

## Altmetrics: An Indicator of Research Consumption other than a Tool for Measuring Research Impact

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### ABSTRACT

Altmetrics are measurements of how people interact with a given scholarly work. They aim to measure web-driven scholarly interactions, such as how often research is tweeted, blogged about, or bookmarked. It looks at the evidence behind claims that altmetrics allow the impact of research to be measured in days rather than years. Low correlations between altmetrics and article citations make it doubtful that altmetrics can reliably predict future citations. In addition, there are good reasons to qualify statements that altmetrics measure the wider impact of research on society. Librarians should be careful not to overstate the value of altmetrics when recommending their use as a complement to more traditional measures of research quality or bibliometrics. This article looked at the evidence behind the idea that altmetrics can measure research impact in days rather than years. It shows that altmetrics are an extremely imperfect tool for predicting article performance in terms of future citations. Altmetrics are also better at measuring the public consumption of knowledge than the long-term practical impact of research.

**Keywords:** Academic Altmetrics, Research Impact, Scholarly Communications, Research Consumption, Scientometrics

### Introduction

Previously, everyone, particularly governments and science policymakers, understood that research and technology should be financially funded due to their outcomes and societal impacts. Science and technology have impacted our culture, ideas, and thinking, as well as enhanced and caused radical changes to the quality and length of people's lives. It is a common opinion, particularly in governments and science policymakers, that research and technology should be financially funded due to their outcomes and societal impacts (Aung *et al.*, 2019). To get notoriety, scientific findings no longer need to be published in peer-reviewed journals.

However, as a growing number of scholars, as well as the general public, assimilate premature data shared in blog posts, presentations, and tweets, this dominance is beginning to crumble (Bar-Ilan, Halevi and Milojević, 2019).

Despite the enormous influence of social media on the way research is conducted and disseminated, scientific conferences, journals, and books are still the most common venues for disseminating research findings. The focus of research is transitioning from closed to open, hidden to transparent and passive consumption to active and co-determinative consumption. The low correlations between altmetrics and article citations, as well as the evidence behind assertions that altmetrics allow the impact of research to be quantified in days rather than years, make it questionable that altmetrics can consistently forecast future citations (Bar-Ilan, Halevi and Milojević, 2019).

However, there are valid grounds to qualify claims that altmetrics quantify the societal impact of research. When proposing altmetrics as a supplement to more standard measures of research quality, librarians should be cautious not to exaggerate their significance (Bornmann, L., & Leydesdorff, L.2013). Altmetrics are more useful as a gauge of

research consumption than as a method for determining the impact of research. As a result, (Costas, Zahedi and Wouters, 2015) are of the opinion that librarians should be wary of exaggerating the significance of altmetrics as a supplement to more traditional bibliometrics, which is the conclusion the current study is attempting to reach.

### **Concept of Altmetrics**

Altmetrics is a movement aimed at capturing previously unseen scholarly influence on social web platforms such as news sites, Wikipedia, blogs, microblogs, social bookmarking systems, and online reference managers (Eynon, 2012). Altmetrics measure the amount of attention given to academia through social media, the press, and other non-traditional outlets. Altmetrics have been presented as a new alternative to existing methodologies since they allow for crowd-sourced peer assessment and a much faster start to public discussion of scholarship (Fairclough and Thelwall, 2015). The new field of altmetrics, which emerged with Web 2.0, incorporated the new social media landscape into fields that aimed to quantify scientific effect on the web. Emerging social media platforms offered a viable alternative to classical bibliometrics, with the added benefit of a far faster impact measurement (Gamble *et al.*, 2020). Researchers were able to identify influential publications quickly after publication, rather than months or years afterwards, which aided current awareness efforts (as in the case of journal article citations). Alternative indicators provide a distinct perspective on the impact of a scholar's work, as traditional citation-based measures are inadequate to capture the increasing variety of online references to a scholar's work (Haustein *et al.*, 2014). More signs have become available as scholarly communication moves more online: how many times an article has been bookmarked, blogged about, cited in Wikipedia, and so on. These measures are known as altmetrics, or alternative impact metrics, and are also known as "social media based metrics."

Furthermore, altmetrics provided a benefit in that they allowed faculty members to identify effect in the increasingly interdisciplinary academic environment that arose with the

introduction of social media enabled interactions (Garcovich and M., 2020). The compartmentalized approach of academic publishing was broken down, allowing faculty members to discover their effect outside of their discipline as well as potential collaborators for interdisciplinary research. Altmetrics also gave academics a means to show granting organizations that their work are reaching a large number of people, which is becoming more and more required in proposal calls (Gunn, 2014). It tracks how individuals respond to a certain scholarly publication. Robinson-Garcia *et al.* (2014) developed altmetrics to track web-based scholarly interactions such as how often research is tweeted, blogged about, or bookmarked.

Web-based measures the influence of publications and other scholarly content using data from social media platforms (e.g., Twitter, Facebook, Google+, blogs, Mendeley, CiteULike, PubPeer, Publons, Reddit, Wikipedia, YouTUBE, etc.) are referred to as altmetrics (Gurney and Boucherie, 2017). It is a novel and critical way to measuring the impact of scholarly research that uses alternative measurements. Jason Priem, a doctorate student in information science at the University of North Carolina, created the term "altmetrics" in 2010. The creation and analysis of new measures based on the Social Web for analyzing and informing scholarship is known as altmetrics (Holmberg *et al.*, 2019). It is unclear how the impact of research on sectors of society other than science should be quantified at this time. While peer review and bibliometrics have established common approaches for assessing the impact of research in science, a framework for assessing social impact has yet to emerge. Alternative metrics, referred to as "altmetrics" to differentiate them from bibliometrics, are seen as a promising option for assessing the societal impact of research since they provide new ways to quantify public involvement with research output Holmberg, & Thelwall, (2014). Web-based measurements for the impact of publications and other scholarly material utilizing data from social media platforms are referred to as altmetrics.

Alternative metrics (also known as altmetrics to differentiate them from bibliometrics; Gunn, 2013) are seen as a promising option for

assessing the societal impact of research since they provide new ways to quantify (public) involvement with research output (Piwowar, in Gunn, 2013). Altmetrics is a concept used to define web-based metrics for scholarly material's influence, with a focus on social media channels as data sources (Shema, Bar-Ilan, & Thelwall, 2014). Altmetrics are a large category of statistics that try to measure the impact of research using non-traditional methods (Priem et al. 2010, 2012a; Priem, Groth, and Taraborelli 2012). In plain terms, they are 'new measures for studying and informing scholarship based on the social web' (Priem et al. 2010).

### Coverage of Altmetric Sources

Altmetrics is a movement that aims to capture new and previously invisible types of impact of scholarly publications on sources such as: Wikipedia; Online reference software (mendeley); Blogs (blogger, WordPress); Social networking sites (facebook); Micro-blogging or short-message services (twitter); Social bookmarking networks (delicious); Patents; and even Grey literature citations (Pooladian, 2018).

### Advantages of Altmetrics

There have been some broad statements made about the future impact of altmetrics on academic librarianship. Altmetrics, for example, are expected to revolutionize the way librarians handle routine reference requests by giving them tools to quickly analyze the most recent research (Joubert and Costas, 2019). Librarians who are assisting people in finding newly published research will be able to safely recommend certain papers over others based on their altmetrics counts now that they know certain types of measures connect with citation counts. Furthermore, altmetrics are expected to become an important tool in collection management decisions, offering real-time information on study quality (Konkiel, 2013). Altmetrics are expected to help librarians grow their "increasingly crucial work in helping professors understand and build their own effect," according to predictions. As a result, the profession will take on a larger role in the research process.

Librarians will be given additional responsibilities in analyzing and massaging

altmetric data on behalf of customers as altmetrics become more significant in grant funding, tenure, and promotion choices (Kousha and Thelwall, 2019). These forecasts are certainly welcome at a time when librarians' conventional duties are being questioned. Evidence of an early impact: The most significant advantage of many alternative indicators in practice is that they provide early impact evidence. They may be consulted informally by academics for their own recently published articles to see if they are garnering any social media attention, whether for personal feedback or CV impact evidence (Kousha and Thelwall, 2017b). Early impact evidence can help shorten the time between conducting research and being able to evaluate it in formal research evaluations, whether evaluating individual researchers, departments, universities, or funding programs. This enables for the evaluation of more recent research and the use of indicators to aid decision-making at a time when papers are too new to have received citations. Altmetrics benefit from the early advantage, but most webometrics don't, because they appear later.

Broader evidence of influence: All altmetrics and webometrics represent impact that is at least partially distinct from citation impact. Alternative indicators provide the opportunity to acquire quantitative evidence concerning a larger range of consequences than citation counts alone if all sorts of research impacts should be valued (Kryl *et al.*, 2012). Alternative metrics can be used to quantify the influence of non-standard outputs like YouTube videos and grey literature, for which citation counts are unavailable or irrelevant.

### Disadvantages of Altmetrics

*Collecting difficulty:* While altmetrics can be gathered on a big scale from a commercial provider, most webometrics are time-consuming to collect. Because there are so many distinct webometrics and data gathering is difficult, this is perhaps the most significant barrier to their implementation in practice. A dearth of employees trained in altmetrics or webometrics, on the other hand, affects the time it takes to find and collect them. Altmetrics appear to be getting more attention

(Aung *et al.*, 2019), which could lead to more knowledge and willingness to learn how to use them effectively.

*Low coverage:* Many alternative indicators are non-zero for a tiny percentage of articles, reducing their ability to distinguish between average impacts of distinct sets of outputs. As a result, they may be limited to big document sets. Patent citations, for example, are uncommon yet prevalent enough to be used to compare colleges in terms of technological influence (Orduna-Malea, Thelwall, & Kousha, 2017). Altmetrics appear to be most common and useful in health-related subjects, although they are also very common in the arts, social sciences, and biological sciences (Costas, Zahedi, & Wouters, 2015).

*Difficulty with field normalisation:* Without benchmark values, such as those acquired by field normalisation, alternative indicator scores are difficult to judge (Thelwall, 2015). The amount of data needed to do field normalisation or benchmarking against other groups increases. Traditional citation index subject categories can be used for field normalization, but indicators for non-standard outputs will almost certainly require a different technique of subject classification. Field normalisation is probably rarely used for alternative indicators in reality, therefore assessors must account for the influence of fields, such as by avoiding comparing health-related altmetrics to mathematics-related altmetrics.

*Coverage of impact areas is incomplete and biased:* There is no certainty that any alternative indicator will collect evidence of any form of impact. Due to the mechanism by which they are made or used, they all have biases. For example, tweet counts as a measure of public interest are skewed against people who don't use Twitter, which includes the vast majority of Chinese people. Some sorts of societal influence are not reflected by any alternative indicator, hence a series of articles could have society impact but score zero on all altmetrics (Li, Thelwall and Giustini, 2012). For example, research aimed at improving farming methods in impoverished countries is unlikely to leave an altmetric trail indicating local farmers' adoption.

*Lack of quality control:* Almost all alternative indicators are vulnerable to intentional or unintentional manipulation, and hence cannot be utilized in assessments where people being evaluated are aware of the assessment procedure ahead of time (Costas, Zahedi and Wouters, 2015). Researchers may believe that altmetric-related evaluations undercut them because they fail to capture impact dimensions, which is related to the preceding difficulties (Regan, & Henschion, 2019).

### **Altmetrics as an Indicator of Research Consumption Rather Than a Tool for Measuring Research Impact**

Even those altmetricians who acknowledge the shortcomings of altmetrics as a guide to quality studies agree that social web metrics measure the influence of research on society. To be clear about this, it is important to know what impact means in altmetric terms. Beyond academia, impact is defined by the Higher Education Funding Council for England as an effect on, change, or benefit to the economy, society, culture, public policy or services, health, the environment, or quality of life (Li, Thelwall and Giustini, 2012). Economic and societal impacts are the: tangible contribution that good research makes to society and the economy, according to Research Councils UK. Individuals, organizations, and nations gain from research-related information and skills in a variety of ways, which are referred to as economic and societal effects (Mas Bleda and Thelwall, 2018).

The Australian Research Council has a similar definition: Beyond academic contributions, research impact is defined as the verifiable contribution that research provides to the economy, society, culture, national security, public policy or services, health, the environment, or quality of life (Mohammadi *et al.*, 2015). In a layman's term, these definitions define impact as the practical, long-term contribution of research to society's well-being. How do they stack up against altmetricians' concept of impact? The first issue is that few altmetricians specifically define research impact. The term 'impact' appears seventeen times in the Altmetrics manifesto, but nowhere does it define what it means (Priem *et al.*

2010). It's not uncommon for altmetric research to fail to define what "impact" means. In effect, most altmetrics proponents' working definition of the term is circular: impact is usually whatever altmetric scores measure. This is not to say that the concept of impact in altmetric terms is not empirically valid; rather, it is required to figure out what it means.

To grasp the significance of altmetrics, it is helpful to start with the claim that altmetrics provide evidence of impact in days. This means that the influence of altmetrics is immediate. The short-term influence of research on society cannot be compared to the long-term contribution of research to society. As a result, altmetrics are likely to assess research consumption rather than its impact. This finding is in line with comments made by a number of altmetricians recently (Adie 2013; Taylor 2013). It should come as no surprise that altmetricians utilize impact in ways other than its traditional connotation. This is, after all, to be expected. Researchers in the field of bibliometrics have long used the term "impact" in ways that have little to do with everyday usage (Ortega, 2020).

People talk about citation counts as a measure of the "importance" or "effect" of scientific work, but those who are educated about the issue use the words in a very pragmatic sense: what they are actually talking about is utility, as Eugene Garfield remarked three decades ago. As previously stated, research that is humorous, eccentric, or offbeat can sometimes receive altmetric scores that are unrelated to its fundamental value (Konkiel, 2013). This has sparked some of the most vehement criticism of altmetrics (Kousha and Thelwall, 2015). If it is true that articles with names that contain buzzwords garner the most attention on Twitter, critics have questioned why tweets are even counted. (Bornmann and Leydesdorff, 2013). When altmetric impact measures are given in context, this argument loses a lot of its sting. Altmetricians just aren't talking about impact in the way that funding agencies and governments do.

### **Challenges of Altmetrics**

Altmetrics face as many challenges as they offer opportunities. Some of the challenges include:

**Heterogeneity**, Data quality difficulties and Altmetrics' particular dependencies, Lack of a common definition, Lack of conceptual framework and theories (Haustein, 2016).

**Heterogeneity**. The greatest benefit of altmetrics, their diversity or heterogeneity is also one of their biggest drawbacks. Altmetrics encompass a wide range of metrics, making a clear explanation of what they represent challenging (Schultz, McKeown and Wynn, 2020). They've been hampered by the fact that they've been viewed as a united, monolithic substitute to citations. Discussions, definitions, and interpretations of what they actually measure: for instance, why would something as disparate as "a mention" on the news cause such a stir from Twitter, an F1000Prime expert recommendation, a Mendeley reader count, a Facebook like, and a blog post citation?

### **Data quality difficulties**

The significance of data quality cannot be overstated, especially in the context of study evaluation of data. Thus, quality, including metadata quality and errors, as well as coverage, has become a recurrent theme in bibliometrics, with a growing body of evidence. Compare Web of Science, Scopus, and Google Scholar, the three largest citation indexes. Data quality is a major concern in altmetrics, and it extends beyond the acknowledged mistakes and biases in citation data (Thelwall, 2020). Errors in citations typically refer to differences between the act and the documented event. These can be found and measured by using a combination of different data aggregators. (for example, citation indexes) or by consulting the original source (i.e., the reference list in a publication). While bibliometrics sources are static documents, most altmetrics data sources are dynamic and can be changed or removed entirely.

### **Altmetrics' particular dependencies**

Another key problem of altmetrics manifests itself in the strong dependent on data sources and aggregators. Similarly to the subject of bibliometrics, which would not exist without the Institute for Scientific Information's Science Citation Index, the evolution of altmetrics is significantly affected by data aggregators, particularly Altmetric. Altmetric's demise would mean the loss of a unique data

source. For example, their collection of tweets has proven so valuable that another data aggregator (ImpactStory) has opted to buy it. This refers to a monopolistic position, which, in the case of the Institute for Scientific Information, resulted in the creation of the widely used impact factor.

#### **Lack of conceptual framework and theories**

One of the most common criticisms of altmetrics is that it lacks a theoretical underpinning and is solely data-driven. Today, the availability of data and the ease with which it may be collected decide virtually entirely what makes an altmetric.

#### **Lack of a common definition**

Altmetrics are usually recognized as internet metrics that evaluate scholarly influence in addition to traditional citations; however there is no precise definition of the term. Altmetrics, as described by (Haustein *et al.*, 2014), is the “study and use of scholarly impact measures based on activity in online tools and environments” whereas the manifesto for altmetrics mentions. They are defined as elements of online scholarly impact traces (Kudlow *et al.*, 2017), which is related to webometrics.

#### **Recommendations**

While altmetrics and webometrics have numerous advantages and downsides, they cannot compete with peer review for judging research quality, or with citation counts as a reliable quantitative indication to supplement or substitute peer review in situations when it is difficult or unwanted (Orduna-Malea, Thelwall, & Kousha, (2017). Alternative indicators are most useful when citations are insufficient, such as when non-academic affects must be evaluated, early impact proof is required, or non-standard outputs must be evaluated. Hence it is recommended that:

1. Evaluators must consider whether altmetrics are capable of providing enough of the type of evidence required for the evaluation and, if so, whether the cost of obtaining them (from a commercial provider or by gathering them) justifies the value they provide.

2. Alternative indications should only be used to inform human judgments, not to replace them, due to the aforementioned constraints. (Kudlow *et al.*, 2017). In addition, when analyzing the results, human judges must be conscious of their limits. Inappropriate usage has the potential to harm the research system they are attempting to assess, whether through unintended repercussions or demoralization of individuals being evaluated.
3. Altmetrics should be extended in application to any collection of scholarly outputs for other purposes, such as assessing interest in an academic journal. They can also be applied to any collection of scholarly outputs for other reasons, such as assessing interest in an academic journal.
4. Organisations that need alternative indicators may need to employ appropriately trained scientometricians to gather them or understand offering from commercial providers and to safeguard against inappropriate interpretations of them (i.e., responsible use of metrics) (Maflahi and Thelwall, 2016). Alternatively, organizations should train a member of the evaluation team in how to collect, process, and evaluate alternative indicators so that they can be used when appropriate but not given too much weight.

#### **Conclusion**

The evidence for the idea that altmetrics may quantify research impact in days rather than years has been examined in this article. It demonstrates that altmetrics are a very poor predictor of article performance in terms of future citations. Altmetrics are also better at measuring the public consumption of knowledge than the long-term practical impact of research. Librarians should be cautious not to overstate the value of altmetrics as a complement to more traditional approaches towards research assessment.

## References

- Adie, E., & Roe, W. (2013). Altmetric: enriching scholarly content with article-level discussion and metrics. *Learned Publishing*, 26(1), 11–17. <http://doi.org/10.1087/20130103>
- Aung, H. H. et al. (2019) ‘Investigating familiarity and usage of traditional metrics and altmetrics’, *Journal of the Association for Information Science and Technology*, 70(8).
- Bar-Ilan, J., Halevi, G. & Milojević, S. (2019) ‘Differences between Altmetric Data Sources—A Case Study.’ *Journal of Altmetrics*, 2(1), pp. 1–13. doi: DOI: <https://doi.org/10.29024/joa.4>.
- Bornmann, L. and Leydesdorff, L. (2013) ‘The validation of (advanced) bibliometric indicators through peer assessments: A comparative study using data’, *Journal of informetrics*, 7(2), pp. 286–291. doi: <https://doi.org/10.1016/j.joi.2012.12.003>.
- Costas, R., Zahedi, Z. and Wouters, P. (2015) ‘Do “altmetrics” correlate with citations? Extensive comparison of altmetric indicators with citations from a multidisciplinary perspective.’, *Journal of the Association for Information Science and Technology*, 66(10). doi: DOI: <https://doi.org/10.1002/asi.23309>.
- Eynon, R. . (2012) ‘The challenges and possibilities of the impact agenda’, *Learning, Media and Technology*, 37(1). doi: <https://doi.org/10.1080/17439884.2012.636367>.
- Fairclough, R. and Thelwall, M. (2015) ‘National research impact indicators from Mendeley readers.’, *Journal of Informetrics*, 9(4), pp. 845–859.
- Gamble, J. M. et al. (2020) ‘Measuring the impact of pharmacoepidemiologic research using altmetrics: A case study of a CNODES drug-safety article’ *Pharmacoepidemiology and drug safety*, 29, pp. 93–102. doi: DOI: <https://doi.org/10.1002/pds.4401>.
- Garcovich, D. and M., A. (2020) ‘Measuring the social impact of research in Paediatric Dentistry: An Altmetric study’, *International Journal of Paediatric Dentistry*, 30(1), pp. 66–74. doi: DOI: <https://doi.org/10.1111/ipd.12575>.
- Gunn, W. (2014) ‘Mendeley: Enabling and understanding scientific collaboration’, *Information Services & Use*, 34, pp. 99–102. doi: DOI: <https://doi.org/10.3233/ISU-140738>.
- Gurney, T. and Boucherie, S. (2017) Report compares UK’s research performance with key nations. Available at: <https://www.elsevier.com/connect/report-compares-uks-research-performance-with-key-nations>.
- Haustein, S. et al. (2014) ‘Tweets vs. Mendeley readers: How do these two social media metrics differ?’, *IT-Information Technology*, 56(5), pp. 207–215. doi: DOI: <https://doi.org/10.1515/itit-2014-1048>.
- Haustein, S. (2016). Grand challenges in altmetrics: heterogeneity, data quality and dependencies. *Scientometrics*. doi: 10.1007/s11192-016-1910-9 Accessed at <https://arxiv.org/ftp/arxiv/papers/1603/1603.04939.pdf>
- Holmberg, K. et al. (2019) ‘What Is societal impact and where do altmetrics fit into the equation?’, *Journal of Altmetrics*, 2(1). doi: DOI: <https://doi.org/10.29024/joa.21>.
- Holmberg, K., Bowman, T. D., Haustein, S., & Peters, I. (2014). Astrophysicists’ Conversational Connections on Twitter. *PLoS ONE*, 9(8). DOI: <https://doi.org/10.1371/journal.pone.0106086>
- Joubert, M. and Costas, R. (2019) ‘Getting to know science tweeters: A pilot analysis of South African Twitter users tweeting about research articles’, *Journal of Altmetrics*, 2(1). doi: DOI: <https://doi.org/10.29024/joa.8>.
- Konkiel, S. (2013) Tracking citations and altmetrics for research data: Challenges and opportunities., *Bulletin of the American Society for Information Science and Technology*. doi: DOI: <https://doi.org/10.1002/bult.2013.1720390610>.

- Kousha, K. and Thelwall, M. (2015) 'An automatic method for extracting citations from Google Books.', *Journal of the Association for Information Science and Technology*, 66(2), pp. 309–320. doi: DOI: <https://doi.org/10.1002/asi.23170>.
- Kousha, K. and Thelwall, M. (2019) 'Can Google Scholar and Mendeley help to assess the scholarly impacts of dissertations?', *Journal of Informetrics*, 13(3), pp. 467–484. doi: <https://doi.org/10.1016/j.joi.2019.02.009>.
- Kousha, K. and Thelwall, M. (no date) 'Are Wikipedia citations important evidence of the impact of scholarly articles and books?', *Journal of the Association for Information Science and Technology*, 68(3), pp. 762–779. doi: DOI: <https://doi.org/10.1002/asi.23694>.
- Kryl, D. et al. (2012) 'Tracking the impact of research on policy and practice: investigating the feasibility of using citations in clinical guidelines for research evaluation.', *BMJ Open*, 2(2). doi: <https://doi.org/10.1136/bmjopen-2012-000897>.
- Kudlow, P. et al. (2017) 'Online distribution channel increases article usage on Mendeley: a randomized controlled trial', *Scientometrics*, 112(3), pp. 1537–1556. doi: <https://doi.org/10.1007/s11192-017-2438-3>.
- Li, X., Thelwall, M. and Giustini, D. (2012) 'Validating online reference managers for scholarly impact measurement', *Scientometrics*, 91(2), pp. 461–471. doi: <https://doi.org/10.1007/s11192-011-0580-x>.
- Maflahi, N. and Thelwall, M. (2016) 'When are readership counts as useful as citation counts? Scopus versus Mendeley for LIS journals', *Journal of the Association for Information Science and Technology*, 67(1), pp. 191–199. doi: <https://doi.org/10.1002/asi.23369>.
- Mas Bleda, A. and Thelwall, M. (2018) 'Assessing the teaching value of non-English academic books: The case of Spain', *Revista Española de Documentación Científica*, 41(4). doi: : <https://doi.org/10.3989/redc.2018.4.1568>.
- Mohammadi, E. et al. (2015) 'Who reads research articles? An altmetrics analysis of Mendeley user categories', *Journal of the Association for Information Science and Technology*, 66(9), pp. 1832–1846. doi: <https://doi.org/10.1002/asi.23286>.
- Orduna-Malea, E., Thelwall, M., & Kousha, K. (2017). Web citations in patents: Evidence of technological impact? *Journal of the Association for Information Science and Technology*, 68(8), 1967-1974. doi:10.1002/asi.23821
- Pooladian, A. (2018). *Altmetrics in Library and Information Science: Coverage of Sources and Use of Social Media by Authors*. A thesis submitted in Partial Fulfilment of the Requirements of the University of Barcelona for the degree of Doctor of Philosophy. [https://www.tesisenred.net/bitstream/handle/10803/663024/AIDA%20POOLADIAN\\_PhD\\_THESIS.pdf?sequence=1&isAllowed=y](https://www.tesisenred.net/bitstream/handle/10803/663024/AIDA%20POOLADIAN_PhD_THESIS.pdf?sequence=1&isAllowed=y)
- Schultz, C. S., McKeown, J. K. and Wynn, D. (2020) 'Altmetrics: Measuring engagement with contemporary leisure scholarship.', *Leisure Sciences*, 42(1), pp. 123–131. doi: <https://doi.org/10.1080/01490400.2019.1682727>.
- Shema, H., Bar-Ilan, J., & Thelwall, M. (2014). Scholarly blogs are a promising altmetric source. *Research Trends*, (37), 1–4.
- Taylor, M. (2013a). Exploring the Boundaries: How Altmetrics Can Expand Our Vision of Scholarly Communication and Social Impact. *Information Standards Quarterly*, 25(2), 27. <http://doi.org/10.3789/isqv25no2.2013.05>
- Thelwall, M. (2020) 'The Pros and Cons of the Use of Altmetrics in Research Assessment.', *Scholarly Assessment Reports*. doi: DOI: <http://doi.org/10.29024/sar.10>.
- Thelwall, M., & Sud, P. (2015). Mendeley readership counts: An investigation of temporal and disciplinary differences. *Journal of the Association for Information Science and Technology*, In press. <http://doi.org/10.1002/asi.23559>