Discussion Paper

Measuring Individuals' and Institutions' Research Impact

An Overview of How Librarians, Publishers, and Other Entities Can Help

Presented by ASME as a Service to Our Librarian Community

The American Society of Mechanical Engineers®
ASME®

ASME®
SETTING THE STANDARD

Contents

"Impact is the demonstrable contribution that excellent research makes to society and the economy. *This occurs in many ways – through creating and sharing new knowledge and innovation; inventing groundbreaking new products, companies and jobs; developing new and improving existing public services and policy; enhancing quality of life and health; and many more."* [1]

-- UK Research and Innovation (UKRI)

[1] UK Research and Innovation (UKRI). "Excellence with Impact," accessed December 12, 2019, https://www.ukri.org/innovation/excellence-with-impact

Introduction

You can help your research community and institution track their research impact with a little help from publishers and other entities.

Scientific research can have both academic and social impact. Research outputs impacting the academic sphere are largely measured through traditional metrics like citation analysis, while new alternative metrics tools (altmetrics) can be used to track and measure the social impact of scientific publications and researcher influence. The prestige of your authors and institution is directly tied to the visibility of their published work.

This document provides a snapshot of how you can help your research community and institution tell impact stories in a meaningful way and better understand the research landscape by accessing, using, and interpreting citation and other bibliometric data and altmetric indicators. This overview of tools and services (provided by publishers and other scholarly technology entities that furnish quantitative and qualitative data) is intended to provide recommendations and guidance with links to explore in greater detail that can be shared with others throughout your organization.

Librarians play an important role to support researchers, and more broadly their academic or government institutions or companies, to develop data-driven contextualized "impact stories." They are educating researchers and administrators about what metrics and tools are available and how to assess their strengths, limitations, and relevancy, and limit their misuse.

Why is creating these impact stories important?

Funders and university administrators are increasingly requiring researchers to document their scientific endeavors and engagement initiatives, as well as the "broader impacts" of their work.

Impact stories of researchers and institutions can support and influence:

- Visibility and impact of work
- Funding
- Finding collaborators
- Enhancing research and career opportunities
- Promotion, review, and tenure
- Hiring
- Gap analyses
- Program evaluation and quality assessment

The global scientific, technical, and medical (STM) publishing community and other organizations, both for- and non-profit, have made significant contributions in establishing new standards and practices that, when instituted across the publishing landscape, support the capture and tracking of metrics on the impact of scientific output. These pioneering efforts continue and are becoming increasingly sophisticated as artificial intelligence tools, machine learning, linked data services, and other technologies continue to evolve.

Currently citation analysis and other bibliometrics, traditionally the primary measures of research output (volume) and impact (influence), are being augmented by a range of alternative metrics (altmetrics) that measure public, social, and mass media impact. Some consider citations the only valid measure, while others call for less reliance on Journal Impact Factors. **Both bibliometric and altmetric data, when used responsibly and in context, have validity and can be used as evidence of research impact.**

Choosing the right metrics to tell impact stories is important.

Tools and Resources: Citations and Downloads Analysis

Librarians: Helping your research community and institution develop powerful impact stories.

Choosing the right metrics to measure the impact of scholarly publishing, popular social media, news coverage, and other sources is critical for creating an accurate profile that tells meaningful impact stories.

Here is an overview of useful and reliable tools and resources that you can use or recommend to researchers to help them measure their research impact, no matter what their career stage may be. Many of these tools have been developed by publishers and information analytics providers specifically to help tell these impact stories.

No single metric should be considered definitive; it only tells part of the story. An excellent resource for exploring a range of available metrics can be found at **https://www.metrics-toolkit.org/explore-metrics.**

Citation Analysis

Tracking citation data by journal title or using article level metrics are the traditional benchmarks for tracking scholarly impact, not only for journal articles but research data as well. Citation alerts are offered by some services.

JOURNAL INDICATORS

Here is a selection of the more frequently used metrics to assess the impact and importance of the journals in which researchers publish.

Journal Impact Factor

The **Journal Impact Factor (JIF)** or **Impact Factor (IF)** of an academic journal is a scientometric index. Data are published each year in *Journal Citations Reports* published by Clarivate Analytics.
https://clarivate.com/webofsciencegroup/solutions/journal-citation-reports

CiteScore

Generated from citation data in the Scopus database produced by Elsevier, **CiteScore** is the number of citations received by a journal in one year to documents published in the three previous years, divided by the number of documents indexed in Scopus published in those same three years.
https://www.elsevier.com/solutions/scopus/how-scopus-works/metrics

SCImago Journal Rank (SJR)

Powered by Scopus, the **SCImago Journal Rank (SJR)** indicator is a measure of scientific influence of scholarly journals that accounts for both the number of citations received by a journal and the importance or prestige of the journals from which the citations originate. Data can also be generated by country of publication. **https://www.scimagojr.com**

Field Normalized Citation Index (FNCI)

Using Web of Science and Scopus data, **Field Normalized Citation Impact (FNCI)** is the ratio between the actual citations received by a publication and the average number of citations received by all other similar publications.
https://www.metrics-toolkit.org/field-normalized-citation-impact

Eigenfactor

The **Eigenfactor** score is a rating of the total importance of a scientific journal. Journals are rated according to the number of incoming citations, with citations from highly ranked journals weighted to make a larger contribution to the Eigenfactor than those from poorly ranked journals. **http://www.eigenfactor.org**

ARTICLE / AUTHOR / DATASET INDICATORS

Here is a selection of the more frequently used metrics to assess the impact of individual authors' output.

Google Scholar Metrics

Google Scholar Metrics provide an easy way for authors to quickly gauge the visibility and influence of recent articles in scholarly publications. **https://scholar.google.com/intl/en/scholar/metrics.html**

Source Normalized Impact Per Paper (SNIP)

Source Normalized Impact Per Paper (SNIP) measures the average citation impact of articles in a journal. Unlike the well-known Journal Impact Factor, SNIP corrects for differences in citation practices between scientific fields, thereby allowing for more accurate between-field comparisons of citation impact. Produced by Leiden University's Centre for Science and Technology Studies (CWTS) and powered by Scopus. **https://www.journalindicators.com**

h-index

The **h-index** is an author-level metric provided by Web of Science, Scopus, and Google Scholar that attempts to measure both the productivity and citation impact of scholarly output. The index is based on the set of the researcher's most cited papers and the number of citations that they have received in other publications. (An h-index can also be generated for journals.) **https://en.wikipedia.org/wiki/H-index**

Data Citation Index (DCI)

Produced by Clarivate Analytics, the **Data Citation Index (DCI)** provides a single point of access to quality research data from global repositories across disciplines. Descriptive records are created for data objects and linked to literature articles in the Web of Science. Citations to datasets and studies are indexed so that their impact can be measured and their influence tracked.
https://clarivate.com/webofsciencegroup/solutions/webofscience-data-citation-index

Citation Percentiles and "Highly Cited" Labels

The position of a paper or group of papers with respect to other papers in a given discipline, country, and/or time period can be determined based on the number of citations they have received. This is typically expressed as a percentile and is sometimes designated as a "highly cited" paper based on its percentile ranking.
https://www.metrics-toolkit.org/highly-cited-papers-and-highly-cited-labels

Publons

Acknowledging peer review activity can be an important addition to an individual's impact story, **Publons** tracks publications, citation metrics, peer reviews, and journal editing work and facilitates correct author attribution. Publons is part of Web of Science Group, a Clarivate Analytics company. **https://publons.com/about/home**

Downloads and Pageviews

The number of times a specific journal article has been viewed and/or downloaded can add another chapter to the impact story. Some publishers and data repositories display this information on their websites.

Tools and Resources: Altmetrics

Librarians: Exploring alternative metrics to monitor online engagement with scholarly output.

Measures of scholarship are becoming more diverse. Altmetrics, or alternative metrics, is a relatively young field that takes into account online reader behavior, network interactions with content, and social media. Altmetrics make it easy to discover what researchers are saying about each other's work and how they value that work. They enable researchers to gain insights into how their work is being discussed, shared, downloaded, read, and reused by other researchers, and beyond that, by the public.

While altmetrics are measures of attention and not necessarily quality, they can add "another chapter" to impact stories by complementing, but not replacing, more traditional impact measures. Supporters of the altmetrics movement believe that doing so will give a more complete picture of how research and scholarship are used.

NOTE: Do not confuse the general term altmetrics with Digital Science's, Altmetric (www.altmetric.com), a data science company that tracks and reports altmetrics data.

You can help your research community understand the strengths of altmetrics...and appreciate their limitations:

- **Currency –** Citations can take months or years to accumulate. Altmetrics can be gathered in real time and calculated immediately
- **Diversity –** Altmetrics capture data from a variety of sources, not just the traditional academic articles, and can reflect the broader impact of research beyond the scholarly community
- **Social impact –** Altmetrics data can help researchers understand how their research is being interacted with by the public, government, policy makers, and other researchers

ALTMETRICS AGGREGATORS

Altmetric Attention Score ("the donut")

The **Altmetric Attention Score (AAS)** is an automatically calculated, weighted count of all attention a research output has received online in sources tracked by Altmetric. This includes, for example, policy documents, news, blogs, Twitter, post-publication peer reviews, Facebook, Sina Weibo, syllabi, Wikipedia, Google+, LinkedIn, Reddit, YouTube, Pinterest, and patents.
https://www.altmetric.com.

PlumX Metrics

PlumX Metrics from Plum Analytics provide insights into the ways people interact with individual pieces of research output (articles, conference proceedings, book chapters, and many more) in the online environment. These metrics are divided into five categories: Citations, Usage, Captures, Mentions, and Social Media.
https://plumanalytics.com/learn/about-metrics

ImpactStory

ImpactStory is an open source, web-based tool that provides altmetrics to help researchers measure the impacts of their research outputs including journal articles, blog posts, datasets, and software. It aims to change the focus of the scholarly reward system to value and encourage web-native scholarship.
https://profiles.impactstory.org

OTHER ALTMETRICS

Social Media

Researchers can use data capture services like Altmetric or PlumX to monitor social media activity generated by their research outputs or they can check social media sites like **Twitter**, **Facebook**, **LinkedIn**, and blog mentions directly.

Mendeley

Mendeley readership counts are best used to understand early scholarly attention to individual research documents. Studies have found positive correlations between Mendeley readership counts and later citation activity[2].
https://www.mendeley.com

Vimeo and YouTube Metrics

Vimeo and **YouTube** provide statistics for tracking views of videos, likes, and favorites hosted on their websites, which can be used to track the impact of video research outputs.
https://vimeo.com and **https://www.youtube.com**

GitHub

GitHub enables individuals who have stored a repository (group of files) on the site, primarily software and code, to track who is actively using or reusing the repository as well as who is interested in the content.
https://www.metrics-toolkit.org/github-forks-collaborators-watchers

[2] Thelwall, M. Early Mendeley readers correlate with later citation counts, Scientometrics, 1231–1240 (2018)
https://link.springer.com/article/10.1007%2Fs11192-018-2715-9

STM Publishers and Other Entities: Supporting Author and Institutional Recognition

ASME, STM publishers, and other entities: Developing and sponsoring organizations and initiatives that enrich research measurement analytics.

Often working in collaboration, STM publishers and other entities are investigating, supporting, and adopting new STANDARDS that enable more accurate and meaningful measurement of research outputs. These initiatives provide some important tools that enable formal recognition of the impact of scientific research conducted by individuals, institutions, and throughout geographic regions.

CrossRef

CrossRef offers participating publishers a wide array of services to ensure that scholarly research metadata is registered, linked, and distributed. This makes research outputs easier to find, cite, link, assess, and reuse. Services include Content Registration, Reference Linking, Cited-By, Crossmark, Metadata Delivery, Similarity Check, Funder Registry, and Event Data. **https://www.crossref.org**

ORCID

ORCID provides a persistent digital identifier that distinguishes each researcher from another and, through integration in key research workflows such as manuscript and grant submission, supports automated linkages between researchers and their professional activities. Improved accuracy of website searches ensures that their work is recognized. **https://orcid.org**

CRediT / CASRAI

CRediT / CASRAI (Contributor Roles Taxonomy) is a high-level taxonomy, including 14 roles, that can be used to represent the roles typically played by contributors to scientific scholarly output. The roles describe each contributor's specific contribution to the scholarly output. **https://casrai.org/credit**

Codes and Standards

Publishers of **Codes and Standards**, like ASME, help institutions, government agencies, and companies document their contributions to standards development. Codes and Standards generate analytical data that reduce the compliance workload. **https://www.asme.org/codes-standards**

NISO

The **National Information Standards Organization (NISO)** maintains the Journal Article Tag Suite (JATS) (ANSI/NISO Z39.96-2019) documenting an international standard XML tag set for journal articles. With extensive metadata, JATS facilitates data mining, semantic interchange, and advanced searchability. **https://www.niso.org/standards-committees/jats**

Kudos

Kudos provides tools and intelligence to help publishers connect with authors after publication, collaborate with them to maximize publication usage and impact, and reclaim lost usage. It also provides a suite of tools that librarians can use to help measure and manage an institution's research performance and strengthen research support. **https://www.growkudos.com**

OTHER ACTIVITIES

In general, STM publishers support authors getting their work noticed through a number of activities, which result in tracking by altmetrics and other measures. These include:

- **Promoting** authors and papers that have potential for a wider public audience via conferences, social media, press releases, etc.
- **Allowing** authors to self-archive or post pre-prints in repositories within the confines of publisher permissions.
- **Providing** opportunities for authors to publish or provide datasets, software, and other non-traditional research assets that increasingly have "impact" on platforms like GitHub and Figshare, etc.

Key Take-Aways

To summarize:

- **Researchers** are increasingly and actively getting their work noticed – then they need to quantify and use this information to their benefit
- **Researchers** need to rely on validated sources and should develop a complete picture that provides context to make both quantitative and qualitative data meaningful
- **Librarians** can support their research communities and institutions by helping stakeholders create impact stories using metrics tools in an informed way
- **Publishers** play an important role creating reliable linkages from authors and their content to metrics tools

Librarians can encourage authors to:

- **Collect** all of their papers, datasets, software, slide decks, and other scholarly products into a single profile
- **Highlight** scholarship and metrics in appropriate sections of their profiles on their homepages or their CVs
- **Learn** who's talking about their work by drilling down into the metrics and underlying data
- **Self-archive** in repositories (within the confines of publisher permissions)
- **Connect** to third-party services to get automatic updates about citation and social media activity

References and Resources

References

[1] UK Research and Innovation (UKRI). "Excellence with Impact," accessed December 12, 2019, https://www.ukri.org/innovation/excellence-with-impact

[2] Thelwall, M. Early Mendeley readers correlate with later citation counts, Scientometrics, 1231–1240 (2018) https://link.springer.com/article/10.1007%2Fs11192-018-2715-9

Resources

https://www.metrics-toolkit.org

The Metrics Toolkit is a resource for researchers and evaluators that provides guidance for demonstrating and evaluating claims of research impact.

https://www.library.pitt.edu/research-support-sharing

University of Pittsburgh, University Library System. Research Support: Sharing

https://guides.lib.berkeley.edu/researchimpact/altmetrics

Berkeley Library, University of California. Measuring Research Impact: Altmetrics