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A multi-metric approach for research evaluation

RONALD Rousseau[1,2,3*] & FRED Y Ye[4]

[1] *VIVES (Association KU Leuven), Faculty of Engineering Technology, Zeedijk 1018400 Oostende, Belgium;*
[2] *Universiteit Antwerpen (UA), IBW, Stadscampus, Venusstraat 352000 Antwerpen, Belgium;*
[3] *KU Leuven, 3000 Leuven, Belgium;*
[4] *School of Information Management, Nanjing University, Nanjing 210093, China*

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Background information is provided about the Web 2.0 related term altmetrics. This term is placed in the context of the broader field of informetrics. The term influmetrics is proposed as a better term for altmetrics. The importance of considering research products and not just scientific publications is highlighted. Issues related to peer review and making funding decisions within a multi-metric approach are discussed and brought in relation with the new metrics field.

altmetrics, influmetrics, multi-metric approach, informetrics, research evaluation

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Informetrics, a term first proposed by Nacke [1], was defined by Tague-Sutcliffe [2] as follows:

Informetrics is the study of the quantitative aspects of information in any form, not just records or bibliographies, and in any social group, not just scientists. Thus it looks at the quantitative aspects of informal or spoken communication, as well as recorded, and of information needs and uses of the disadvantaged, not just the intellectual elite.

Since then this definition has been accepted and its use supported by many workers in the field, (so-called informetricians) such as Wilson [3], Ingwersen and Björneborn [4], Bar-Ilan [5] and Rousseau [6]. Ingwersen and Björneborn [4] even explicitly mention that studying activities in chat rooms in cyberspace belongs to the field of informetrics. Clearly, according to this definition, bibliometrics, scientometrics, webmetrics and citation analysis are all subfields of informetrics.

Recently, a newcomer has entered the metrics field, namely altmetrics [7,8]. It has not (yet) a precise definition, but refers to the use of social media, particularly Web 2.0 media, in assessing the influence of researchers on all type of users. Recall that the term Web 2.0 has been introduced by O'Reilly [9]. Although there is no precise definition of Web 2.0 (and hence also no official starting date) the term implies special attention to web services. Web 2.0 ideology has facilitated the use and growth of social media platforms, leading to creative exchanges of user generated content. Weblogs, forums and social networking websites such as Facebook, LinkedIn, YouTube and Twitter are well-known exponents of this development. In view of the definition recalled above, altmetrics is clearly a subfield of webmetrics and hence of informetrics.

1 The new US NSF policy

In a recent article in *Nature* Piwowar [10] draws the attention of colleagues to the new policy of the US National Science Foundation (NSF), in which a principal investigator is asked to list her/his *research products* rather than *publications*. Yet, in the new NSF policy "Acceptable products must be citable and accessible including but not limited to publications, data sets, software, patents, and copyrights". Citations are measures of influence or visibility but, as

*Corresponding author (email: ronald.rousseau@ua.ac.be)

Piwowar notes, nowadays influence and visibility are also shown through Web 2.0 media such as the ones stated above. Mentions in these media can be counted via altmetrics. Moreover, in the age of Big Data [11] data repositories have become essential tools for scientific investigations and contributors to these repositories must be acknowledged appropriately.

Bollen, Van de Sompel and their team [12–14] apply different usage or download data in the context of a large project called MESUR (Metrics from Scholarly Use of Resources). This group also makes use of clickstream data, virtual trails of users surfing the Internet [15]. Following these ideas Wan et al. [16] studied download data from the CNKI database, a large Chinese full-text database, leading to a download immediacy index. Much earlier, Van Els et al. [17] and Jansz [18] already observed that software programs, blueprints, constructions and scientific instruments are outcomes of scientific research. As most scientific instruments and software programs are not citable and carry no name (although the names of the team of engineers who worked on it are known within the company) they do not even fall under the new US NSF policy.

2 Is altmetrics a good idea?

We think altmetrics is a good idea, but a bad name. We have already shown that it is just a new form of informetrics. Moreover, what is alternative today will not be alternative in ten years. Shall we call the future new types of indicators alt^2, alt^3, alt^n-metrics? Although originally introduced in the context of acknowledgements [19] we would like to propose the term influmetrics, or maybe web-based social influmetrics, as a better name for altmetrics.

It is well-known that mentions on the Internet or in other electronic communication media are very sensitive to manipulations: just ask any businessman how to manipulate large crowds on a public forum. Moreover, such numbers may, even more than citations, be popularity measures. Can anyone imagine high Twitter numbers discussing Einstein's general relativity? Or string theory? Hence altmetrics data must be approached with caution, and in the context of multi-dimensional evaluation exercises. With Cheung [20] we may say that "likes" or "shares" lack authority and scientific credibility so that the use of altmetrics may still be somewhat premature. That said: we fully agree with Priem, Piwowar and their colleagues [7,8,10,21] that making an impact nowadays is totally different from making an impact 50 years ago, and hence research evaluation should adapt to changed academic, technical and social circumstances. Moreover, citation counts are slow, by their nature, as publications must be read, reflected upon, and used in one's own research; then this scientific piece of work must pass peer review and be published before a citation can occur. We further note that using modern communication media social scientists and colleagues from the humanities can much easier play (and prove they do) their role in bridging academia and everyday life. Of course, considering published research reports and patents will always be the core of any evaluation exercise.

3 The role of indicators and peer review

A reviewer pointed out that simplistic short-term input/output analysis could make some high-importance projects look bad. An example of such a project (provided by this reviewer) is the ongoing British National Child Development Study [22] which follows the lives of all those living in Great Britain who were born in one particular week in 1958. Its aim is to improve understanding of the factors affecting human development over the whole lifespan. Clearly, such longitudinal studies could easily get a disadvantageous evaluation if inappropriate indicators are used. Yet, most indicators are not used for such longitudinal studies, but as support for peers who must perform evaluations of research groups, departments and universities, or make tenure decisions. Note that we explicitly use the word "support". Indeed, real scientific progress can only be acknowledged by peers who understand the research they have to evaluate. Nowadays, pure objective opinion may not exist anymore, but is always informed by quantitative data, be it consciously or unconsciously. Yet, no peer can be aware of all developments in his/her field and hence runs the risk of being too subjective. Hence, we propose that combining informetric data (via a multi-metric approach) and peer review (for the many aspects that are not quantitative, including the interpretation of quantitative data) is necessary for all forms of academic evaluation.

4 A point related to funding decisions: efficiency

Grant decisions are different from, e.g. tenure decisions. In grant decisions allocation of public funds is at stake. Besides the use of classical, often publication and citation based, indicators (and we explicitly include patent-based indicators) and different alternative forms provided by altmetrics (influmetrics), also proven (earlier grants) and projected (for the new grant application) efficiency should lead to an indicator to be used in funding decisions [23,24]. Clearly if high costs lead to a relatively small amount of research products or products with relatively small academic and/or social value then this should be discounted by an appropriate indicator.

5 Conclusion

Research evaluation has never been easy and already in the

eighties Martin and Irvine [25] considered using converging partial indicators. While human society has since then changed drastically, methods used in evaluation exercises have not always followed. Yet, as stated above, real scientific progress can only be acknowledged by peers and even experts may be proven wrong in hindsight. Hence, informetric indicators, including those provided by altmetrics (influmetrics), should be developed further to help peer review. We made a point to include efficiency as one indicator in funding decisions. Surely research evaluation is a multi-dimensional undertaking for which a multi-metric approach is important and necessary [10,26]. We hope that this contribution will stimulate further discussions on research evaluation and the role altmetrics (influmetrics) may play in it.

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