Mendeley
  - Plum Analytics
  - SciVal
  - Scopus
  - Pure
Two Golden Rules for using research metrics

Always use both qualitative and quantitative input into your decisions

- Benefit from the strengths of both approaches. Don’t replace one with the other
- Combining both approaches = closer to the whole story
- Valuable intelligence comes when these approaches show different messages

Always use more than one research metric as the quantitative input

- One metric’s strengths can complement the weaknesses of others
- There are many different ways of being excellent
- Using multiple metrics drives desirable changes in behaviour (harder to game)
How can we help create more structured insight in impact-performance?
Let’s get granular!

- Often if you are not looking at a physical entity (e.g. an institution), you want to look at areas of research
- One of the most common categorization methods is based on the publication’s journal subject areas
  - In Scopus 334 categories
- Other groupings have to be created by the user, which is very unstructured
  - e.g. Research Areas in SciVal

- But what if we could help the user find their topics of interest at a much more granular level?
So that we could…

…Help Research managers

- Identify pockets of **well funded research** in the **research portfolio**.
- Find the **top performers** and **rising stars** in those areas for recruitment, tenure and collaboration.
- **Showcase** that their institution is active in topics with high momentum
- **Identify which topics other universities** are active in that have high momentum.

…and uncover the impact
Introducing Topic Prominence in Science

• We have identified ~97,000 global research topics by clustering all of Scopus using direct citation linking and ranked them by Prominence.

• **Prominence is a new indicator** that shows the **current momentum** of a topic by looking at **very recent citations**, **views** and **CiteScore** values.

• **Prominence = momentum** (not the same as importance!).

• **Prominence can predict funding** – helps researchers and research managers identify topics which are likely to be well funded.
First of its kind

The first truly global detailed research portfolio analysis – this has never been done before – we use all of Scopus to form topics.

- **Who’s leading the way** – we can identify emergent topics with high momentum to understand who is currently leading the way.
- **What’s related** – We can tell you how the topics are related to your research portfolio.
- **A better reflection of reality** – topics are an excellent reflection of reality since they are based on citation patterns and not journal categories and are therefore truly multidisciplinary.
What is a “Topic”? 

A topic is a collection of documents with a common intellectual interest – a “research problem”

Topics can be large or small, new or old, growing or declining

Topics are dynamic and can evolve

New topics can be born

Many topics are inherently multidisciplinary

Old topics may be dormant, but still exist

Researchers have mobility and can contribute to multiple topics
But what can we do with this new level of aggregation?

• Look at an institution or country
• Identify areas where they are a key contributor
• Learn more about the area
• See who’s doing what and with whom
• Identify the key researcher(s)
• See what research is providing conceptual or instrumental impact through via the Newsflo media mentions
Let’s take a look at Canada
Let’s look at the top 1% by prominence
Canada has 20% publication share and can make a difference
Learn more about the topic

permafrost; tundra; permafrost thaw T.1359

Overall research performance

Scholarly Output: 1,266
Field-Weighted Citation Impact: 1.76
International Collaboration: 539

Views Count: 25,598
Citation Count: 12,918
Topic Prominence percentile: 99.469

Source: Scopus
Topic character

What is this topic about?

Keyphrases are derived from the article data using NLP.
Are the centrally linked and very recent publications in the Topic

Climate change and the permafrost carbon feedback.
Schuur, E.A.G., McGuire, A.D., Schädel, C. and 14 more
View in Scopus

Estimated stocks of circumpolar permafrost carbon with quantified uncertainty ranges and identified data gaps.
Hugelius, G., Strauss, J., Zubrzycki, S. and 14 more
View in Scopus

Climate sensitivity of shrub growth across the tundra biome.
Myers-Smith, I.H., Elmendorf, S.C., Beck, P.S.A. and 30 more
View in Scopus

Advances in thermokarst research.
Kokelj, S.V., Jorgenson, M.T.
View in Scopus
Discover the more about the Topic including top:

- Institutions
- Countries & regions
- Authors
- Scopus sources
Let’s get more specific!

I want to identify the top Canadian researchers and see if their research is being picked up in the media.

Let’s take a look at Trevor Lantz.
Trevor works a lot in this Topic!

- 22 publications in 5.5 years
- 23% international collaboration
- Excellent citation impact
- Let’s take a look at all his publications
Climate sensitivity of shrub growth across the tundra biome

Rapid climate warming in the tundra biome has been linked to increasing shrub dominance. Shrub expansion can modify climate by altering surface albedo, energy and water balance, and permafrost, yet the drivers of shrub growth remain poorly understood. Dendroecological data consisting of multi-decadal time series of annual shrub growth provide an underused resource to explore climate-growth relationships. Here, we analyse circumpolar data from 37 Arctic and alpine sites in 9 countries, including 25 species, and 1,142,000 annual growth records from 1,821 individuals. Our analyses demonstrate that the sensitivity of shrub growth to climate was: (1) heterogeneous, with European sites showing greater summer temperature sensitivity than North American sites, and (2) higher at sites with greater soil moisture and for taller shrubs (for example, elders and willows) growing at their northern or upper elevational range edges. Across latitude, climate sensitivity of growth was greatest at the boundary between the Low and High Arctic, where permafrost is thawing and most of the global permafrost soil carbon pool is stored.
One of the biggest studies to date of key vegetation in the Arctic tundra provides strong evidence that dramatic changes in the region are being driven by climate warming.

Dr Isla Myers-Smith, of the University of Edinburgh's School of GeoSciences, who co-ordinated the study, said: “Arctic shrub growth in the tundra is one of the most significant examples on Earth of the effect that climate change is having on ecosystems. Our findings show there is a lot of variation across this landscape. Understanding this should help improve predictions of climate change impacts across the tundra.”

Significant changes in one of the Earth’s most important ecosystems are not only a symptom of climate change, but may fuel further warming, research suggests.

One of the biggest studies to date of key vegetation in the Arctic tundra provides strong evidence that dramatic changes in the region are being driven by climate warming.

Studies of tundra shrubs - which act as a barometer of the Arctic environment - show that they grow more when temperatures are warmer. Increased shrub growth, driven by recent and future warming in the Arctic, could cause more warming in tundra ecosystems and for the planet as a whole.
It’s all about discovery – here’s another example

- A Topic where Canada has a +41% article share
- Most prolific global researcher – Ian Gates – Univ Calgary
- Uncovers a related paper from June 2018
- Already 2 news articles about it
The Canadian government says its new regulations would reduce GHG emissions by 20 millions tonnes per year.

But while CO2 emissions from combustion are easy to estimate and measure, methane from upstream sources – wells, pumps, valves, pipelines, processing plants – is far more challenging.

But researchers at the University of Calgary Johns Hopkins and Canadian Energy Research Institute have come up with a new modelling approach that may help governments develop more accurate baselines to work from.

Although it is shorter lived in the atmosphere, methane has higher heat insulating properties than CO2, making it even worse, from a global warming perspective.

**Instrumental**: influencing the development of policy, practice or service provision, shaping legislation, altering behaviour

**Conceptual**: contributing to the understanding of policy issues, reframing debates
Summary

What are the latest developments on measuring impact and how do they help create more structured insight in impact-performance?

• Topic Prominence aids discovery and provides a granular structure to measure impact-performance
• Societal impact can be demonstrated using tools like SciVal, PlumX, Pure and Scopus
• Always remember the 2 Golden Rules for the responsible use of metrics!
Research Intelligence

Thanks and questions
Outputs in Top Citation Percentiles

Publication Year

- **y-axis**: Outputs in Top 10 cited percentiles (%)
- **x-axis**: Publication Year

Researchers and Groups:
- Jones, Benjamin M.
- Kuhry, Peter
- Lantz, Trevor C.
- Natale, Susan M.
- Shaver, Gaius R.
- Walker, Donald A.
-Welker, Jeffrey M.

View list of Scopus Sources for the selected Researchers and Groups
Measurement tools

Sean Newell

Chief Executive Officer,
Researchfish, United Kingdom
A Structured, Shared Approach to Research Impact Assessment

AESIS 2018 Ottawa
Sean Newell, CEO Research Fish Ltd

www.researchfish.com
How do we track the Impact of Research?
I have been struck again and again by how important measurement is to improving the human condition

- Bill Gates
Success was measured by the amount funded…
Then came publications...
And now …

- Publications
- Collaborations
- Further Funding
- Next Destination
- Engagement
- Policy Influence
- Tools & Methods
- Databases & Models
- 16 Outcome Types
- IP
- Medical Products
- Artistic & Creative
- Software & Technical
- Spin Outs
- Awards & Recognition
- Outputs & Knowledge
- Facilities & Resources
Research Fish History

- **2009**: MRC Project
  - Replacing end of grant reporting

- **2011**: Shared Platform
  - 11 Biomedical organisations

- **2013**: Adopted by all Research Councils
  - Expanded Common Question Set

- **2018**: > 130 organisations globally
  - 2.5m outputs
  - 100k+ grants
  - $60bn tracked
Some of our Members
Why a Common Question Set?

• Speak the same language
• Share data
• Collaborate internationally
• Publish impact reports
• Learn from each other – best practice
• Common Question Set is available to all and is not owned by Research Fish
How Does it Work?
The Researchers provide the data

• Proven to be the best source of information
• As much information as possible is harvested automatically
• Acutely aware of reporting burden on Researchers
  • Average time is 45 minutes per year
  • Aim for “write once, read many”
• Platform integration is key
Data Exchange

Over 1000 different data sources

University Systems

XLSX

API

Researchfish®
It’s not just about the numbers

• Counting records provides only part of the story
• Researchers are encouraged to use narrative
Sample Reports

Community

• International Community of like-minded people

• Development is guided by the members

• Best practice is shared

• Annual Strategy of Impact Conference open to all members and non-members
International Community of like-minded people

Development is guided by the members

Best practice is shared

Annual Strategy of Impact Conference open to all members and non-members
“By adopting Researchfish you will be able to collect data immediately and gain a systematic knowledge of output. It is also good for researchers as they will have one system to report into rather than many.”

Thomas Alslev Christensen, PhD, Chief Operating Officer of the Novo Nordisk Foundation
Biomedical Catalyst Fund

• Started at £90m UK government research fund
• MRC provided data gathered through Researchfish
• Consequently the fund grew to £180m, announced by Prime Minister David Cameron
• Government cited the evidence provided
• Supporting collaboration between academia and industry
Summary

• Common questions yield a structured, consistent data set, backed-up by narrative
• Authenticated by researcher
• Provides far deeper insights than automated harvesting alone
• Stakeholders can evidence the impact of their research
• Allows the research community to better understand, track and measure the impact of funded research
Thank You

sean.newell@researchfish.com
+44 7884 102611
Measurement tools

Susan Renoe
Assistant Vice Chancellor for Research, Extension & Engagement
Principle Investigator, National Alliance for Broader Impacts
Connecting the people, resources, tools, and ideas of UM System research and creative activities for the purposes of growing research, strengthening communication, and increasing engagement to benefit the people of Missouri, the nation, and the world.
• 718 members representing 50 states, D.C., Puerto Rico, and 8 countries

• Building individual & institutional capacity,

• Advancing broader impacts,

• Demonstrating the societal benefits of research,

• Working between policymakers and policy implementers.
“Meaningful assessment and evaluation of NSF funded projects should be based on appropriate metrics, keeping in mind the likely correlation between the effect of broader impacts and the resources provided to implement projects. If the size of the activity is limited, evaluation of that activity in isolation is not likely to be meaningful. Thus, assessing the effectiveness of these activities may best be done at a higher, more aggregated, level than the individual project.”

–NSF Guiding Principles
BINDERS PLATFORM

• Create Projects
• Create Goals and Activities
• Survey Dashboard – Online Surveys, Combined Surveys
• Project Tools (Annual Forms)
Broader Impacts Network Data, Evaluation, & Research System (BINDERS)

- Online platform for entering, collecting, and tracking BI evaluation data related to broadening participation, undergraduate research, high school outreach, and public outreach
- Completely free and links easily with myVITA
- Created in partnership with the MU Assessment Resource Center.

http://arc-binders.missouri.edu
Please select an activity

Activities to Broaden Participation

☐ Community outreach events for general public hosted at the University
☐ Authentic research experiences for undergraduate science majors from underrepresented groups
☐ High School campus visits and presentation to institutions serving underrepresented groups
☐ Other

Save & Return Home

All NSF proposals must include a statement on broader impacts that describes the potential of the proposed activity to benefit society and contribute to the achievement of specific, desired societal outcomes. Broader impacts may be accomplished through the research itself, through the activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to the project.

Select which of the following goals you will include in your project:

## Broader Impacts Goals

- Full participation of women, persons with disabilities, and underrepresented minorities in science, technology, engineering, and mathematics (STEM)
- Improved STEM education and educator development at any level
- Increased public scientific literacy and public engagement with science and technology
- Improved well-being of individuals in society
- Development of a diverse, globally competitive STEM workforce
- Increased partnerships between academia, industry, and others
- Improved national security
- Increased economic competitiveness of the United States
- Enhanced infrastructure for research and education