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Bibliometrics to Altmetrics: Changing Trends in Assessing Research Impact

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ABSTRACT

Quantitative measurement in library arena for the impact of researches has travelled a lot from bibliometrics to citation metrics and for article level and author level assessment upto h-index, g-index and tol-index, etc. Altmetrics incorporates multiple data sources-both traditional and emerging. The data collected in altmetrics are not limited to calculating article level metrics, but have the potential to be used to generate journal and author metrics as well with new form of scholarly publication. Thus, altmetrics provides researchers and scholars both the new ways to track influence across a wide range of media and platforms. An attempt is made in this paper to discuss the term 'altmetrics' and its possible implications in library world.

Keywords: Bibliometrics, citation metrics, altmetrics

1. INTRODUCTION

Bibliometric studies are said to be started with the publication of Cole & Eales's study[1] on 'The History of Comparative Anatomy, Part-1: A Statistical Analysis of the Literature', where they studied the contributions in the field of anatomy by counting the number of publications produced by different countries covering a period of more than 300 years (1543-1860) for books and the journal articles. Later Hulme[2] in 1923 used the term statistical bibliography to mean 'the illumination of the process of science and technology by means of counting documents'. But it was Prichard[3] who used the term bibliometrics in 1965 to shed light on the process of written communication and of the nature and course of a discipline (in so far as this is displayed through written communication) by means of counting and analysing the various facets of written communication. Since then, bibliometrics is developed into a scientific tool for literature assessment purely based on the principles of mathematical statistics.

Traditionally, the bibliometrics include the citation counts, journal citation reports and impact factors and immediacy impact factors for assessing the research impact. Later, they were followed by *g*-index, *h*-index, Tol index, etc. But now the research articles are available on Web as blogging, tweeting, posting, responding, linking, bookmarking, sharing, linking etc. So, traditional measures of scholarly output present a challenge that is 'long established citation-based metrics are unable to capture the increasing variety of online references to a scholar's work'[4]. However, Barbaro, *et al.*[5] supports the fact that traditional citation metrics are still important but are increasingly incapable of showing the full picture as they do not measure new forms of scholarly output, such as datasets and software, and new ways of disseminating content through social media. Hence, new means are being developed for them and altmetrics is one of them.

2. WHAT IS ALTMETRICS

Almetrics that is also known as 'Alternative Metrics' (ALM) or 'Alt-metrics' is relatively a new term that was coined in 2010 by Jason Priem[6] as an alternative way of measuring impact in the social web aims at enhancing and complementing the more traditional ways of impact assessment by expanding the idea of impact. Das & Mishra[7] mention that 'the altmetrics manifesto was published in 2010 by a group of enthusiasts and subsequently it becomes a baseline for a burgeoning altmetrics movement that achieves a global appreciation. Later, a dynamic organisation was born to technologically support multi-dimensional measurements of published works, beyond citation counts in 2011. The name of this start-up company is altmetric LLP, a new avatar in providing online services for generating ALM as a new performance indicator. Simultaneously, the concept of altmetrics is increasingly getting popular since the San Francisco DORA was made public in 2012'. King & Thuna[8] mention that the term 'almetrics'

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itself is used to describe the emerging or newer data sources for item level metrics, for example, the Twitter, Facebook, or blogs. Where article level metrics refers to data collected to determine the impact of individual articles, and altmetrics refers to the source of the data, for example, a tweet, rather than the data itself, or for example, the number of times an item has been tweeted about. But 'altmetrics, beside usage statistics and citation counts is used as a value-added service to showcase their content impact and give some hints on how this tool can be used to supplement the traditional research performance assessment exercise in an institution. Altmetrics can provide a measure of impact for all non-journal scholarly works available in open access, like usage statistics, but it can go further by contextualising the readership of an author's research output'[9].

Rehemtula, *et al.*[9] further adds that altmetrics can be very useful in providing data about the impact of non-journal publications. In some cases, it could be a good predictor of later citations such as usage statistics. Also its immediacy in showing impact helps to fill the gap until the first citations appear. But unlike citations, altmetrics is capable of giving context and meaning to impact and, unlike journal impact factor, it provides impact at article level. 'Altmetrics measure the impact not only of journal articles but a diverse array of scholarly products. It can free scholars to experiment with and receive credit for alternative outputs such as digital humanities projects, open data sets, computer code, and blogs'[10]. Therefore, citations are the major source for altmetrics; but discussion by the media, mentions in the news, discussion by the public as well as importance to colleagues are also other sources of altmetrics.

3. ADVANTAGES OF ALTMETRICS

Altmetrics help to analyse impact and sharing of raw science like datasets, codes and experimental designs, 'nanopublication' where the citatble unit is an argument or passage rather than entire article and 'widespread self-publishing' via blogging, microblogging, comments or annotation with scoring mechanism (altmetrics.org/manifesto/).

In Sutton's[11] opinion most of the advantages of altmetrics over traditional measures of scholarly output stem from the diversity of sources used in altmetrics calculations, in no little part because multiple sources of data allow triangulation. He further elaborates that altmetrics use mostly publically available data, making the process and calculations completely transparent where as traditional metrics like the journal impact factor are often made available only by subscription and calculated using a less transparent algorithm, even though the equation has been published many times.

Altmetrics also have nearly real-time metrics of scholarly impact. According to Mounce,[12] the altmetrics may also be of particular use for demonstrating the impact of articles published in open access mega journals. These mega journals, for example, the PLOS ONE, PeerJ, SAGE Open, and Scientific Reports, etc., do not reject articles on the basis of the perceived impact that they may have and accept article submissions as long as they are well-reported and technically sound contributions to the academic literature. He further adds, thus article-level altmetrics may be particularly key to these mega journals as a means of post-publication filtering and peer review to differentiate among many thousands of articles that pass through them. While citations take many years to accrue, but tweets, facebook shares, blog posts and reference management bookmarks tend to occur much more quickly after publication, thus, the immediacy of altmetrics relative to more traditional measures, such as citations, also helps this filtering process.

Altmetrics also can provide the necessary measures for garnering attention from an audience that might otherwise consider the work irrelevant or of low quality. It can also facilitate discovery through social media channels that are more inclusive and democratic than publishers and citation databases, where scholars are allowed from the developing world to assert their worldview on a global stage for scholarly communication development[13].

4. DISADVANTAGES OF ALTMETRICS

Munnolli & Pujar[14] mention that altmetric tools help into filling up the time gap but most of the existing altmetric tools are not structured and provide hazy picture of computation. The criteria of quality measure to capture science communication are also not clear and also the quality of the data used is a challenging component as social media services differ from one to another and counts for indicators are relatively easy to game and fabricate. Sutton[11] adds that almetrics lacks the standardisation of definition that is provided by initiatives like Project Counter. So, it is easy to misinterpret altmetric's meaning or take them out of context. Further, there is no one-stop shop for everything because altmetrics are only beginning to be developed on larger scales and to be accepted on a larger scale. Moreover, some altmetrics are more easily gamed or maneuvered than others, for example the Google Scholar citations. Besides, the consistency, provenance and contexts are also the problems because article level metrics providers have the right to collect metrics as needed for their purposes, but as article-level metrics consumers, there is a problem to compare data from the same source across providers.[15] Further, some altmetrics are more easily gamed or maneuvered than others

but Kelley[16] suggests that the sheer volume of data on which altmetrics are based may alleviate this. Further, Thelwall,[17] *et al*., also mention that there is a lack of systematic scientific evidence that altmetrics are valid proxies of either impact or utility, however, a few case studies have reported medium correlations between specific altmetrics and citation rates for individual journals or fields.

5. ALTMETRICS RESOURCES/TOOLS

Altmetrics tools capture the article level scholarly data which are shared in social media and measures the impact of content in real time basis and the data are presented with visual effects[14]. However, almetrics is not about the citations and not the webometrics but relatively is unstructured and closed. Though, there exist many resources or the tools, the help of which can be sought to calculate the altmetrics of different publications, Alperin[18] mentions that there is no fixed list of sources for these metrics, but they typically include mentions from social media outlets like Twitter and Facebook; links from blogs from sites such as Research Blogging, Science Seeker, and Wordpress.com; citations in Wikipedia; social bookmarking like delicious.com or academic bookmarking like Mendeley, CiteULike, Bibsonomy, and many others. Altmetrics can also refer to metrics on alternative research products, such as presentations, videos, data sets, and the software. Altmetric.com (www.altmetric.com); ImpactStory (http://impactstory.org/) and PlumX (https://plu.mx/) are the most used altmetrics tools.

Altmetric sources can be grouped into various categories, like usage, captures, mentions, social media and citations, etc.

Based on Roemer & Borchardt[19] & Barbaro, *et al.*[5] following are most popular resources/tools of altmetrics:

5.1 Altmetric.com

Altmetric.com analyses the online impact of research articles based on a variety of sources, generates a score, and conveys this information through small donut shaped visualisations for fast comprehension. Altmetric.com collects data about an individual article and supplies this data to publishers. The publisher, who can subscribe to various altmetric products, can store and present article-level metrics to their readers and the authors. But it is a paid service which can be accessed through www.altmetrics.com.

5.2 Altmetrics.org

This free web site is a central hub for information about the growing altmetrics movement. Altmetrics.org maintains links to new online tools for calculating impact. Its other prominent features include an altmetrics 'manifesto' that argue to show that altmetrics can improve existing scholarly filters. It can be accessed through http://altmetrics.org.

5.3 ImpactStory

ImpactStory is a free open source web application that collects the data from a variety of sources related to a broader set of resources including preprints, datasets, presentation slides and other research output formats. Users can create collections of materials through online identifiers, such as Google Scholar Profiles, DOIs, and PubMed IDs. ImpactStory uses more than a dozen APIs to search the sources ranging from popular social media to scholarly tools like Mendeley and PLoS. Items are subsequently assigned impact categories, such as generally/highly 'saved', 'cited', 'recommended' or 'discussed'.

ImpactStory is most useful for the researchers publishing in non-traditional venues or with scholarship too new to have accumulated traditional citations but it is not a comprehensive source for tracing web impact. It can be accessed through http://impactstory.it/

5.4 PLoS Article Level Metrics

Public Library of Science (PLoS) which has emerged as the leading open access journal repository, offers an alternative to traditional impact in the form of article level metrics. It tracks the influence of individual PLoS articles, from times downloaded to mentions in social media and blogs. Besides, internal article metrics, including comments, notes, and ratings can also be tracked. While a valuable resource for impact, only PLoS articles benefit from its metrics. Nevertheless, this resource represents an important new avenue for metrics, which future publishers will likely replicate. It is available free and can be accessed through http://article-level-metrics.PLoS.org/.

5.5 PlumX

PlumX is an impact dashboard created by Plum Analytics for collecting data from a particularly wide variety of sources. It summarises and compares the impact of not only individual researchers but also of research centres, departments and institutions.

5.6 Publish or Perish

Publish or Perish (PoP) was created by Anne-Wil Harzing to assist faculty looking for more diverse bibliometrics. It is a free and downloadable program that harvests data from Google Scholar based on author names. Users can manually remove records to refine the data, just similar to what is now offered by Google Scholar citations. It can also calculate numerous metrics, including alternatives to the *h*-index but a few people are familiar with non *h*-index calculations, so it is up to users to explain

such metrics to larger audiences. It can be accessed through http://www.harzing.com/pop.htm.

5.7 ReaderMeter

ReaderMeter is also a free tool that has been created by Dario Taraborelli of the Wikimedia Foundation. It crowdsources impact by processing readership data from Mendeley. However, it contrasts with traditional bibliometric tools and keeps focus on the readership, but not on citation. The site functions by compiling reports based on authors' names, which are subsequently processed through the Mendeley API. Each report highlights information such as an author's 'HR-Index', 'GR-Index', 'Total Bookmarks' and 'Top Publications by Readership'. Currently, it draws the data from Mendely but it is planning to integrate data from multiple reference management sites, such as CiteULike. It can be accessed through http://readermeter.org/.

Besides, many other tools also exist for altmetrics but a comparison of most popular tools with their main characteristics is presented in Table 1.'

6. USE OF ALTMETRICS IN LIBRARIES

Altmetrics can provide an objective way of understanding the reach of research. Elaborating on the use of altmetrics, Ayre[20] adds that altmetrics is useful both for researchers and the librarians perspective.

Table 1. Comparison of popular altmetric tools[7]

Products	Altmetric.com	Impact story	PlumX
Products tracked	Papers, datasets, books	Papers, blog posts, datasets, software, slides	Papers, blog posts, book chapters, books, case studies, clinical trials, conference presentations, datasets, figures, grants, interviews, letters, media patents, posters, presentations, source code, theses/ dissertations, videos, web pages
Output of user interface	Free bookmarklet, Explorer, metrics badges, API	Profile pages, metrics widgets, API	Profile page, Widget Builder, API
Organisation type	For profit	Nonprofit sources	For profit
Sources			
Usage Stats			
Dryad		X	X
Figshare		X	X
GitHub		X	X
PLoS ALMs		X	X
SlideShare		X	X
Social Web Shares			
Facebook	X	X	X
Google+	X	X	X
LinkedIn	X		
Reddit	X		X
Twitter	X	X	X
Bookmarks			
CiteULike	X	X	X
Delicious		X	X
Mendeley	X	X	X
Scholarly Citations			
PubMed		X	X
Scopus		X	X
Non Scholarly Citations			
ScienceSeeker			X
Wikipedia		X	X

Note: X' shows the presence of the features in altmetric tools in the products tracked. Either of them has both-positive and negative features. But the users can use them accordingly for their altmetric studies.

She explains that from a researcher's perspective, altmetrics provide an alternative measurement of impact alongside download and citation counts. From the academic library perspective, this tool helps to develop the value of functionalities offered by institutional repositories by having its most talked about institutional research available for legal and free download. Further, its assurance that these conversations surrounding the research can be authoritatively traced back to the author and their original piece of work make almetrics useful for both researcher and the librarians.

Based, on Sutton[11], major opportunities exist for following purposes:

6.1 Academic Libraries

Altmetrics provides opportunities to spot trends and make informed decisions based on deep quantitative evidence for the academic libraries. Further, using big data to 'present an integrated view of how one unit of content or on researcher has moved across the digital landscape in a series of actions or digital conversations' which can 'then be scaled up to clusters of articles, groups of researchers, or potentially even a combination of the two'. Thus, trends and informed decisions can be used in academic libraries for scholarly access of information.

6.2 Collection Development

Almetrics can help in collection development by providing an altmetric overlay for journal usage that will complement the standard COUNTER statistics provided by the publishers. It may:

- Capture bookmarks, favourites on slideshare, followers on GitHub, groups in Mendeley, etc.
- Usage downloads.
- Rreviews on Amazon, SourceForge, links from Wikipedia, comments on YouTube, etc.
- Social Media-Tweets, shares, recommendations on Figshare, ratings on SourceForge, etc.
- Citations through SCOPUS, Web of Science etc.

6.3 Institution Support

Altmetrics can make the libraries and librarians central in new educational role. Thus, it is helping the researchers and institutions to understand and manipulate their own impact of research and scholarly communication.

6.4 Open Access

Open access journal initiatives were the first to provide article-level metrics, where according to Michalek, *et al*.[21] altmetrics may provide new insights for the authors and as the direct measures of article rather than the journal. It has not only done away the notion of a journal brand, but has also increased the importance to authors for all articles in all journals.

Besides, Sutton[11] adds that a few altmetrics exist for e-books, mainly because "they are generally much more substantial works containing many individual ideas" and thus perhaps not the appropriate unit of analysis to apply current altmetrics.

7. CONCLUSIONS

It is rightly seen that 'scholarly publishing has entered into an era where the print journals are slowly becoming obsolete, and new publication types emerge from open science communities on the internet. Along with this development, also comes an increased need for research evaluation that is tailored to these new publication types and channels, as a supplement to the traditional academic evaluation based on article and citation counts'[22]. Now, open access is relatively established field, but altmetrics is still fairly new, relatively unexplored and under-developed field.

But altmetrics is getting better reflection of social impact and outreach of scientific publications. Altmetrics include a much broader spectrum of measurements (citation counts, web based references, article views/downloads, social media mentions, news media mentions, etc.) of a much broader collection of scholarly authors and outputs (articles, people, journals, books, data sets, presentations, videos, source code repositories, etc.)[11]. So 'altmetrics is here to stay, and librarians, mainly those involved in learning and research support activities, must be familiarised with the tools available to implement and disseminate it and the librarians may play a crucial role in supporting the adoption of this metrics by researchers in a responsible way'[9]. However, as Das and Mishra[7] narrate, scientific communities in the developing countries are still naive in handling highly-interactive academic communication channels available to them with web 2.0 readiness. They need to have the necessary information and digital literacy competencies to be conversant with born-digital documents and sharing them with academic social networking platforms. Equally, it is equally important to keep in mind that one can only use altmetrics in certain social spheres on the web that support them through their openness and standardised APIs as indicated by Mounce[12].

Thus, altmetrics is still in its infancy stage in comparison to the decades old bibliometrics field and it will take much time to become a mature branch of study. However, the importance of altmetrics cannot be overlooked in changing world of digital technology.

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