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ResearchGate: An effective altmetric indicator for active researchers?

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ABSTRACT

As research performance becomes increasingly important for academic institutions in competition for rankings, student recruitment, and funding, many performance indicators have been developed to measure various aspects of research performance. ResearchGate combines bibliometrics and altmetrics to create a more comprehensive performance measure for researchers and institutions. The ResearchGate score, the flagship indicator calculated by an undisclosed algorithm, is a metric that measure scientific reputation. In this research, ResearchGate metrics are firstly compared with those that Research Excellence Framework (REF) and Quacquarelli Symonds (QS) World University Rankings to assess the quality of UK universities and global universities respectively. This study then utilizes correlation analysis to examine whether ResearchGate metrics demonstrate effectiveness on the researcher level in comparison with SciVal metrics. For this research, 300 ResearchGate members from the supply chain management field were selected. The results provide empirical evidence that demonstrate that the ResearchGate score can be an effective indicator for measuring individual researcher performance.

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1. Introduction

Science researchers usually rely on sharing their research outcomes to gain peer recognition and funding opportunities, and the most popular method of knowledge sharing is via publications. During the past few decades, academic publishing has been experiencing dramatic transformation as it makes the transition from print to electronic format. The popularity of the Internet has helped electronic publications evolve further into Web publishing; thus, the distribution of publications has become streamlined, and widespread Web publishing is rising into the higher levels of publications. Thelwall and Kousha (2015), for example, claimed that Web publication has dramatically changed the manner in which researchers disseminate and promote their research. Liu (2003) also observed that scholarly communication is undergoing a transformation because of collaborative trends and the explosive growth of in the number publications. Researchers currently often communicate and disseminate their research via the

Web instead of through journal articles and conference presentations (Mas-Bleda, Thelwall, Kousha, & Aguillo, 2014). Mas-Bleda et al. identified three types of Web presences: personal, institutional, and social. Personal and institutional websites are created by researchers and academic institutions, respectively, to provide academic information. Social websites—such as Google Scholar, Microsoft Academic Search (MAS), Mendeley, LinkedIn, Academia.edu, and ResearchGate—are social platforms that allow researchers to provide their publications either automatically (Google Scholar and MAS) or by self-entry (Mendeley, LinkedIn, Academia.edu, and ResearchGate).

These academic social websites are forms of online communities. Bishop (2007) claimed that these online communities will bring together people who share similar goals, beliefs and interests. A survey conducted by Gruz, Staves, and Wilk (2012) provided evidence that researchers have been increasingly adopting academic social websites in their professional lives for research-related activities due to the convenience for making new connections with peers, collaboration, and promoting their work online. These benefits are considered important for junior researchers who are still working on developing their network of peers, and their portfolio of expertise. Wang and Chen (2012) further suggested that the when more members with similar interests joined an on-

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line community, network externalities will develop, and interaction ties incurred. Furthermore, members are encouraged to participate more frequently since they believe that their friends or reference groups are concerned with their participation.

The transition in the format and distribution of academic publications has also changed the manner in which researchers can be evaluated in terms of their research performance. Techniques for measuring academic impact, traditionally known as bibliometrics, are generating conflict and concern, especially when tenure-track scholars reach beyond conventional discipline, media, audience, and format (Roemer & Borchardt, 2012). The scope of academic impact becomes questionable from the development of social media. Emerging web-based alternatives, known as altmetrics (alternative metrics), have been developed to help measure the influence of academic performance in social media and blogs. These two categories of metrics continue to be used either exclusively or interchangeably to evaluate the academic quality of articles, researchers, institutions, and even countries.

1.1. Bibliometrics

Bibliometrics, a statistical measure named by Pritchard (1969), are used to analyze the quantity and performance of publications. During the first few decades after the term was introduced, bibliometric indicators were primarily counting methods to indicate research performance (van Raan, 1999). Eugene Garfield invented the impact factor metric in the early 1960s to measure a publication's performance based on the average number of times, for a given year, that each article from that publication has been cited in the previous two years (Garfield, 2006). The impact factor metric has been one of the most popular bibliometric indicators ever since. However, it is sometimes criticized for ignoring differences among research fields and being misleading in terms of the performance of individual researchers (Seglen, 1997). Hirsch (2005) proposed a single-number criterion, the h-index, to evaluate the scientific performance of a researcher. The h-index depends on both the number of publications authored by a researcher and the impact of those publications on the researcher's peers: a researcher has an index h if h of his/her N_p papers have at least h citations each and the other ($N_p - h$) papers have fewer than h citations each. Although Braun, Glänzel, and Schubert (2006) recommend the h-index as an alternative to the impact factor, Bornmann and Daniel (2009) suggested that it should be used only to compare researchers of similar ages and within similar research fields.

Lundberg (2006) classified bibliometrics into three types of indicators: performance, structural, and collaboration indicators. Performance indicators quantify a researcher's output with measures such as the number of citations, Thomson Reuters Impact Factor, and h-index. Structural indicators are used to measure the character of a unit's research such that the cognitive structure of a research field or unit can be described. Collaboration indicators analyze co-authorship and multiple affiliations and thus indicate diffusion of knowledge. Durieux and Gevenois (2010) added quantity indicators into the list of bibliometrics to measure the productivity of a researcher or a research group. Their study demonstrated that ease of use and availability are major advantages for bibliometric indicators. However, bibliometrics are sensitive to research field characteristics and research group size. Thus, Durieux and Gevenois (2010) suggested that multiple indicators be used when evaluating research performance.

1.2. Altmetrics

As social media has become a popular platform for interacting with the rest of the world, people have changed the manner in which they communicate, distribute information, exchange ideas,

and make friends. A number of websites provide platforms for researchers and institutions to manage, share, and promote their publications and to seek collaboration opportunities. Unlike bibliometrics, altmetrics emphasize measurement of the societal impact that emerges from the use of social media (Haustein et al., 2014; Priem, Piwowar, & Hemminger, 2012). Li, Thelwall, and Gius-tini (2012) noticed that the focus of scientometrics has been moving from Web citation analysis toward social media usage analysis. The trendy altmetrics have even caught the attention of the giant database provider Elsevier, who in 2013 acquired Mendeley, a London-based company that operates a global research management and collaboration platform. This acquisition has allowed Elsevier to extend its reach from pure academic services to social networking services to advocate collaboration among researchers and institutions. Mohammadi and Thelwall (2014) found that the readership altmetrics of Mendeley and the citations of Web of Science exhibit low-to-medium correlations for publications in the social sciences and humanities. These results provide empirical evidence that demonstrates that there is a correlation between altmetrics and bibliometrics to some extent, therefore suggesting that Mendeley may be used for research performance measurement.

1.3. ResearchGate

ResearchGate was founded in 2008 by Ijad Madisch, who aims to transform the way researchers are doing their research (Dolan, 2012). Started in Boston and now based in Berlin, Germany, and backed by several U.S. venture capital firms, ResearchGate now has more than 7 million members, with an average of seven researchers signing up per minute (ResearchGate, 2015).

The success of ResearchGate has enabled researchers to disseminate their ideas and share their publications free of charge to facilitate collaboration among researchers from all over the world. Through ResearchGate, members can use the platform to maintain their own publications, ask and answer research-related questions, and follow other researchers to receive their publication updates.

ResearchGate attempts to combine both bibliometrics and altmetrics to create a more comprehensive performance measure for institutions and researchers. Traditional bibliometrics as a performance indicator aims at measuring the quantity and quality of publications such as books and articles. In ResearchGate, four bibliometric indicators (i.e., impact points, number of publications, number of downloads, and profile views) are used to measure the academic impact of institutions and researchers. The ResearchGate score, a new performance indicator calculated by an undisclosed algorithm, is used to integrate both bibliometrics and altmetrics by measuring researcher publications, questions asked and answered, and number of followers. Thus, ResearchGate claims that its score measures scientific reputation based on an individual researcher's contributions, interactions, and reputation. The ResearchGate scores are summed up on the institutional and country levels such that organizational performance can be measured.

1.4. SciVal

SciVal, build by Elsevier using semantic technology developed by Collexis after it was acquired by Elsevier in 2010, is unlike the open-source tools such as Mendeley and ResearchGate: it is a subscription-based research performance assessment tool developed by Elsevier. SciVal creates researcher profiles based on the content contained in Scopus and automatically maintains updated publication and grant information (Vardell, Feddern-Bekcan, & Moore, 2011). It also allows researchers to self-enter their curriculum vitae such that personal information can be selectively disclosed and promoted.

SciVal provides bibliometric indicators to measure researchers' academic performance. Available metrics include absolute measures, such as the number of publications, number of citations, citations per publication, and field-weighted citation impact (FWCI). The FWCI measures how the number of times a researcher's publications are cited compared with the average number of citations received by all other similar publications (Colledge & Verlinde, 2014). An FWCI of 1.00 indicates that the researcher's publications have been cited exactly as would be expected based on the global average for similar publications. Currently, these metrics are restricted to publications from between 2010 and 2014. Relative performance indicators include output in the top percentiles (i.e., publications in the top 10% most cited worldwide), publications in the top journal percentiles (i.e., publications in the top 10% journals in terms of source-normalized impact per paper), international collaboration, and academic-corporate collaboration.

Although ResearchGate is becoming a popular social media platform for researchers, the effectiveness of its research performance indicators has been seldom investigated. Thelwall and Kousha (2015) reported that the ResearchGate indicators of institutional levels exhibit a moderate correlation with five university ranking systems. Among the performance indicators, total impact points, a traditional bibliometric indicator, usually exhibits the highest correlation with university rankings. However, the ResearchGate score exhibits a weak positive correlation. Thelwall and Kousha (2015) also found that different countries seem to use ResearchGate disproportionately; thus, researchers in some countries may miss opportunities to disseminate their publications.

Most studies investigate the effectiveness of altmetrics based on either the institutional level (Jung, Kim, So, & Kim, 2015; Ortega, 2015a; Thelwall & Kousha, 2015) or the country level (Alhoori, Furuta, Tabet, Samaka, & Fox, 2014; Haunschild, Bornmann, & Leydesdorff, 2015; Neylon, Willmers, & King, 2014; Thelwall & Kousha, 2015). However, the benchmark of altmetrics based on individual researchers has not been studied because of difficulties connected with data collection and sampling. Ortega (2015b), for example, studied the relationship between altmetrics and bibliometrics using profiles of researchers that belonged to the Spanish National Research Council, which is a very narrow sample since all the selected researchers have identical nationality. To fill this research gap, this study aims to investigate whether research social media platforms, such as ResearchGate, can provide effective performance indicators, even at the researcher level. Altmetric indicators from ResearchGate are used, and samples of individual researchers with various nationality and affiliations are selected such that their altmetrics can be collected. Metrics from the subscription-based SciVal are then used to benchmark the ResearchGate metrics.

1.5. Methodology

To examine the effectiveness of the ResearchGate metrics, this research begins with a correlation analysis to compare ResearchGate metrics with those that the Research Excellence Framework (REF) and Quacquarelli Symonds (QS) World University Rankings use to assess the quality of UK universities and global universities respectively.

The 2014 REF survey (2014 REF, 2015) was jointly conducted by the Higher Education Funding Council for England (HEFCE), the Scottish Funding Council (SFC), the Higher Education Funding Council for Wales (HEFCW), and the Department of Employment and Learning, Northern Ireland (DEL). These four higher education funding bodies customarily use the assessment results to allocate grants to UK institutions.

Institutional performance metrics for REF include outputs, impact, environment, and overall quality. Outputs were measured by

the quality of publications between 2008 and 2013. Impact was assessed by measuring the potential benefits that the institution provides to society. Environment was evaluated in terms of the institution's vitality and sustainability based on its strategy, resources, and infrastructure. The overall quality is a weighted measure of the previous three metrics, with outputs accounting for 65%, impact for 20%, and environment for 15%.

QS World Universities Rankings, the only world ranking conducted by a private company (Aguillo, Bar-Ilan, Levene, & Ortega, 2010), on the other hand, utilize different sets of indicators that include 40% of academic reputation, 10% of employer reputation, 20% of faculty student ratio, 20% of citations per faculty from Scopus, 5% of the proportion of international faculty, and 5% of the proportion of international students (QS Top Universities, 2015).

Whether ResearchGate metrics exhibit effectiveness at the researcher level can be further assessed by comparison with SciVal metrics. Because ResearchGate does not apply any restrictions for membership registration, this research will focus only on active researcher members. Active researchers are considered to be those who interact with peer researchers and ask or answer questions through this social medium. ResearchGate allows researchers to classify themselves into specific research disciplines. To obtain active researchers from a more diversified population, supply chain management was chosen as the discipline from which to select researchers. Supply chain management (SCM) is a trendy discipline that draws researchers from around the world and from diverse backgrounds. Many different disciplines such as marketing, economics, system dynamics, operations research/management science, operations management, and financial management, have contributed concepts to the original SCM theory (Ganeshan, Jack, Magazine, & Stephens, 1999). As for August 5, 2015, the total number of followers for SCM discipline is 14,450. For this project, 300 ResearchGate members with a ResearchGate score of greater than 3.0 were selected from the SCM discipline. This score was selected because 90 percent of ResearchGate members have a ResearchGate score of greater than 3.0. The samples were selected and their metrics were recorded on March 31, 2015.

Six ResearchGate metrics, including the ResearchGate score, impact points, number of downloads, number of publication views, number of citations, and number of profile views, were considered when testing for correlations with two SciVal metrics, FWCI and the number of citations per publication. Of the eight metrics, the ResearchGate score is an altmetric indicator, whereas the rest are bibliometric indicators. Therefore, the correlation analysis will also examine how altmetrics and bibliometrics are related and whether the ResearchGate score can be used as an effective performance indicator for researchers.

2. Results and discussions

The results of the correlation analysis between ResearchGate metrics and other performance metrics, based on both the institutional and researcher levels, are as follows.

2.1. ResearchGate metrics at the institutional level

To examine the effectiveness of ResearchGate metrics at the institutional level, REF metrics for evaluating UK universities were used as the benchmark because ResearchGate automatically computes the associated metrics for thousands of institutions around the world. The ResearchGate metrics for the REF universities can be found at the website of ResearchGate Institutions (<https://www.researchgate.net/institutions>). Pearson correlations among these metrics were calculated and are summarized in Table 1. In this research, we use Cohen's (1988) conventions to interpret effect size.

Table 1
Correlation matrix between ResearchGate metrics and REF metrics.

	RG score	RG impact points	REF output	REF impact	REF environment	REF overall
RG score	1	0.971**	0.404**	0.415**	0.408**	0.409**
RG impact points		1	0.324**	0.332**	0.330**	0.328**
REF output			1	0.985**	0.985**	0.998**
REF impact				1	0.989**	0.992**
REF environment					1	0.993**
REF overall						1

Note: *indicates significance level with a p value of <0.05; **indicates significance level with a p value of <0.01.

Table 2
Correlation matrix between ResearchGate metrics and QS metrics.

	RG score	RG impact points	QS academic reputation	QS citation per faculty	QS overall score
RG score	1	0.827**	0.617**	0.528**	0.627**
RG impact points		1	0.579**	0.615**	0.678**
QS academic reputation			1	0.393**	0.870**
QS citation per faculty				1	0.626**
QS overall score					1

Note: *indicates significance level with a p value of <0.05; **indicates significance level with a p value of <0.01.

A correlation coefficient of 0.10 is assumed to characterize a small association; a correlation coefficient of 0.30 is considered a moderate correlation; and a correlation coefficient of 0.50 or larger is thought to represent a strong correlation. It is observed that the ResearchGate score exhibits a very strong correlation (0.971) with ResearchGate impact points. This result is surprising because impact points are computed based on the total impact factors of the journal articles that researchers from a university have authored. The ResearchGate score, on the other hand, is an altmetric indicator that measures research performance as well as reputation and interactions with peers. Of the four REF metrics, these two scores are highly correlated with each other, thereby suggesting that the weighted REF overall indicator can very well represent the overall performance of a university. With equal sub-0.40 correlations, the altmetric ResearchGate score also exhibits a moderate correlation with all REF metrics. It is interesting to observe that the ResearchGate score exhibits stronger correlations with the REF metrics than ResearchGate impact points do. The results suggest that the ResearchGate score provides an effective measurement of academic performance for UK universities at the institutional level.

To further examine the validity of the ResearchGate score for institutional performance measurement, the metrics from the QS world university rankings were used to calculate correlations between them. [Thelwall and Kousha \(2015\)](#) used Spearman's rank correlation coefficient to study the relationship between ResearchGate metrics and five university ranking systems, including the Times Higher Education Ranking, QS World University Ranking, Academic Ranking of World Universities, CWTS Leiden Ranking, and Webometrics Ranking of World Universities. According to their results, the ResearchGate score exhibits moderate-to-weak correlations with these university rankings for 2013. Our research, in contrast, used the Pearson correlation coefficient to study the relationship between ResearchGate and QS ranking metrics. QS employs six metrics (academic reputation, employer reputation, faculty/student ratio, citations per faculty, international student ratio, and international student ratio) to compose the overall score for the university ranking ([QS Top Universities, 2015](#)).

To focus on research performance, this research used the academic reputation, citations per faculty, and the overall score for the correlation analysis. Academic reputation was determined by collecting 63,500 responses from academics worldwide to identify the best university within their field of expertise. Citations per faculty were calculated using information from Scopus. Because only

the top 400 universities were given individual ranking positions, the QS metrics of these institutions were used for the correlation analysis. The results are presented in [Table 2](#). Unlike the results of [Thelwall and Kousha \(2015\)](#), both the ResearchGate score and impact points exhibit significant strong correlations with all three QS metrics. The Pearson correlations obtained from both the REF and QS rankings indicate that the ResearchGate score is an effective academic indicator at the institutional level.

2.2. ResearchGate metrics at researcher level

The 300 samples selected from the members of ResearchGate are rather diversified in terms of nationality and institutions. These researchers are from various 48 countries and more than 200 different academic institutions. To examine whether the ResearchGate score is also effective for measuring academic performance at the researcher level, a correlation analysis was performed between six ResearchGate indicators and two SciVal indicators for the 300 researchers in the SCM field. Because the eight indicators are measured on different scales, the original indicators were standardized using z-score transformations.

[Table 3](#) lists the Pearson correlations among the z values of the eight indicators. Among the ResearchGate indicators, the number of publication downloads and profile views exhibit weak correlations (less than 0.4 and 0.3, respectively) with the other ResearchGate indicators. However, the ResearchGate score, impact points, number of publication views, and number of citations exhibit strong correlations with one another. Two SciVal indicators are strongly correlated with each other, with a Pearson correlation of 0.749. It is interesting to observe that the ResearchGate score is significantly positively correlated with SciVal FWCI (the Pearson correlation coefficient is 0.238) and SciVal citations per publication (the Pearson correlation coefficient is 0.209). Although the effect size between the ResearchGate score and SciVal metrics is low ([Cohen, 1988](#)), the results are inspiring. Unlike ResearchGate, a free-of-charge and open-access social medium, SciVal is a subscription-based scientific performance assessment tool, based on interaction with Scopus, that calculates its bibliometrics using data from between 2011 and 2014. In contrast, the ResearchGate score is an altmetric indicator that measures researchers' so-called "scientific reputations" based on how they and their peers interact. The positive correlation provides further evidence that the ResearchGate score is an effective academic performance metric that organizations might use for funding and promotion evaluations.

Table 3
Correlation matrix between ResearchGate metrics and SciVal metrics.

	RG score	RG impact points	RG publication downloads	RG publication views	RG citations	RG profile views	SciVal FWCI	SciVal citations per publication
RG score	1	0.820**	0.404**	0.754**	0.635**	0.387**	0.238**	0.209**
RG impact points		1	0.472**	0.765**	0.759**	0.332**	0.240**	0.259**
RG Publication downloads			1	0.669**	0.551**	0.378**	0.225**	0.195**
RG publication views				1	0.691**	0.574**	0.161**	0.132**
RG citations					1	0.283**	0.269**	0.251**
RG profile views						1	0.098	0.062
SciVal FWCI							1	0.749**
SciVal citations per publication								1

Note: * indicates significance level at a p value of <0.05; ** indicates significance level at a p value of <0.01.

3. Conclusion

As online social media platforms have become a trendy means of communication, websites for scientific researchers have been introduced to allow academics to share and promote their publications and discover opportunities to collaborate with peer researchers. Many altmetric indicators have been developed for these academic social media platforms to measure the societal benefit generated by researchers. However, the effectiveness of these indicators has seldom been studied.

ResearchGate has become one of the most popular academic social networks, with more than 7 million members. What is special about ResearchGate is that its website not only allows member researchers to share and distribute their publications but also provides a platform for them to communicate. Researchers' usage activities are recorded and transformed into performance indicators. Every registered member is automatically measured by various performance indicators, which are added to yield metrics for the institution and country levels. The ResearchGate score, a flagship indicator that ResearchGate claims to be capable of measuring a researcher's scientific reputation, was previously studied and demonstrated to exhibit only a moderate correlation with several established university ranking indicators (Thelwall & Kousha, 2015). However, the indicator's measurement effectiveness on the researcher level remained intact.

In this work, the effectiveness of ResearchGate metrics were first examined at the institutional level. Unlike the Spearman rank correlation used by Thelwall and Kousha (2015), this research calculated Pearson correlation coefficients to study the relationships among ResearchGate indicators and metrics of the REF UK and QS world university rankings. It is interesting to observe that whereas the ResearchGate score exhibits a moderate correlation with REF metrics, it exhibits a strong correlation with selected QS metrics. The results demonstrate that the ResearchGate score has potential as an alternative performance indicator for academic institutions.

Several subscription-based research information providers, such as SciVal of Elsevier and Research Analytics of Thomson Reuters, have utilized Scopus and WoS, respectively to analyze the output and impact of individuals, journals, and institutions. However, only a small fraction of researchers can gain access to these compared with open-access websites such as ResearchGate.

This research provides empirical evidence that demonstrates that the ResearchGate score can be an effective indicator for measuring an individual researcher's performance. When used along with other bibliometrics—such as impact points, number of citations, and number of downloads—ResearchGate can provide comprehensive measurements for researchers, institutions, countries, and even research disciplines. Although the ResearchGate score exhibits only a weak correlation with SciVal's metrics, the fact that it is open access and free of charge may encourage researchers to take advantage of it.

The effectiveness of the ResearchGate score, considered as social impact measurement, further provide evidence that members of the academic online communities are affected by their community peers' social influence. In addition, strong correlation between altmetrics and bibliometrics indicates that the researchers who have greater academic impact can usually enjoy better social impact among researchers sharing similar research interests.

In this research, only researchers in the discipline of supply chain management were sampled. However, as altmetric indicators such as ResearchGate score gaining more popularity, further study may be conducted to observe how the researchers behave differently in different research disciplines regarding the use of academic social websites.

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