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TWEETS OF AN ARTICLE AND ITS CITATION: AN ALTMETRIC STUDY OF MOST PROLIFIC AUTHORS

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ABSTRACT:

The present study was carried to find out the association between twitter and citation pattern for scholarly articles. This study was carried out with the most prolific authors of 2014 from the four subject domain "Clinical medicine, Microbiology, Molecular Biology, and Neuroscience" and 4886 papers were identified to studied their tweets and citation counts. From the study, it was found that the articles of the most prolific authors have a strong correlation with a citation and its value ρ =.518**. The linear relationship for individual subjects was between .386** to .559**, significant at .01 level.

KEYWORDS: Alternative Metrics, Altmetric, Twitter, Citation, New Media.

INTRODUCTION

With the advent of internet technologies, Web 2.0 is the current state of online technology which is characterized by greater user interactivity and collaboration. The elements of Web 2.0 like Wikipedia, Facebook, Twitter, and LinkedIn, in the virtual spaces, are called as Social Networking Sites (SNS). These elements had changed the communication and information transmission pattern by moving beyond traditional citation-based performance analysis into new citation databases that attempt to cover a large variety of the researcher's output, the impact of scholarly communication in social networks and public services. SNS had penetrated to all walks of life; these social media are not confined to the conventional communication. In the past, scholar communication is made only in scholarly journals but now blogs and other SNS had penetrated into that space. Till now the quality of a scholarly communication is measured by the number of citation, h-index and i-10 index. A new tool that tries to explain the reach of scholarly communication is Altmetric Scores which is calculated using various variables like News, Blogs,

Tweets etc., ("How is the Altmetric Attention Score calculated?: Altmetric Support,2016). One important variable which contributes to the Altmetric Score is "Twitter". According to Priem et al. (2010), altmetrics is "the creation and study of new metrics based on the social web for analyzing and, informing scholarship." Altmetrics includes data about usage (e. g. pdf downloads); captures (e. g. Bookmarks); mentions (e. g. in Blogs); social media (e. g. shares on Twitter, Facebook) and citations (e. g. Scopus) (Cave, 2012). Altmetrics is proposed as an alternative to (and the extension of) the traditional bibliometric indicators (such as Journal Impact Factor or h-index). Altmetrics (Priem & Costello, 2010; Priem, Costello, & Dzuba, 2011) tracks the online mentions by pulling in data from social media, blog, traditional media and online reference managers. From an altmetrics point of view, the tweeting of research papers could be considered as an early proxy of article-level research impact (Eysenbach 2011; Priem et al. 2012; Shuai et al. 2012).Tweets can predict the citation count for a publication (Eysenbach, 2011), but this relationship cannot be considered for all kinds of data.

LITERATURE REVIEW

The first studies on Twitter came up shortly after starting the service and they were focused on describing the service and its impact on the social web communication (Java et al. 2007; Huberman et al. 2008). Earlier studies had tried to predict, how many citations an article could get in future in that case altmetric can be used as future prediction tool (Priem, Piwowar, & Hemminger, 2011). A publication from social sciences, humanities and medical and life sciences show the highest presence of altmetric score(R Costas, Zahedi & Wouters, 2015). But the presence of paper in this platform is very low (Haustein et al., 2015). Today, the quality of the scholarly article is quantified on the basis of citation. There are 33 different ways for increasing the citation count (Ebrahim, Saheli, & Embi, 2013). Some write a blog post highlighting the finding of their study to have a wide reach. Some are cited in the blog also, blog citation can be used as an alternative metric source (Patric D, 2015) (Shema, Bar-Ilan, & Thelwall, 2014). Facebook is another medium to get feedback on an article which may be likes and dislikes. The Facebook likes can also be used to predict the citations. This social media indicator can be potential early indicator of the impact of a scientific work in a particular domain of Knowledge (Ringelhan et al., 2015). From the related work it evident that various studies had been carried on altmetric and its components, but still there is no correct conclusion that each of its variables contributes to the citation.Eysenbach (2011) finding that tweets can predict highly cited articles within the first 3 days of publication. Shuai et al. (2012) analyzed the number of tweets to 4606 pre-prints in Arxiv.org and they observed statistical correlations between tweets and an early citation impact in favor of highly mentioned articles.More recently, De Winter (2015) studied the citation impact of PLOS One papers and notified that tweets were better predictors of other altmetrics than citations.The correlation between tweets and citations was low and varied according to disciplines and publications.However, Haustein et al. show that the correlation between citation and tweets is relatively low (Haustein, Peters, Sugimoto, Thelwall, &Larivière,

2014).Thelwall et al. (2013) found a negative correlation between tweets and citations, provoked by the fast increase of paper mentions in Twitter due to the delay of citations. In one of the most comprehensive studies, Haustein et al. (2014) analyzed the Twitter mentions to 1.4 million of research papers from PubMed.First of all, it is important not to apply the same criteria for older and as for newer articles. Web 2.0 is developing, e. g. there are more and more Twitter users every day, therefore, the number of tweets for a 2009 article will be lower than for a 2014 article. Also, altmetric scores can depend on the scientific field – e. g. people tweet life sciences papers more than some other subject papers (Adie, 2014).In a related studies, it has been suggested that highly tweeted articles are about ‘‘catchy’’ topics (Van Noorden 2012), about ‘‘offbeat topics, current events, and general curiosities’’ (Liu 2014), and about ‘‘climate change, human health and diet, and online information and privacy’’ (Taylor and Plume 2014).The proportion of scientists’ tweets containing links can vary between disciplines (62% to75%; Holmberg & Thelwall, 2013). Yet another possibility is that Twitter users hardly read the articles they tweet about.

METHODOLOGY

The main purpose of this study is to compare the relationship between tweets and citation of an article and to find out a correlation between Twitter and citation. The first source that was identified in this study is the“The World’s Most Influential Scientific Minds 2014” by Thomas Reuter published by Web of science. This document contained a list of authors of multiple hot papers with their profiles published during 2014. Out of 21 subjects from the source; four subjects were selected for the study namely Clinical Medicine, Microbiology, Molecular biology and Neuroscience on the basis of their presence on twitter. Before downloading the articles, author’s affiliations were cross-checked from both the document as well as articles. Altmetric.com facilitated the best altmetric scores (twitter counts) at the end of 2014. Citation details of the articles from each field were downloaded from Google Scholar during December 2016 to February 2017. Data are then entered into Excel and for analyzing it SPSS software is used. Spearman correlations were used to assess the strength of association between the citation counts and the twitter counts.

Since Science subjects get more citation and more recognition in social networking sites compared to social sciences subjects, therefore, this study has been proposed to find that do all the life sciences subjects association at the same level of arrangement between Twitter and citation. Related research has been conducted in the field of Clinical Medicine, and found out that, a correlation exists between citation and twitter; whereas no comparative study has been conducted yet in the field of Clinical Medicine, Molecular biology, Microbiology, and Neuroscience.

LIMITATIONS

This study has some limitations which are as follows:

1. This study is limited to one year i.e., 2014.

2. The present study is limited to the prolific authors' top 10 articles irrespective of their subject domains.

3. This study is limited to four disciplines only.

OBJECTIVES OF STUDY

The aim of this study is concentrated on how the subjects are reflected in social media specifically Twitter and to compare the relationship between citation and twitter of this four subjects (Clinical Medicine, Neuroscience, Microbiology and Molecular biology).

1. To study the association of articles between tweets and its citation.

2. To compare the association between twitter and citation received by prolific author's articles in these four subjects.

REFLECTION OF ACADEMIC WRITING ON SOCIAL MEDIA

In the present social media, environment communication is quite fast and focused. In the traditional print method, it takes years to get recognition for a piece of writing. In the current platform, authors are using social media to publicize their own work and build a network among the peers and also maintain the professional identity in the virtual world (Carrigan, 2016). Social media comprises of various communication channels like Twitter, Facebook, Blog, Wiki's, News post, Google+ etc., The above communication tools play a vital role in disseminating information. These web tools had been recognized as an important medium in scholarly communication and tools like Twitter has prompted Modern Language Association one of the major style sources for academic writing, to come out with formal guidelines on how to cite Tweets (Hall, 2012). At present twitter has an average of 313 million monthly active users, which generated around 8TB of data on daily basis (Polt, 2010; "Twitter," 2017). This platform disseminates information in various fronts; one important area is scientific literature. The growth of scientific literature on twitters had been treated as subject research (Fausto & Aventurier, 2015). Web 2.0 variables are brought together to form a new metric called Altmetric, which will inform an author how his/her writings are perceived by the various audience using the above tool. Now the Almetric score is considered parallels to traditional metrics(Reznik-Zellen, 2016).

DATA ANALYSIS

In order to analyze the data, we performed Spearman's correlation analysis. The first set of analyses focused on the degree to which articles of the most prolific authors of 2014 found in Web of Science associated with tweets and citation a paper received. For this analysis, 4886 articles written by 718 authors was computerized using SPSS.

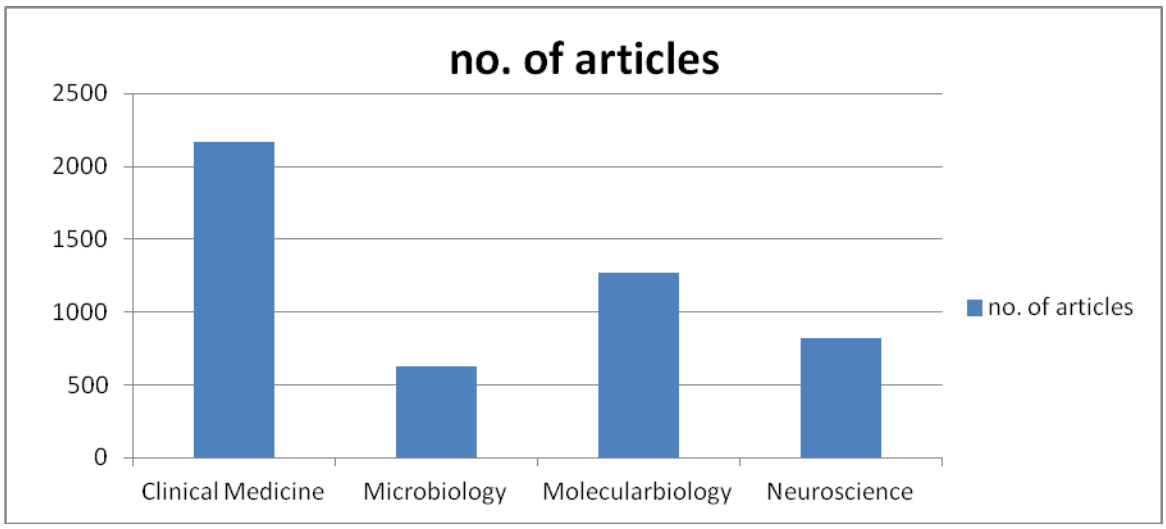


Fig 1: No of articles shared by four disciplines.

The sample was classified into four subjects.The major share among the authors is from Clinical medicine followed by Molecular- biology, Neuroscience, and Microbiology and these subjects contributed 2169, 1269, 822 and 626 respectively.

			Tweeter
Spearman's rho	Citation	Correlation Coefficient	.518**
		Sig. (1-tailed)	.000

**. Correlation is significant at the 0.01 level (1-tailed).

Table1: Spearman correlations between Twitter and citation counts.

From table 1, it was clear that correlation is significant between the two variables (twitter and citation).The ρ value=.518**, which indicates that there is a strong correlation between an article tweets and number of citation. The prolific author's article had aggregately received 1, 39,615 tweets for the total 4886 article and the same articles had been cited by 3, 33,784 papers. Earlier

studies have evidenced that altmetric value for each discipline is different (Zahedi et al. 2014; Haustein e.t al.2015), which suggests that a subject bias could alter the obtained results. Therefore, these results are in line with previous studies (Eysenbach 2011; Shuai et al. 2012), confirming a strong relationship between tweets and citations. However, some related studies (Thelwall et al. 2013; Haustein et al. 2014; Zahedi et al. 2014; De Winter 2015), have the weak relationship between tweets and citations.

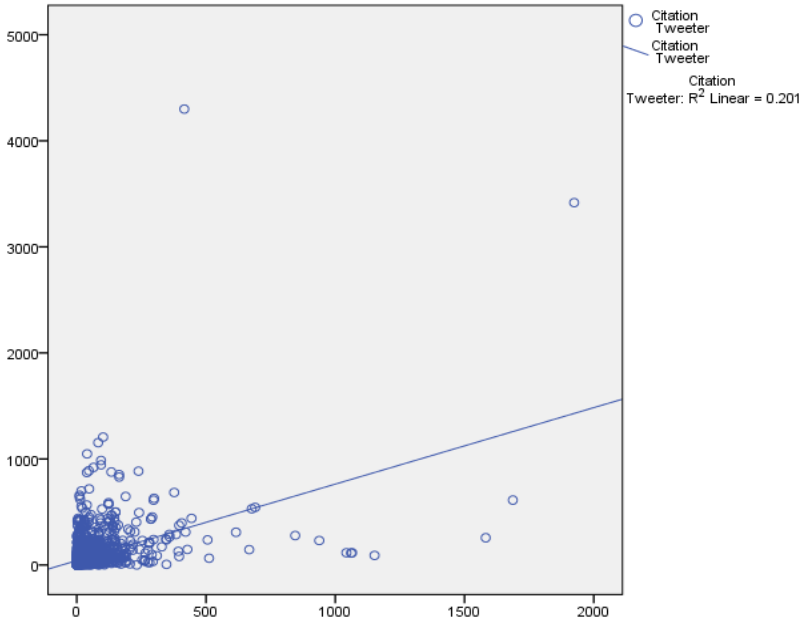


Fig 2: Graph showing Spearman linear correlations between Twitter and citation counts for prolific authors of 2014 articles from Clinical Medicine, Microbiology, Molecular biology, and Neuroscience.

The graph above shows the linear relationship between tweets and citation counts. Most of the data (number of tweets and citations) are close to the fitted regression line and only a few are scattered away from the line. There is a positive linear correlation i.e. R^2=0.201 suggesting that tweets and citation are concentrated in the regression line. Figure 2 depicts the linearity between two variables.

	Spearman's rank correlation	
	SUBJECTS	**CORRELATIONS (ρ)**
Citation vs. Twitter	CLINICAL MEDICINE	.547**
	MICROBIOLOGY	.386**
	MOLECULAR BIOLOGY	.559**
	NEUROSCIENCE	.475**

Table2: Spearman rank correlation between Twitter and citation.

The last set of analysis examined the relationship between tweets and citation among individual disciplines. Spearman correlations were calculated for each sub-discipline between twitter and citation counts for all articles. There were statistically significant between tweets and citation count for Clinical medicine area which had 2169 papers, written by prolific authors in the year 2014.From the above table, ρ=.547** shows that a strong correlation at 0.01 level is between the two variables. From inference, it can be ascertained that there is a positive linear correlation between citation and tweets a paper received. These results are in line with previous studies (Costas, Zahedi and Wouters, 2014).

Microbiology, Molecular biology, and Neuroscience has the value of ρ=386**;ρ =.559**;ρ=.475** respectively and the correlation between the two variables is significant at 0.01 levels. This ascertained that there is a positive correlation between citations and tweets a paper received. These results are in line with previous studies (Haustein, Peters, Sugimoto, Thelwall and Larivière, 2013).

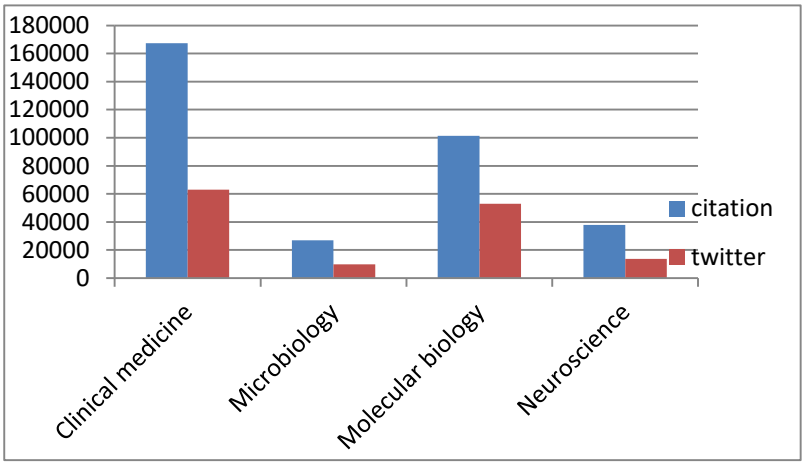


Fig 3: No of tweets and citation received by subject domain.

The bar graph above shows the number of tweets and citation counts received by four main areas. Clinical medicine area which had 2169 papers received 167354 citation and 63130 tweets followed by Molecular biology, Neuroscience, and Microbiology area which received 101477, 37906, 27047 citations and 52887,13657, 9941 tweets respectively.

RESULTS

As Table 2 above shows, the correlations for all of the disciplines are similar but are highest in Molecular biology (ρ =.559**) followed by Clinical medicine (ρ=.547**) and are statistically significant at the 0.01% level.Among the four subject domains, the correlation in the field of

Microbiology is less compared to the correlations in Molecular biology and others. In most sub-dataset, the correlation coefficient ranges from .386 to .559which is almost the same when compared in general (.518**).Clinical medicine and Molecular biology got more counts because they have more paper compared to the others.In other words, more the paper means more the citation.

DISCUSSION

In this paper, we have performed a study to focus on correlations between tweet and citations. There is a positive correlation between Twitter and citation counts for all the four disciplines i.e, Clinical Medicine, Microbiology, Molecular biology, and Neuroscience. These findings corroborate previous studies (Bar-Ilan, 2012; Li et al., 2012; Mohammed & Thelwall, 2014) but stronger correlations were found for this data set.

As from the results above, it can be understood that citation is a more standard tool compared to Twitter. Citation tends to accumulate several years after the research has been completed therefore the number of counts keeps on increasing whereas twitter count will be more only for a certain period of time but then it will decrease gradually.Though twitter gets recognition at an early time when compared the tweet and citation counts, the citation is far ahead. Therefore, the citation is more prominent to evaluate articles whereas social networking tools act as a complement to it.

CONCLUSION

Most of the articles with top tweets and citation counts from the list of prolific authors come from the field of Medicine. This may be because medicine is a specific field of science whose development depends on a rapid flow of information, causing a larger production of articles with many citations (Costas, Zahedi and Wouters, 2014).The current study ascertains that tweets (an altmetric variable) have a positive correlation in all the four fields and is associated with previous studies (Thelwall, Haustein, Lariviere, & Sugimoto, 2013).According to these findings, it is suggested that the usage of altmetrics (twitter) has a high potential among the researchers. This paper shows that metrics (twitter) is correlated with citations. Therefore, tweets do predict citations and this study line up with previous studies (Eysenbach, 2011).Citations from Google Scholar seem more closely correlated with tweets which likely reflect the fact that Google Scholar includes a wider range of citing sources. It is not inconceivable that exposure on Twitter leads to a few extra citations: social media are often used by scientists “to catch useful citations...scholars might not otherwise be exposed to” (Priem J, Costello KL, 2010), and many scientists see the value of Twitter as being a constant live literature alert service crowdsourced from peers. Tweets should be primarily seen as a metric for social impact and knowledge translation as well as a metric to measure public interest in a specific topic, while citations are primarily a metric for scholarly impact. Tweet counts are one of the most promising altmetric variables due to potentiality to reflect evidence of wide public range. Since the alternative

metrics is in the evolving stage because of the dynamic seen in the new media environment, Twitter in specific has not got the attraction from many subject domains; for example paper in medical sciences received good citation count whereas other subject papers were hardly discussed in the new media environment. Hence more research is necessary in order to determine and validate these potential types of impact (Rodrigo Costas, Zahedi & Wouters, 2015). As most of the former empirical studies on altmetrics have been pointed out, we need further studies (including a broad range of altmetrics) dealing with the question of the specific impacts of altmetrics (Bornmann, 2014).In this sense, more research is necessary in order to determine and validate these other potential types of impact, probably combining not only quantitative analysis as in this paper but also other more qualitative studies as already suggested by other studies (Thelwall, et.al., 2013;Haustein et. al., 2013b; Zahedi, Costas & Wouters, 2013).

From this study, it is also possible to conclude that the presence and density of social media (twitter) is relatively high among scientific publications. In addition, the fact that they exhibit strong correlations with citations suggests that the potential of altmetrics as a supplement to the more traditional citation analysis is very strong. However, they could actually represent an interesting relevant complement to citations, particularly in order to inform other types of impact (e.g. societal or cultural impact) and especially in those fields where they have a higher presence, particularly the humanities and social sciences.

SUGGESTIONS

This study covers only the relationship between tweets and citation of an article. Therefore it can be suggested that content analysis can be carried out in this area; to know whether tweets on scholarly articles are positive or negative in nature; critical or analytical in temperament. Thus, content analysis will help to find out in what way the general readers usually tweets on a paper and this will help the readers as well as the author to know how an article is perceived by the readers.

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