*by Dolores Pereira**

Should geoscientists, employers, funding agencies and publishers be slaves to impact factors?

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Citations and the h-index are parameters to evaluate a researcher's performance. Several platforms are used to analyse these parameters. However, all of them differ in their methods. As a consequence, an author can appear with several different h-index values and with a varying number of publications and citations, which can differ by more than a hundred per cent from one platform to another. This work investigates the differences in values obtained using the publication data of the author of this paper. The conclusion is that the databases most frequently used for academic purposes are not always the most objective, as they can lack important information that can be found in other databases that are often less considered. Here, recommendations for carrying out a citation search are made and include: avoiding a single number to characterize an author by his/her h-index; using a combination of available platforms; and exploring the use of more objective tools to evaluate the research trend of a researcher, who may depend on these numeric values for obtaining a job or a promotion.

Introduction

Worldwide, there is a growing demand for information regarding quality research performance and trends by funding bodies, ranking agencies, universities and the governing bodies of research centres, who use this data for awarding promotions, appointments and grants (Solarino, 2012; Moed and Halevi, 2015; Piro et al., 2016). Publishing in high impact factor journals has become a sort of competition between researchers ("impact or perish" in words of Biagioli (2016), but also seems to have become a competition among journals. Scientific journals are major entities studied in bibliometrics and scientometrics. Journal rankings, such as those published by Thomson Reuters, Scopus and others, are being used to filter researchers who are competing for a promotion, a research grant or, what can be worse, for their first job either within a private company or academia. Rankings are based on citations, and while some papers can be highly cited, most academic papers go uncited. This situation could be interpreted that a paper with few citations is of much lower quality than frequently cited papers (Tahamtan et al., 2016 and references therein). Publishing in first-quartile journals, being cited, and increasing ones h-index all form part of a game that some platforms exploit, such as Researchgate.net, to keep researchers checking the website when a new citation or a "new read" of the author's paper is detected. This issue has been the core of recent, seminars, debates and publications, appearing in scientific journals (Matarese, 2010) and in high impact newspapers, where it has been concluded that this impact factor illusion is encouraging researchers to try to publish in the so called elite journals, despite the quality of the science. Also, this situation could deter scientists from publishing what may be considered as a minor work, containing unexciting but essential results. Furthermore, this raises the question of whether research that lacks impact is actually useful and worthy of being published.

Currently, high impact journals have created a type of 'bubble' associated with fashionable themes, such as climate change. Since this research area is a hot topic, climate change is monopolizing most research funding programs, creating a 'climate change lobby' where many researchers and research teams repeatedly read and cite (and self-cite) their own articles, increasing the journal impact factor and their own h-index. Randy Scheckman, a cell biologist and winner of the 2013 Nobel Prize for Medicine, has even decided to stop publishing in Nature and Science, the present desirable target for scientific findings, in protest of this distortion of the scientific publication process, which causes detriment to science as a whole (http://www.theguardian.com/commentisfree/2013/dec/09/how-journals-nature-science-cell-damage-science). Scheckman can make this decision, as he is already a well-known scientist and recognized for his contributions to Medicine. By contrast, junior and senior scientists trying to establish or further their careers are not in the same position. One surprising outcome that has been highlighted in the present work is the large differences found between databases when searching for the publication lists, citing lists and h-index of a particular geoscientist. This is a capital observation, as all of them are frequently used bibliometric indicators in the scholarly research impact assessment (Moed and Halevi, 2015). Another result worth noting is how a given publication can appear within different categories (i.e., quartiles) in the different databases. Both WoS and Scopus base their information on the quality and quantity values of the journals, but some of the geological journals can appear within very different categories.

The main objective of this study was to compare four widely used databases using data from the author's own publications to check the reliability of each citation search. Bibliometric indicators are known to be highly volatile at the individual level, but consequences of using a particular one can be very negative for the researcher when subjected to promotions or evaluations. The values published by the different platforms are listed, and some conclusions have be drawn regarding the fact that some of the databases are more respected than others when using data to filter researchers. The potential gender issue related to the biased use of databases, as has already been demonstrated for some research areas (Pereira and Díaz, 2016; Symonds et al., 20016) has also been evaluated.

Methodology

To carry out the study, the author compared her own data archived in the following academic databases: the Web of Science (WoS), Scopus, Google Scholar, and Researchgate.net. Although there are other platforms containing information on authors and publications (e.g., Academia.net, LinkedIn, GeoRef, and national databases such as CRIStin in Norway and Dialnet in Spain), they did not contain information regarding the parameters used for purposes of this study. This data can be retrieved, free of charge, from Google Scholar and Researchgate.net. The other two databases, WoS and Scopus, require registering for an institutional account. All data refers to information retrieved prior to the 16th December 2016.

The Databases

The four databases used in this study are described (according to their own website and regarding journal impact factor) as follows:

Web of Science

This platform belongs to Thomson Reuters. Access is restricted to registered institutions. It contains several databases dedicated to metrics on journals, researchers and publications in different areas. For the purpose of this paper, the following databases have been used: Journal Citation Reports, for information on quartiles and impact factor of publications, and ResearcherID, for different metrics on the author. **Journal Citation Reports** is described as: "The recognized authority for evaluating journals. Journal Citation Reports® offers a systematic, objective means to critically evaluate the world's leading journals, with quantifiable, statistical information based on citation data. By compiling articles' cited references, JCR helps to measure research influence and impact at the journal and category levels, and shows the relationship between citing and cited journals."

ResearcherID

ResearcherID provides a solution to the author ambiguity problem within the scholarly research community. Each member is assigned a unique identifier to enable researchers to manage their publication lists, track their times cited counts and h-index, identify potential collaborators and avoid author misidentification. In addition, ResearcherID information integrates with the *Web of Science* and is ORCID compliant, allowing to claim and showcase your publications from a single one account.

Scopus-SCImago

"The SCImago Journal & Country Rank is a portal that includes the journals and country scientific indicators developed from the information contained in the Scopus® database (Elsevier B.V.). These indicators can be used to assess and analyse scientific domains." "SJR is a measure of scientific influence of scholarly journals that accounts for both the number of citations received by a journal and the importance or prestige of the journals where such citations come from."

ResearchGate

"ResearchGate is a social networking site for scientists and researchers to share papers, ask and answer questions, and find collaborators. According to a study by Nature and an article in Time Higher Education it is the largest academic social network in terms of active users."

Google Scholar

"Google Scholar provides a simple way to broadly search for scholarly literature. From one place, you can search across many disciplines and sources: articles, theses, books, abstracts and court opinions, from academic publishers, professional societies, online repositories, universities and other web sites. Google Scholar helps you find relevant work across the world of scholarly research. Google Scholar aims to rank documents the way researchers do, weighing the full text of each document, where it was published, who it was written by, as well as how often and how recently it has been cited in other scholarly literature." Google Scholar refers even to Doctoral Thesis. Doctoral Theses are documents that are cited in many important publications. However, they are not considered in the most used databases: Scopus and the Web of Science.

Based on these definitions, only ResearchGate is recognized as a social network (Van Noorden, 2014; Matthews, 2016). Although, the other three seem to have the same objective: evaluate the researchers profile through the number of publications, citations and h-index.

Factors affecting the reliability of Impact Factor information

Derrick et al. (2011) conducted a project to understand metrics using some of their colleagues' data, who had been encouraged to participate by the offer of having their h-index calculated. In theory this should have been very simple, however, in practise, as shown by this paper, calculating a single and meaningful number was somewhat complicated. The authors also reassured each participant that their information would be treated confidentially and not used in publications to characterise their individual research output. Informed written consent to calculate and use their publication metrics was obtained from each of the participants via email. This project dealt with data obtained from the WoS, and the list of publications was complemented by a full search to look for material such as books and "grey" literature. If citations for a particular publication were not found using either of these methods, it was assumed that the publication had not achieved enough visibility within the research literature to affect the researcher's h-index. However, it was found that some of the citations not found within the WoS could be found elsewhere. Due to the complexity of comparing such a large quantity of data among the databases, the author of this

Table 1. Data regarding the author's number of publications, citations and h-index found within the different databases

Researcher: D. Pereira	Database	Number of Publications	Number of Citations	h index
	WoS-ResearcherID	33	547	9
	Scopus	43	631	10
	Researchgate.net	68*	717	12
	Google Scholar	98*	861	13

*Total publications, including proceedings, Theses, obituaries, and other publications in Spanish journals.

paper has used her own publication record to reduce both the amount of work and to avoid conflicts with data protection laws. After registering the list of contents (i.e., list of publications, list of citations and h-index) obtained from the four platforms, a comparison of the data retrieved was conducted. The missing items and the uneven treatment of book chapters both among the databases and within the individual databases was highlighted. Table 1 shows that the difference in the number of publications was over a hundred per cent in some cases.

All data can be checked within the cited platforms; however unfortunately, not all of the platforms are Open Access.

Results and Discussion

By comparing the author's data regarding the number of publications, number of citations and h-index, it was found that the numbers greatly differed from one platform to another. The maximum differences were found among the WoS-ResearcherID, Google Scholar and Researchgate.net (Table 1). However, important differences regarding quality were detected between the WoS-ResearcherID and Scopus. This observation is important, as these two platforms are frequently used to select researchers for both project funding and promotion among academic positions. To understand the differences, we compared, one by one, the publications and citations that appeared in all of the databases. For example, Researchgate.net and Google Scholar included all publications: papers in high impact journals, books, book chapters, proceedings, thesis, reports, and articles in so-called "niche journals" that are published for very specialized audiences. This is why both platforms retrieved a much higher number of publications for all researchers than other platforms. The WoS and Scopus only use data that are included in their own databases, which do not always coincide, and lack homogeneity even within one of them!

First, the difficulty of searching for a researcher in the WoS, originating from a country where several names and surnames are used and the use of initials is not a common practice, as is the case of the author of this paper (Pereira and Díaz, 2016), must be noted. This is the same for a researcher who has a very common name, such as Mary Smith, which ends up producing many different results. It has to be taken into account that these combinations are not always dependent on the author, as the journals may take for granted that the first name and surname is the most probable combination, which is not always the case. Also, names with accents, diacritical marks, and other naming peculiarities are often difficult to find in the search engines of these platforms.

To obtain the accurate final number of the author´s publications, different combinations, including the name of the institution, had to be used within the search in order construct a better filter. Whilst using Scopus, the author even had to ask the database management team to merge, correct and include some publications that were scattered throughout the database under different surnames (the first, the second or both) and initials. In the case of the WoS, once the author was unable to retrieve more publications to be added to the list (i.e., by using the tool "Search Web of Science Core Collection", which, in the author´s case, is supposed to search through a collection of the world´s leading scholarly literature in the sciences), it was checked whether publications were missing because they formed part of a book (i.e., as book chapters).

Missing Publications

From the search, it was observed that most of the publications from 2016 where not yet uploaded onto the WoS database. Surprisingly, it was detected that the WoS listed some of published book chapters and proceedings (e.g., Pereira et al., 2010a, 2013a; Navarro et al., 2015a), but not all, independently of whether these books were considered in the Book Citation Report, as is the case of the Lyell Collection, published by the Geological Society of London as Special Publications. It was found that the list of publications in WoS for D. Pereira contained one book chapter in one of these Special Publications (Pereira et al., 2007), but was lacking five chapters that had been published in three of the same serial publication Publications (Pereira et al., 2010b, 2015b, 2015c; Pereira and Cooper, 2014; Navarro et al., 2015b; Wikström and Pereira, 2015). Regarding book chapters, besides the confusion in the WoS with the recognition for some chapters but the lack of mentioning others, Thomson Reuters has a separate database for books; the Book Citation Report, which requires institutions to have a subscription to gain access to the contents. This may be connected to a commercial and not a scientific issue that should probably be considered in future studies. As a consequence, a difference of ten publications was registered between Scopus and the WoS, and there were many more when comparing these to Researchgate.net and Google Scholar (Table 1).

Missing Citations

When searching for citations, we also found many differences. Focussing on the differences between the WoS and Scopus, we found that some of the papers, for the reasons already explained, cited in Scopus had zero citations in the Web of Science. To a lesser extent, some of the citations that appeared in the WoS did not appear in Scopus, regardless of being publications in high impact journals or book chapters. Since some of the missing data were related to publications in journals of high impact factors (e.g., Pereira and Shaw 1997), and ranked in the first quartile of the WoS for Geochemistry and Geophysics, we searched for the citations mentioned in Scopus. It was found that this paper had been cited in 12 papers (7 after excluding the self-citations), all of which were first order publications (Q1: Ore Geology Reviews, Geological Society of America Bulletin, Contributions to Mineralogy and Petrology, Journal of Metamorphic Petrology (Q1); Q2: Geologica Acta; Q3: Transactions of the Royal Society

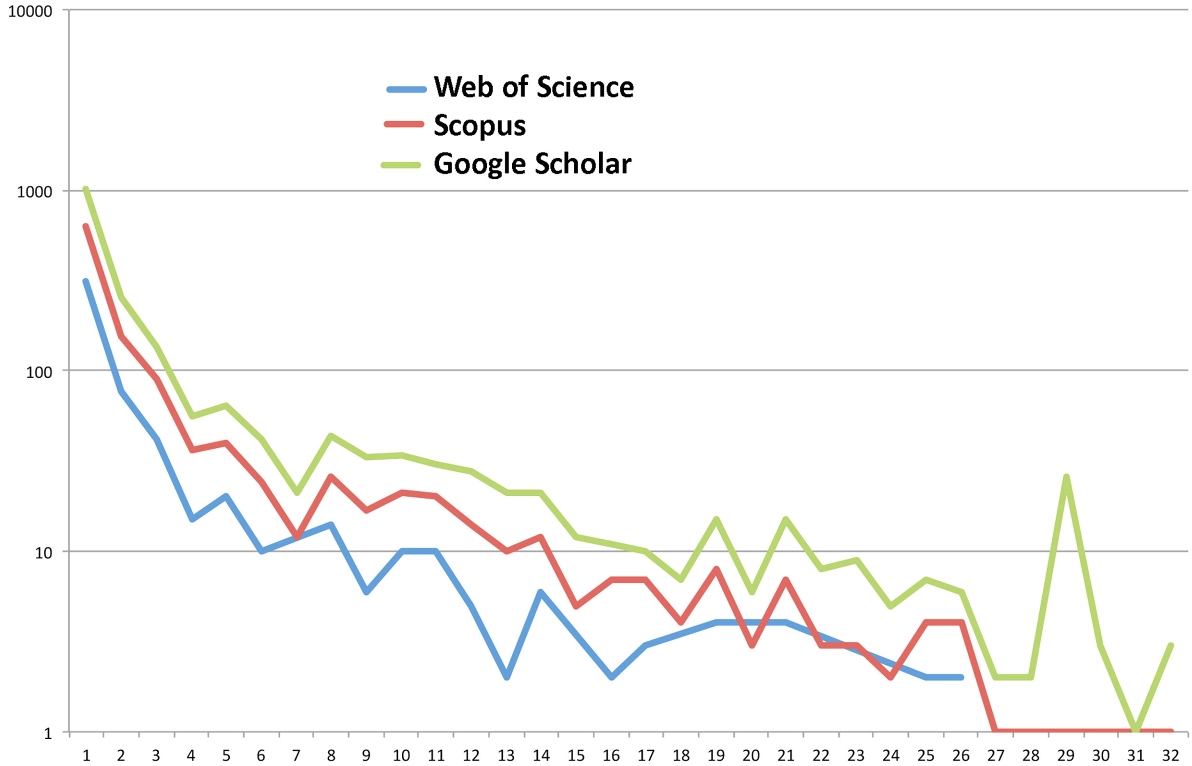

Figure 1. "Quality profile" of the researcher as seen using the three different studied databases (Web of Science, Scopus and Google Scholar) for the lifetime citations of the author's papers.

of Edinburgh, Earth Sciences, Canadian Mineralogist. Data came from the Journal Citation Reports 2014. Thomson Reuters). A similar case was found when searching in Scopus [Pereira and Rodríguez Alonso 2000): 8 citations (6 after excluding self-citations) in journals of high impact (Q1: Chemical Geology, Reviews in Mineralogy and Geochemistry, Precambrian Research, Lithos; Journal of the Geological Society of London. Q2: International Journal of Earth Sciences. Data came from the Journal Citation Reports 2014. Thomson Reu-

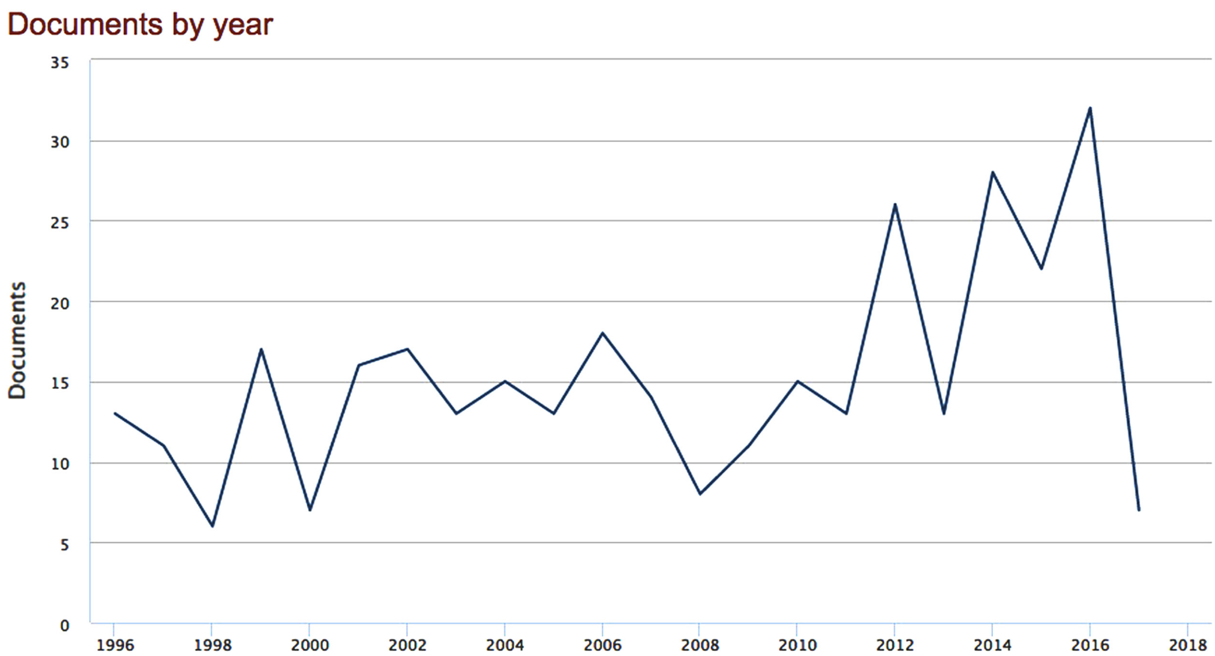

Figure 2. Evolution of citations of the highest cited paper of the author: Bea et al. (1994). The figure shows that a large number of citations are received after more than 20 years of publication, which contradicts the generalization that citation factor has a time limit. Screen capture of Scopus web page, on 2017-03-31.

ters). This paper was found in Scopus when searching for Gomez MDP, and it was requested that authorship be changed and added to D. Pereira's publications list. The WoS only recognized 10 of these citations. The same was observed with several other publications, and the differences in the citations and the h-index are shown in Table 1 and Figure 1.

When comparing citations, it has to be taken into account that self-citations are also counted in all of the platforms to calculate the h-index, and therefore, present an advantage to journals that use them to increase their Impact Factors (although this issue is always evaluated in the databases, comparing citations against self-citations in journals). Self-promotion and self-citations were more typically exhibited by males than by females (Lawrence, 2006; Pereira and Díaz, 2016); therefore, filtering researchers using the h-index or citation index calculated by any of these platforms could be a disadvantage to female researchers. Symonds et al. (2006) tried to use a different index that did not take this 'sexist' index into account, one that was calibrated using quantity and quality data. Long (1992) determined that female researchers produced fewer but higher quality publications than males, and that their publications were often more cited. This assessment is not so accurate if it is considered that many publications are prepared by research groups where a desirable equilibrated composition may occur and the male to female ratio is more balanced. It has to be considered that at the beginning of academic careers, researchers usually publish with their tutors or teams, and thus, it would be unfair if credit was only given to one of the authors when analysing these statistics. Most of it when some authors believe that the citation factor has a time limit, meaning that the number of citations is initially higher and then decreases over time (Tahamtan et al., 2016). But this conclusion can only be applied to research areas that become fashionable at a given time, or very active in producing new scientific results, however, this cannot be generalized for all papers. Some papers publish information that is 'ahead of their time' and remain low in terms of citations for a time before being "rediscovered". For example, D. Pereira has been described in the WoS as having a citation metric of 16.61 cites per article. However, Bea et al. (1994) (314 citations in WoS and 323 in Scopus) received a high number of citations more than 20 years after the publication of that paper, as can be seen in the author´s Scopus page (Fig. 2). It must also be noted that publication records are comparable to citation records, where in some cases a high citation metric can be explained through self-citation, but in the present study this is not the case.

Additionally, more anomalies have been detected in other databases. For example, the paper by Pereira and Shaw (1996), cited by ten papers in WoS, Scopus and Google Scholar, was only referred to by one citation in ResearchGate, which is puzzling, as ResearchGate produces the second highest number of citations of all of the different databases dealing with published literature. Table 2 lists the number of citations of the various publications retrieved from both the WoS and SCOPUS. The other two databases studied (Google Scholar and ResearchGate) have been omitted from the table because, although they were also included within the study, they also refer to abstracts and documents in low diffusion journals that were difficult to compare in this context. However, these databases also contained papers that had been cited several times (e.g., Bea et al. (1990) has been cited 18 times in Researchgate.net and 21 in Google Scholar) in papers published in high impact journals, which at the same time have been cited several hundred times and have not been considered in either the WoS or Scopus. Moreover, the impact experienced by authors who have publications missing due to the selective filter of "prestigious" databases should be analysed.

There is one more parameter that can be found in some of the databases (e.g., ResearchGate.net) and even some journals make it avail-

Table 2. A list of the citations of the papers by D. Pereira according to the database searched. For the sake of simplicity, only WoS and Scopus are listed. The table contains papers that have been cited at least once in any of the two databases

Publication	WoS citations	Scopus Citations
Bea et al., 1994a	314	323
Bea et al., 1994b	76	80
Pereira and Bea, 1994	42	47
Cooper et al., 2013	15	21
Acosta et al., 2001	20	20
Nespereira et al., 2010	10	14
Pereira and Shaw, 1997	0	12
Hall et al., 1996	14	12
Pereira et al., 2007b	6	11
Pereira et al., 2003	10	11
Pereira and Shaw, 1996	10	10
Pereira et al., 2008	5	9
Pereira and Rodríguez Alonso, 2000	2	8
Pereira, 1998	6	6
Navarro et al., 2013	*	5
Pereira, 2012	2	5
Pereira, 2014	3	4
Pereira et al., 2010	*	4
Acosta et al., 2000	4	4
Pereira et al., 2015a	0	3
Pereira et al., 2012	4	3
Bea et al., 1990	*	3
Pereira and Cooper, 2014	*	3
Pereira et al., 2013a	0	2
García-Barriuso et al., 2011	2	2
Pereira and Shaw, 1999	2	2
Pereira and Marker, 2016	*	1
Pereira et al., 2015b	*	1
Pereira et al., 2015c	*	1
Pereira and Cooper, 2015	0	1
Wikström et al., 2015	0	1
Pereira et al., 2013b	0	1
TOTAL	547	631

*These journals are not listed in the WoS, either because they are considered as book chapters (but see text. Pereira et al., 2010 and Pereira and Cooper, 2015 are book chapters) or because the database had not been updated to include data from 2015 and 2016.

able through their web page (e.g., Episodes: www.episodes.org): "article views". Some authors have noticed a slight correlation between 'views', 'downloads' and 'citations' (between 0.59 and 0.76, Schlögl et al., 2013, 2014), and it seems that the more views and downloads that an article has, the more possibility it has for being cited. However, a perfect correlation cannot be expected, as the 'views' and 'downloads' are mostly done by students or university teachers that may not have an active publication record; therefore, these viewed and downloaded articles would never be cited by these types of users (Schlögl et al., 2014). In the present research, and for this specific studied case, correlations between publications, citations and h-index can be used to show that there is a strong link among all of them in all of the platforms analysed, where the correlation coefficient is equal to or higher than 0.79. This fact can be interpreted as the presence of missing data that can be compensated for in a homogeneous way: missing publications is correlated with missing citations, in most cases in detriment of the researcher.

Anecdotally, the author of this paper, as well as other researchers, have noticed the aggressive method of attracting sign-ups for ResearchGate.net using announcements of the various 'views' and 'citations' for a specific researcher. This practice can sometimes be considered as spam and can be very upsetting (http://academia.stackexchange.com/questions/16870/researchgate-an-asset-or-a-waste-of-time). Also, it has been demonstrated that papers uploaded onto an open access platform (e.g., Academia.edu) receive 16% more citations after one year, 51% more citations after three years, and 69% after five years than a similar article not available online (Schlögl et al., 2013). It was also found that articles posted onto Academia.edu had 58% more citations than articles only posted onto other online sites, such as personal and departmental home pages, after five years.

Rankings

Although databases such as Researchgate.net and Google Scholar, are not considered reliable for measuring the quality value of a researcher, it must be taken into account that some research areas are very productive through short reports that contain extremely useful values, and do not have to go through strict peering review to be published and advance in science (Rentz 2009). However, there is also a lack of transparency associated with some of these databases, and a final decision for judging a researcher should be investigated. For example: who decides that some journals have the same ranking positions in the databases, namely WoS and Scopus, and that others have different ranking positions, or do not even appear at all? (Tables 3 and 4). From the data obtained from this study it can be concluded that it is not always obvious that citations should not be the only deciding factor for ranking a journal, owing to that some important citations may be missing in some of the databases.

Several considerations can be made based on the results of this study that trigger various open questions. First, is the quality profile of a researcher also dependent on his/her ability to capture the wide attention of the scientific community to cite his/her work as well as to increase his/her h-index? Does this ability also depend on the language skills of the researcher, since most cited journals are published in English? Is impact factor linked to the commercial interests of journals and restricted databases such as the WoS? Is Open Access putting an end to the market of impact factors?

It is clear that databases are not built on the same data. However, two databases that do not contain the same information for individual authors, producing different results, are currently being used to rank researchers using their indexes, the h-index and citation index.

Table 3. Journals were some of the author's articles have been cited, but not taken into account in some of the databases (mainly the WoS, which is supposed to be the most reliable). It is always considered the highest ranking research area in both databases

Name of Journal	Web of Knowledge	SCOPUS
Geological Society of London, Special Publications	No quartile*	Q1
Ore Geology Reviews	Q1	Q1
Geological Society of America Bulletin	Q1	Q1
Contributions to Mineralogy and Petrology	Q1	Q1
Journal of Metamorphic Petrology	Q1	Q1
Geologica Acta	Q2	Q2
Transactions of the Royal Society of Edinburgh, Earth Sciences	Q3	Q3
Canadian Mineralogist	**Q3**	**Q2**
Chemical Geology	Q1	Q1
Reviews in Mineralogy and Geochemistry	Q1	Q1
Precambrian Research	Q1	Q1
Lithos	Q1	Q1
Journal of the Geological Society of London	Q1	Q1
International Journal of Earth Sciences	**Q2**	**Q1**

*Some volumes of the Geological Society Special Publications are found in the WoS, although they have not been assigned a quartile.
The journals that have been assigned a quartile and have a different category in each platform are in bold.
Information retrieved from the databases on 2016-09-22.

Table 4. Journals where the author has published her research. Proceedings and book chapters that are referenced in SCOPUS but are not contemplated in WoS have been excluded from the table

Name of the journal	WoS	Scopus
Episodes	Q1	Q1
Geosciences (Switzerland)	*	**Q2**
Geological Society Special Publication	*	**Q1**
Environmental Earth Sciences	**Q2**	**Q1**
International Journal of Environmental Research and Public Health	Q2	Q2
Materiales de Construccion	Q2	Q2
Natural Hazards and Earth System Sciences	Q1	Q1
Journal of Materials in Civil Engineering	**Q2**	**Q1**
Geology Today	*	**Q3**
Biologia	**Q4**	**Q3**
Engineering Geology	Q1	Q1
Local Environment	*	**Q1**
Canadian Mineralogist	**Q3**	**Q1**
Lithos	Q1	Q1
Journal of Geochemical Exploration	**Q2**	**Q1**
Physics and Chemistry of the Earth, Part A: Solid Earth and Geodesy	**Q2**	**Q1**
Petrology	**Q3**	**Q2**
Mineralogy and Petrology	**Q3**	**Q2**
American Mineralogist	**Q3**	**Q2**
Chemical Geology	Q1	Q1
Geochimica et Cosmochimica Acta	Q1	Q1
Boletín Geológico y Minero de España	*	**Q4**
Studia Geologica Salmanticensia	*	*

*These journals are not indexed in the above mentioned database.
The journals with different categories within each platform are in bold.
Information retrieved on 2016-09-22.

Conclusions

From the results of this paper and the background information on the subject, it is clear that the assessment of a scientific career should not ultimately boil down to a single number such as the h-index or the citations number. Also, a potential gender-based bias that exist within the current research performance metrics, inherent to the fact that male researchers tend to conduct self-citations more than their female counterparts, has also been illustrated. Evaluating a researcher using only his/her h-index will always be a detriment to female researchers for the reasons already described in this paper. It has also been objectively demonstrated that none of the most respected metric platforms (i.e., WoS and Scopus) represent the exact profile of a researcher, where some are more user-friendly than others when self-updating profiles. The implementation of Open Access journals should help in controlling the impact that some commercial journals are having on publishing scientific results. However, this is not a perfect solution, as publishing in Open Access is expensive for authors and the economic crisis has caused a reduction in the number of research grants, and thus, some investigators cannot compete with well-funded institutions. At present, some changes and developments are being done in metrics research by companies (e.g., Elsevier, Thomson Reuters). While the perfect researcher evaluation method is being developed, it should include the use of research performance metrics by combining several measures based on the quantity of research output and its quality or impact, marking the researcher's progress over time. At the moment, combining both Scopus and WoS data has proved to be the most objective approach that takes into account both parameters.

The author of this paper has observed that all database values correlate almost perfectly ($R^2 > 0.99$), and this can be interpreted that they evaluate a researcher's progress in a different way. However, in terms of specific values, all databases differ in number of publications, citations and h-index, and this can affect the result of a researcher who is applying for a job, a promotion or a research grant, where the evolution of the researcher is not commonly taken into account when comparing the curricula of many applicants.

Additional research should contemplate data from different geoscientists and from researchers from different research areas, such as other Sciences and Social Studies. Baccini and De Nicolao (2016) observed that since the Social Sciences are not commonly published in international journals, or at least not as often as other Sciences, the influence of data output and research areas ratings on citation metrics should be analysed, leading to an extra bias when judging researchers performance.

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References

Acosta, A., Pereira, D., Shaw, D.M., and London, D., 2001, Contrasting behaviour of boron during crustal anatexis: Lithos, v. 56, no. 1, pp. 15–31.

Acosta, A., Pereira, M.D., and Shaw, D.M., 2000, Influence of volatiles in the generation of crustal anatectic melts: Journal of Geochemical Exploration, v. 69–70, pp. 339–342.

Baccini, A., and De Nicolao, G.G., 2016, Do they agree? Bibliometric evaluation versus informed peer review in the Italian research assessment exercise: Scientometrics, v. 108, no. 3, pp. 1651–1671.

Bea, F., and Pereira, D., 1990, Estudio petrológico del Complejo anatéctico de la Peña Negra, Batolito de Avila: Revista de la Sociedad Geológica de España, v. 3, pp. 87–104.

Bea, F., Ibarra, I., and Pereira, D., 1990, Migmatización metatexítica y fenómenos anatécticos en la Formación Almohalla, Complejo Anatéctico de la Peña Negra: Boletin Geológico y Minero, v. 101, no. 2, pp. 187–209.

Bea, F., Pereira, D., and Stroh, A., 1994, Mineral/Leucosome trace element partitioning in a peraluminous migmatite (a laser ablation ICP-MS study): constraints on melt-producing reactions during crustal anatexis: Chemical Geology, v. 117, pp. 291–312.

Bea, F., Pereira, M.D., Corretgé, L.G., and Fershtater, G.B., 1994, Differentiation of strongly peraluminous, perphosphorus granites: The pedrobernardo pluton, central Spain: Geochimica et Cosmochimica Acta, v. 58, no. 12, pp. 2609–2627.

Biagioli, M., 2016, Watch out for cheats in citation game: Nature. v. 535, pp. 201.

Cooper, B., Marker, B., Pereira, D., and Schouenborg, B., 2013, Establishment of the "Heritage Stone Task Group" (HSTG): Episodes, v. 36, no. 1, pp. 8–10.

Derrick, G.E., Haynes, A., Chapman, S., and Hall, W.D., 2011, The association between four citation metrics and peer rankings of research influence of Australian researchers in six fields of public health: PLoS ONE, v. 6, no. 4, pp. e18521. doi:10.1371/journal.pone.001852

García-Barriuso, M., Bernardos, S., Nabais, C., Pereira, D., and Amich, F., 2011, Phytogeochemical, geographical and vulnerability study of the Paleosubtropical element Notholaena marantae subsp. marantae (Sinopteridaceae) at the western edge of its range: Biologia, v. 66, no. 2, pp. 258–265.

Hall, A., Pereira, D., and Bea, F., 1996, The abundance of ammonium in the granites of central Spain, and the behaviour of the ammonium ion during anatexis and fractional crystallization: Mineralogy and Petrology, v. 56, no. 1–2, pp. 105–123.

Lawrence, P.A., 2006, Men, women, and ghosts in science: PLOS Biology, v. 4, no. 1, pp. e19. doi:10.1371/journal.pbio.0040019

Long, J.S., 1992, Measures of sex-differences in scientific productivity: Social Forces, v. 71, pp. 159–178.

Matarese, V., 2010, Emerging concepts in high-impact publishing: insights from the First Brazilian Colloquium on High Impact Research and Publishing: Annali dell'Istituto Superiore Di Sanita, v. 46, no. 4, pp. 451–455.

Matthews, D., 2016, Do academic social networks share academics' interests?: https://www.timeshighereducation.com/features/do-academic-social-networks-share-academics-interests. Retrieved 25 November 2016.

Moed, H.F., and Halevi, G., 2015, Multidimensional assessment of scholarly research impact: Journal of the Association for Information Science and Technology, v. 66, no. 10, pp. 1988–2002.

Navarro, R., Pereira, D., Gimeno, A., and del Barrio, S., 2013, Verde Macael: A serpentinite wrongly referred to as a marble: Geosciences, v. 3, no. 1, pp. 102–113.

Navarro, R., Pereira, D., Gimeno, A., and del Barrio, S., 2015a, Characterization of the Natural Variability of Macael Serpentinite (Verde Macael) (Almeria, South of Spain) for Their Appropriate Use in the Building Industry. Engineering Geology For Society and Territory, Vol 5: Urban Geology, Sustainable Planning and Landscape Exploitation, pp. 209–212.

Navarro, R., Pereira, D., Rodríguez-Navarro, C., and Sebastian, E., 2015b, The Sierra Nevada Serpentinites: the serpentinites most used in Spanish Heritage buildings: Geological Society, Special Publications, v. 407, pp. 101–108.

Nespereira, J., Blanco, J.A., Yenes, M., and Pereira, D., 2010, Irregular silica cementation in sandstones and its implication on the usability as building stone: Engineering Geology, v. 115, no. 3–4, pp. 167–174.

Niyazov, Y., Vogel, C., Price, R., Lund, B., Judd, D., Akil, A., Mortonson, M., Schwartzman, J., and Shron, M., 2016, Open Access Meets Discoverability: Citations to Articles Posted to Academia.edu. http://dx.doi.org/10.1371/journal.pone.0148257

Pereira, A., Pereira, D., Neves, L., Peinado, M., and Armenteros, I., 2013, Radiological data on building stones from a Spanish region: Castilla y León: Natural Hazards and Earth System Sciences, v. 13, no. 12, pp. 3493–3501.

Pereira, A., Pereira, D., Neves, L., Peinado, M., Blanco, J.A., and Tejado, J.J., 2012, A radiological study of some ornamental stones: the bluish granites from Extremadura (Spain): Natural Hazards and Earth System Science, v. 12, no. 2, pp. 395–401.

Pereira, D., and Cooper, B., 2014, Building stone as part of a World Heritage site: "Piedra Pajarilla" granite and the city of Salamanca (Spain). in Stone in Historic Buildings: Characterization and Performance: Geological Society, Special Publications, v. 391, pp. 7–16.

Pereira, D., 1998, P-T conditions of generation of the Peña Negra anatectic complex, central Spain: Petrology, v. 6, no. 6, pp. 555–563.

Pereira, D., 2012, A report on serpentinites in the context of heritage stone resources: Episodes, v. 35, no. 4, pp. 478–480.

Pereira, D., 2014, Improving female participation in professional engineering geology to bring new perspectives to ethics in the geosciences: International Journal of Environmental Research and Public Health, v. 11, no. 9, pp. 9429–9445.

Pereira, D., and Bea, F., 1994, Cordierite-producing reactions in the Pena Negra Complex, Avila Batholith, central Spain: the key role of cordierite in low-pressure anatexis: The Canadian Mineralogist, v. 32, no. 4, pp. 763–780

Pereira, D., and Cooper, B., 2015, A global heritage stone province in association with the Unesco World Heritage city of Salamanca, Spain. Engineering Geology for Society and Territory – Volume 5: Urban Geology: Sustainable Planning and Landscape Exploitation, pp. 205–208.

Pereira, D., and Díaz, C., 2016, Are women properly represented in scientific publication and research? Interim results from a Spanish case study in Earth Sciences: Episodes, v. 39, no. 1, pp. 52–58.

Pereira, D., and Marker, B., 2016, Heritage stone 1. Repair and maintenance of natural stone in Historical structures: The potential role of the IUGS global heritage stone initiative: Geoscience Canada, v. 43, no. 1, pp. 5–12.

Pereira, D., and Rodríguez Alonso, M.D., 2000, Duality of cordierite granites related to melt-restite segregation in the Peña Negra Anatectic Complex, central Spain: Canadian Mineralogist, v. 38, pp. 1329–1346.

Pereira, D., and Shaw, D., 1996, Boron and lithium distribution of B and Li in the Peña Negra complex: an alpha-track study: American Mineralogist, v. 81, pp. 141–145.

Pereira, D., and Shaw, D., 1997, The behaviour of boron during anatexis. A case of study: the Peña Negra anatectic complex, central Spain: Lithos, v. 40, pp. 179–188.

Pereira, D., and Shaw, D.M., 1999, Relationship between tectonic structures and generation of anatectic melt, central Spain: Physics and Chemistry of the Earth, Part A: Solid Earth and Geodesy, v. 24, no. 3, pp. 317–319.

Pereira, D., Baltuille, J.M., and Cooper, B., 2013a, Documenting the architectonic heritage: the best way of preserving it. in Rogerio-Candelera, M.A., Lazzari, M., and Cano, E. (eds.), Science and Technology for the Conservation of Cultural Heritage: CRC Press, London, pp. 411–414.

Pereira, D., Blanco, J.A., and Peinado, M., 2013b, Study on serpentinites and the consequence of the misuse of natural stone in buildings for construction: Journal of Materials in Civil Engineering, v. 25, no. 10, pp. 1563–1567.

Pereira, D., Kramar, S., and Cooper, B., 2015a, Global heritage stone resource: an update: Episodes, v. 38, no. 2, pp. 78.

Pereira, D., Gimeno, A., and del Barrio, S., 2015b, Piedra Pajarilla: a candidacy as a Global Heritage Stone Resource for Martinamor granite. in Pereira, D., Marker, B.R., Kramar, S., Cooper, B.J., and Schouenborg, B.E. (eds.), Global Heritage Stone: Towards International Recognition of Building and Ornamental Stones: Geological Society, Special Publications, v. 407, pp. 93–100.

Pereira, D., Marker, B., Kramar, S., Cooper, B., and Schouenborg, B., 2015c, Introduction. in Pereira, D., Marker, B.R., Kramar, S., Cooper, B.J., and Schouenborg, B.E. (eds.), Global Heritage Stone: Towards International Recognition of Building and Ornamental Stones: Geological Society, Special Publications, v. 407, pp. 1–4.

Pereira, D., Peinado, M., Blanco, J.A., and Yenes, M., 2008, Geochemical characterization of serpentinites at Cabo Ortegal, Northwestern Spain: The Canadian Mineralogist, v. 46, no. 2, pp. 317–327.

Pereira, D., Peinado, M., Yenes, M., Monterrubio, S., Nespereira, J., and Blanco, J.A., 2010, Serpentinites from Cabo Ortegal (Galicia, Spain): a search for correct use as ornamental stones: Geological Society of London, Special publication, v. 333, pp. 81–85.

Pereira, D., Shaw, D., and Acosta, A., 2003, Mobile trace elements and fluid-dominated processes in the Ronda peridotite, southern Spain: The Canadian Mineralogist, v. 41, no. 3, pp. 617–625.

Pereira, D., Yenes, M., Blanco, J.A., and Peinado, M., 2007, Characterization of serpentinites to define their appropriate use as dimension stone: Geological Society of London, Special publication, v. 271, pp. 55–62.

Piro, F.N., Rørstad, K., and Aksnes, D.W., 2016, How does prolific professors influence on the citation impact of their university departments?: Scientometrics, v. 107, no. 3, pp. 941–961.

Rentz, K., 2009, The importance of "niche" journals to new business-communication academics and to all of us: International Journal of Business Communication, v. 46, no. 3, pp. 404–411.

Schlögl, C., Gorraiz, J., Gumpenberger, C., Jack, K., and Kraker, P., 2013, Download vs. citation vs. readership data: The case of an information systems journal (abs.): Proceedings of the 14th International Society of Scientometrics and Informetrics Conference, AIT Austrian Institute of Technology GmbH, Vienna, pp. 626–634.

Schlögl, C., Gorraiz, J., Gumpenberger, C., Jack, K., and Kraker, P., 2014, A comparison of citations, downloads and readership data for an information systems journal: Research Trends, v. 37. On line at: https://www.researchtrends.com/issue-37-june-2014/a-comparison-of-citations-downloads-and-readership-data/

Solarino, S., 2012, Impact Factor, Citation Index, H-Index: are researchers still free to choose where and how to publish their results? in Peppoloni, S., and Di Capua, G. (eds.), Geoethics and Geological Culture: Reflections from the Geoitalia Conference 2011: Annals of Geophysics, v. 55, no. 3, pp. 473–477. doi: 10.4401/ag-5518

Symonds, M.R., Gemmell, N.J., Braisher, T.L., Gorringe, K.L., and Elgar, M.A., 2006, Gender differences in publication output: towards an unbiased metric of research performance: PLoS ONE, v. 1, no. 1, pp. e127. doi:10.1371/journal.pone.0000127

Tahamtan, I., Afshar, A.S., and Ahamdzadeh, K., 2016, Factors affecting number of citations: a comprehensive review of the literature: Scientometrics, v. 107, pp. 1195–1225.

Van Noorden, R., 2014, Online collaboration: Scientists and the social network: Nature, Retrieved 2014-11-06.

Wikström, A., and Pereira, D., 2015, The Kolmården serpentine marble in Sweden, a stone found both in castles and every-day homes: Geological Society, Special Publications, v. 407, pp. 49–56.

Wikström, A., Pereira, D., Lundquist, T., and Cooper, B., 2015, The Dala (Älvdalen) porphyries from Sweden: Episodes, v. 38, no. 2, pp. 79–84.

Visited Web Pages

http://www.theguardian.com/commentisfree/2013/dec/09/how-journals-nature-science-cell-damage-science

http://academia.stackexchange.com/questions/16870/researchgate-an-asset-or-a-waste-of-time

https://www.timeshighereducation.com/features/do-academic-social-networks-share-academics-interests

https://www.scopus.com/authid/detail.uri?authorId=7401842667

https://scholar.google.es/citations?user=hvSxEGQAAAAJ&hl=es

http://www.researcherid.com/Workspace.action

https://www.researchgate.net/profile/Dolores_Pereira/citations

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