2018 International Conference on Multidisciplinary Research
Track 4: Education
https://doi.org/10.26803/MyRes.2018.23

ResearchGate: Investigating Altmetric and Bibliometric Relationships for Environmental Science Researchers at Unisa

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Abstract
This paper aims to establish the relationships between the altmetrics derived from the academic social networking tool ResearchGate and bibliometrics derived from the citation resources Web of Science, Scopus and Google Scholar to establish which academic social networking tools gives the most advantage. The investigation forms part of a longitudinal study investigating the e-visibility of the environmental science researchers at the University of South Africa during December 2014 and December 2016. The bibliometric indicators from Web of Science, Scopus and Google Scholar, and altmetric indicator data from ResearchGate were collected in six (6) month intervals, and analysed using SPSS to determine the Pearson's rank correlations. The results indicated a positive correlation between the bibliometric indicators derived from Web of Science, Scopus and Google Scholar, and the altmetric indicators derived from the academic social networking tool ResearchGate. The results show that ResearchGate altmetric indicators influence the bibliometric indicators positively. ResearchGate therefore can be recommended for academic social networking as a strategy to influence the Environmental Science researcher's citations positively at Unisa.

Keywords: bibliometrics, altmetrics, ResearchGate, citation resources, altmetrics bibliometric correlations

Introduction

Bibliometric indicators were traditionally used during research evaluations and research performance measurement to ascertain the research impact of researchers (Hoffman, Lutz, & Meckel, 2014). With the advent of Web 2.0 Technology, social networking tools with enhanced functionalities permeated academia and the research processes of researchers. The new generation academic social networking tools allow for the discovery, communicating, disseminating and sharing of research during the research workflow and has ushered in a new dimension to measuring scholarly research activity i.e. usage statistics, downloading statistics, and sharing of research (Kim & Abbas, 2010).

The introduction of the alternative measuring indicators i.e. altmetrics, made it possible to measure the attention and usage the scholarly research on social networking tools was receiving online. It is suggested that altmetrics be an alternative metric indicator to bibliometrics, trying to fill the gap in traditional citations metrics by producing more inclusive and timely metrics which are pertinent to the researcher and the research output (Kim & Abbas, 2010; Konkiel, 2013). The aim of altmetrics was to capture previously invisible impacts i.e. the impact of research output on a larger audience – society as a whole. Recent studies found, the emergence of relationships between bibliometrics, as performance indicators for the measurement of research performance, and altmetrics, as possible indicators for research impact on social networking tools (Costas, Zahedi, & Wouters, 2014; Khodiyar, Rowlett, & Lawrence, 2014; Li, Thelwall, & Giustini, 2012; Naude & van Biljon, 2017; Schlögl, Gorraiz, Gumpenberger, & Jack, 2014).

This paper aims at investigating and reporting the relationships between the traditional research impact represented by bibliometrics, derived from citation resources Web of Science, Scopus and Google Scholar and altmetrics, derived from the social networking tool ResearchGate. Alternative metrics being alternative to bibliometrics represents the societal impact of researchers. The research for this paper focus on Phase 1 of an e-visibility study, which forms part of a larger PhD longitudinal comparative study spanning a two-year period from December 2014 to December 2016. The e-visibility study aims at developing an e-visibility strategy for the researchers at the School of Environmental Sciences (SES) at University of South Africa (Unisa), and comprises of five (5) phases combining bibliometric and altmetric data collection over six (6) month intervals, and two e-visibility surveys determining the e-visibility status of the researchers over the two year period. On commencement of the study, very little research were available on the correlation of bibliometrics and altmetrics for the environmental sciences in South Africa.

The main contribution of this paper is to establish the correlation between the bibliometrics and altmetrics of the SES researchers within a South African context. The premise is that bibliometrics derived from citation resources correlate with the altmetrics derived from social networking tools.

Research metrics

The introduction of altmetrics as a possible alternative measurement indicator of research impact necessitates the investigation of the possible influence of altmetric indicators from social networking tools on bibliometric indicator in a research context. Following an overview of the nature of each indicator and their role within research impact.

Bibliometrics

The number of citations a researcher receives suggests how influential the research is deemed within the subject discipline (Konkiel, 2013), and suggests the rate of citations as an indicator of the researcher's performance. Bibliometrics describes the counting and analysing of published scholarly research and describes the techniques measuring scholarly impact of research (Bornmann, 2014a, 2014b; Roemer & Borchardt, 2012). It is generally accepted that a citation indicates the utilization of research and gives acknowledgement of the researcher's contribution to the body of knowledge within the specific subject discipline implying research credibility and quality. However, the growing realization that the existing research metrics, comprising of bibliometrics, is seen to be inadequate and exclusive in addressing the full spectrum of research evaluation and do not cater for the attention the research output receives on the Web and on social networking tools (Chen, Tang, Wang, & Hsiang, 2015; Roemer & Borchardt, 2012).

Altmetrics

The emergence of the Web 2.0 technologies, introduced change to the new generation research communities and how they experienced information (Haustein, Peters, Bar-Ilan, Priem, Shema, & Terliesner, 2014; Yeong & Abdullah, 2012). Incorporation of social networking tools in the research workflow, have affected how researchers conduct, discuss and disseminate research, significantly becoming a "nutrient rich space for scholars" (Priem, Groth, & Taraborelli, 2012; Priem, Piwowar, & Hemminger, 2012). Social networking tools gathers and records the social usage data and scholarly activity of research outputs on the Web according to altmetric type (e.g. reads, sharing, links, counts, views, downloads, bookmarks, saves, annotates, discussing, recommended scholarly items) (Adie & Roe, 2013; Robinson-García, Torres-Salinas, Zahedi, & Costas, 2014; Thelwall, Haustein, Larivière, & Sugimoto, 2013). This trail of social activity and impact gives insight into broader view of the research consumption of research output on the Web i.e. the digital footprint of the research (Kortelainen & Katvala, 2012; Priem, Groth, & Taraborelli, 2012). This translates to the societal impact of research. Altmetrics can be described as an attempt to measure the influence and scholarly interaction on the Web (social platforms) and to quantify the social networking resources interactions (Galligan & Dyas-Correia, 2013; Hassan & Gillani, 2016; Haustein & Siebenlist, 2011).

Research impact makes use of traditional bibliometric indicators in the measurement of research impact while societal impact makes use of alternative metrics to measure the societal impact of the research (Bornmann, 2014a). Yeong and Abdullah (2012) suggest that altmetrics is the answer to a new generation of scientists and

researchers seeking measurement of the more complete and inclusive research impact of their research as researcher.

Relationships between Bibliometrics and Altmetrics

Various studies have been conducted on establishing the relationships between altmetrics by calculating correlations between altmetrics and bibliometrics (Costas, Zahedi, & Wouters, 2014; Khodiyar, Rowlett, & Lawrence, 2014; Li, Thelwall, & Giustini, 2012; Naude & van Biljon, 2017; Schlögl, Gorraiz, Gumpenberger, Jack, & Kraker, 2013; Torres-Salinas, Robinson-Garcia, & Jimenez-Contreras, 2016).

Prior research on altmetrics bibliometric indicator relationships regarding ResearchGate reported strong positive correlations for altmetric indicators for ResearchGate and citation resources: Scopus, Web of Science and Google Scholar. These include:

- Scopus, Pearson's r=0.98 (significance not listed) (Shrivastava & Mahajan, 2015);
- Web of Science, Spearman r=0.974 - 0.976 (<0.000 significance) (Onyancha, 2015); and
- Google Scholar, Spearman r=0.956 (<0.05 significance) (Ortega, 2015) and Spearman r=0.87 (significance not listed) (Orduña-malea, Martín-martín, & Delgado-lópez-cózar, 2016).

Methods

Participants

The sample population includes the 62 researchers in the School of Environmental Sciences (SES) at Unisa.

Design

The aim of this paper is to investigate the relationships with the purpose of establishing correlations between bibliometrics and altmetrics for the School of Environmental Sciences (SES) researchers from University of South Africa.

Materials

The following combination of altmetric indicator data from ResearchGate and bibliometric indicator data from Web of Science, Scopus and Google Scholar, would help establish the altmetric bibliometric indicator relationships between ResearchGate and Web of Science, Scopus and Google Scholar.:

- Name of author; number of publications;
- Number of citations of researchers of citation resources (Web of Science, Scopus and Google Scholar);
- Number of views (December 2014 to July 2015), downloads and reads from ResearchGate;
- Number of downloads (December 2014 to July 2015), from ResearchGate;
- Number of reads (December 2015 to December 2016), from ResearchGate.

Procedure

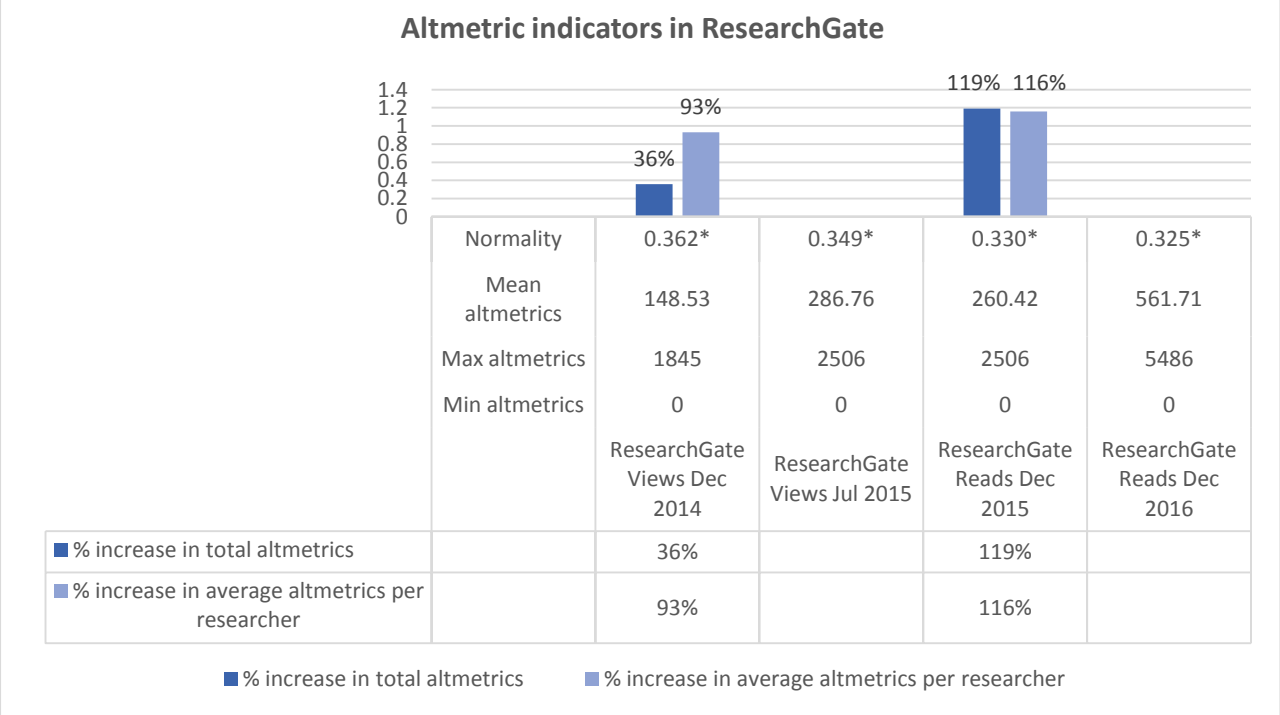
The collection of data, which included sourcing altmetric indicator data derived from the academic social networking tool ResearchGate, and bibliometric indicator data derived from the citation resources: Web of Science, Scopus and Google Scholar, were extracted, recorded and collected manually during December 2014 and December 2016. The data collected from ResearchGate proved to be a limitation as ResearchGate changed the method of harvesting the altmetric indicators from views and downloads in between July 2015 and December 2015, to reflect reads motivating that reads incorporate both views and downloads to be expressed as reads for a more accurate reflection of the altmetric indicator (Nicholas, Clark, & Herman, 2016). The data was analysed using SPSS software for statistical analysis, including the Kolmogorov-Smirnov (Lillefors significance correction) normality tests for each value. The Pearson rank correlation was used to calculate the correlations between altmetrics and bibliometrics that is suitable for non-normal distributions typically used in large social network data testing.

Results

The following results were obtained from the statistical analysis of bibliometrics from Web of Science, Scopus and Google Scholar, and altmetrics from the social networking tool ResearchGate relating to the 62 SES researchers for the two year period from December 2014 to December 2016.

Distribution of bibliometrics and altmetrics

The distribution of the altmetric and bibliometric indicators during December 2014 to December 2016 for the SES researchers are summarised in Figure 1 and 2.



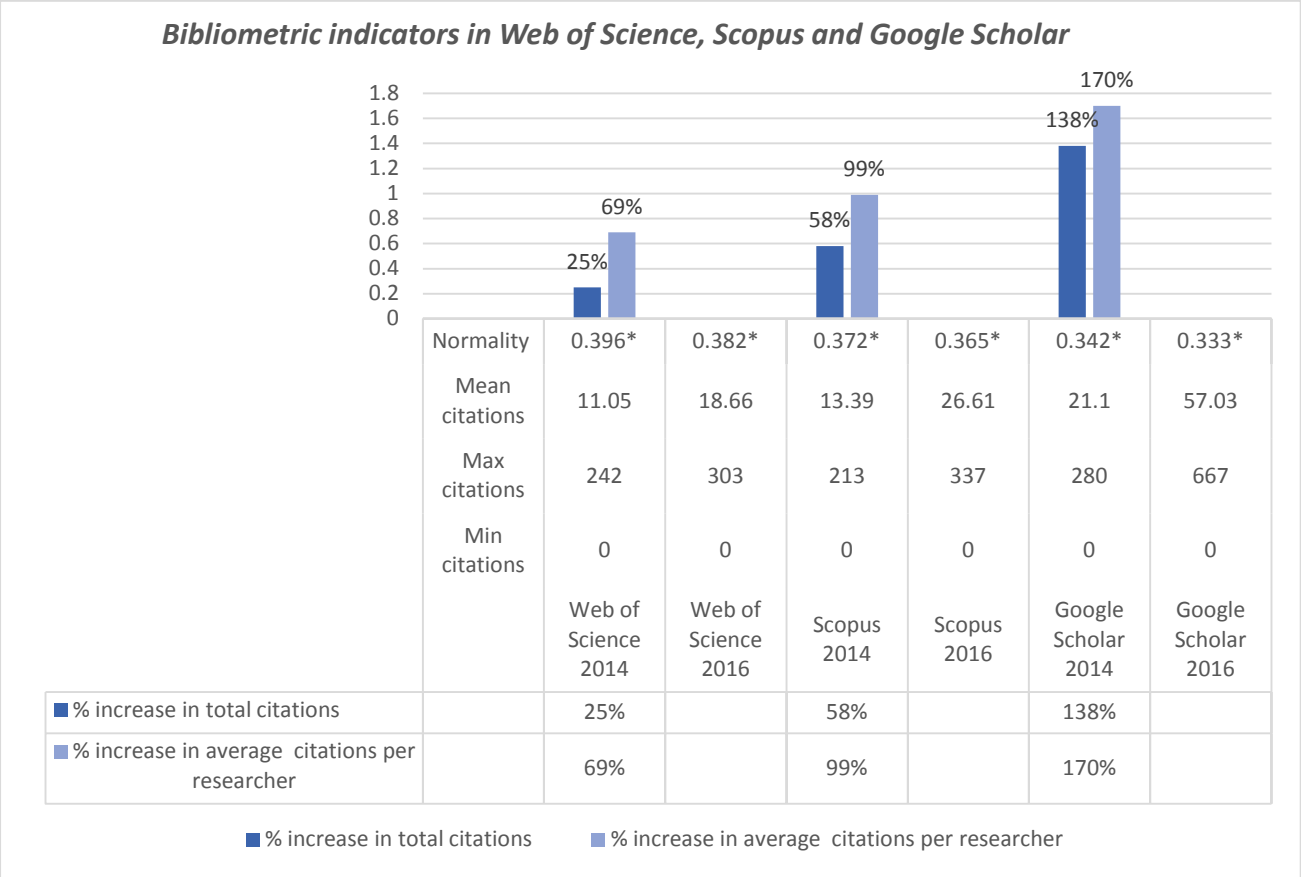
		ResearchGate Views Dec 2014	ResearchGate Views Jul 2015	ResearchGate Reads Dec 2015	ResearchGate Reads Dec 2016
Normality		0.362*	0.349*	0.330*	0.325*
Mean altmetrics		148.53	286.76	260.42	561.71
Max altmetrics		1845	2506	2506	5486
Min altmetrics		0	0	0	0
% increase in total altmetrics		36%		119%	
% increase in average altmetrics per researcher		93%		116%	

*(Lillefors Sig. correction)

Figure 1 - Distribution of altmetric indicators in ResearchGate

In Figure 1, the altmetric distribution results indicated an increase in the total reads of 119% with an increase in average reads per researcher of 116% for the period December 2015 to December 2016. The results for the period December 2014 to July 2015 for ResearchGate, indicated an increase in total views of 36% and an increase in the average views on ResearchGate of 93%.

The results for bibliometric distributions indicate the largest increase in total citations (138%) and average citations (170%) in Google Scholar, followed by 58% for total citations and 99% for average citations in Scopus; and 25% for total citations and 69% for average citations in Web of Science – see Figure 2.



	Web of Science 2014	Web of Science 2016	Scopus 2014	Scopus 2016	Google Scholar 2014	Google Scholar 2016
Normality	0.396*	0.382*	0.372*	0.365*	0.342*	0.333*
Mean citations	11.05	18.66	13.39	26.61	21.1	57.03
Max citations	242	303	213	337	280	667
Min citations	0	0	0	0	0	0
% increase in total citations	25%		58%		138%	
% increase in average citations per researcher	69%		99%		170%	

*(Lillefors Sig. correction)

Figure 2 - Distribution of bibliometric indicators in Web of Science, Scopus and Google Scholar

The results indicate an increase in total citations and an increase in average citations for SES researchers across the three citation resources.

Correlations between altmetrics and bibliometrics

The relationships between bibliometric and altmetrics indicators are demonstrated by the Pearson's rank correlation coefficient between bibliometrics from Web of Science, Scopus, and Google Scholar, and altmetrics in ResearchGate. Table 1 shows the correlation matrix for the correlation analysis of citations from Web of Science, Scopus and Google Scholar; and views and downloads from ResearchGate (December 2014 to July 2015) and reads from ResearchGate (December 2015 to

December 2016).

Table 1 - Correlation analysis of the rank values for the bibliometrics and ResearchGate as altmetric indicators

Pearson correlation	WOS 2014	WOS 2016	Scopus 2014	Scopus 2016	Google Scholar 2014	Google Scholar 2016
ResearchGate Views Dec 2014	0.726 *	0.783*	0.819*	0.855*	0.919*	0.847*
ResearchGate Views Jul 2015	0.681*	0.733*	0.774*	0.820*	0.855*	0.840*
ResearchGate Downloads Jul 2015	0.688*	0.653*	0.635*	0.619*	0.449*	0.614*
ResearchGate Reads Jul 2015	0.599*	0.644*	0.664*	0.731*	0.802*	0.741*
ResearchGate Reads Dec 2016	0.549 *	0.612*	0.633*	0.696*	0.766*	0.702*

*(Sig. (2-tailed) <0.000)

Correlation matrix legend

0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1

Discussion of bibliometric correlations for ResearchGate

The results following include the Pearson's rank correlation for ResearchGate (views and downloads within the period December 2014 to July 2015). The strongest correlation was observed in Google Scholar and views from ResearchGate (r=0.919, <0.000 significance) in December 2014. The weakest correlation was observed in ResearchGate downloads for July 2015 and Google Scholar December 2014 with Pearson r=0.449 (<0.000 significance). The results for ResearchGate and Web of Science, Scopus and Google Scholar found that ResearchGate has an overall positive correlation between Web of Science, Scopus and Google Scholar for the period December 2014 and December 2016. The Pearson's ranks correlations vary from r=0.549 to r=0.919 with only one moderate correlation Pearson r=0.449 for ResearchGate downloads for July 2015 and Google Scholar December 2014.

The importance of calculating the altmetrics bibliometric correlations lies within the ability to identify the significant relationships between altmetrics and bibliometrics relationships between the views and reads from ResearchGate and the citations from Web of Science, Scopus and Google Scholar during the period December 2014 and December 2016. The established correlations between altmetrics and bibliometrics points towards an assumption that altmetrics and bibliometrics are related and can exert influence on each other (Thelwall, Haustein, Larivière, & Sugimoto, 2013). Previous studies on correlations between bibliometrics and altmetrics indicators have support the findings of this study and have also recorded strong positive correlations (Pearson and Spearman) for Web of Science and ResearchGate views and downloads (Onyancha, 2015); for Scopus and ResearchGate (Shrivastava & Mahajan, 2015), for Google Scholar and ResearchGate (Orduña-malea et al., 2016; Ortega, 2015).

Conclusion

The altmetric bibliometric correlation results, relating to ResearchGate altmetrics and bibliometrics from Web of Science, Scopus and Google Scholar, found an overall positive correlation varying from r=0.549 to r=0.919 with only one moderate correlation Pearson r= 0.449 for ResearchGate downloads for July 2015 and Google Scholar December 2014.

The strong correlation between the altmetrics derived from ResearchGate and the bibliometrics derived from Web of Science, Scopus and Google Scholar indicate that there was a positive correlation between Web of Science, Scopus and Google Scholar, and ResearchGate. The results provide evidence that altmetrics indicators from ResearchGate associate with the bibliometric indicators and exert influence positively on citations. This positive influence of ResearchGate as academic social networking tool has a positive societal impact on the Environmental Science research output at Unisa. This study therefore recommends the creation and maintenance of a research e-profile on ResearchGate for the positive influence of citation counts on citation resources of researchers.

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