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Is open access the solution to increase the impact of scientific journals?

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Abstract The very nature of scientific activity and information, which are meant to be shared, is the starting point in defining a scientific journal, and the criteria according to which its value and role are determined. The authors aim at analysing some criteria that define the quality of scientific journals considering their visibility and impact. The concept of open access for journals is analysed in point of its advantages and disadvantages, since it differs greatly from the subscription-based access, whether we talk about institutional or individual subscriptions. The authors are in favour of the concept of public access, considering that it gives a journal more visibility, on the condition that article processing charges are reduced. The essential condition for a journal to become renowned is to be as visible as possible. The concept of open access is beneficial, supports instruction through and for scientific research, regardless of educational level. The aim of this paper is to emphasise the modalities, specificities and bibliometric performances (percent of citable documents, impact factor and immediacy index) of open access versus subscription-based access, as well as to investigate whether the use of open access concept determines an increase of the journals' quality, study applied to the analysis of Hindawi Publishing Company journals and Multidisciplinary Digital Publishing Institute (MDPI) journals.

Keywords Journals assessment · Visibility and impact · Open access concept · Publication fees · Instruction through scientific research

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Introduction

Within an economy based on knowledge, all types of information (scientific, technical, medical, socio-human) have an essential role in the society development. Identifying and assessing the consequences of scientific information lack haven't always been a concern to all policy-makers, though they are fully aware that economic development and social welfare are closely connected to the existence of a well-informed intellectual élite.

Innovation, as a process consisting in extracting social and economic values out of knowledge, generates and develops new ideas, and, consequently, requires not only use, but also dissemination. Researchers and innovators in the domains of various sciences and technologies can expand the frontiers of knowledge only if good and rapid information is ensured. The market success of researchers and the implicit economic development are closely connected to the access to information, especially to highly specialised information, and the benefits of research depend mainly on the access to information. Scientific activity is based on a series of vehicles of communication, which have specific objectives.

Scientific articles as vehicles of communicating research results appeared for the first time in the early scientific journals of the 17-th century: Philosophical Transactions of the Royal Society—1665 in England, Journal des Sçavans—1665 and Comptes Rendus de l'Académie des Sciences—1835 in France. From the beginning, the journal *Philosophical Transactions* acquires a significant prestige, since among those who published in it there were Isaac Newton, Charles Darwin, Michael Faraday, William Herschel and many others. *Philosophical Transactions* established the important principles of scientific priority and peer review, which have become the central foundations of scientific journals ever since (Philosophical Transactions 2015). Le Journal des Savants publishes original articles which present examples of notable progress in various domains (Journal des Savants 2015). Comptes Rendus ensures the dissemination of scientific information, keeping the scientific community informed in a rapid way about the newest and most significant published research results (Institut de France, Académie des Sciences 2015).

Scientific journals are the basic instruments in the process of knowledge dissemination, at the same time, being true knowledge archives, connecting domains, thematic areas, authors, research entities, quotations, examples of cooperation etc. (Ardelean et al. 2014).

As science is defined using terms belonging to the domain of scientific literature, it results that the notions of knowledge and scientific writings are quasi-synonymous. This equivalence was made for the first time by John Derek de Solla Price (1964), who, making use of Lotka and Bradford's studies (Lotka 1926; Bradford 1934), stated the principle of using the number of scientific articles as a quantitative index of research activity: *science is what is published in scientific journals, articles, and presentations*. He hypothesised that the number of scientific articles published every year represents an index of the general activity or of a certain research domain, pointing out that by measuring the science development in this way, the result is an exponential growth following a period of linear growth.

Exponential growth has characterised the development of western science beginning with the 17-th century, and the law describing this growth is expressed by the equation:

$$F(t) = ae^{bt}$$

where $F(t)$ represents the variation in the scientific literature corpus in time; a represents the initial dimension of the scientific literature corpus at the moment $t = 0$; b represents the continuous level of knowledge, i.e. the percentage of yearly scientific literature increase.

This law of the exponential growth of sciences stated by Price, was established after accounting the number of scientific articles in the series *Philosophical Transaction of the Royal Society of London*, starting with the year 1665, and *Physics Abstracts* (between 1898 and 1950). The law was verified on the articles in the domain of mathematics referring to determinants and matrices, between 1693–1919 and 1920–1949, Price making the following observation: *if a significantly large segment of science is measured by a reasonable means, its natural growth is exponential* (Ardelean et al. 2014).

An article, irrespective of its nature, is regarded as a message, as a summum of representations, but also as a sum of specific elements which can be analysed by using different methods and interpreted accordingly. An article published in a journal meets one of the final purposes of research, i.e. its acknowledgement by the scientific community. Periodicals are classified according to a variety of criteria: the most cited in the form of the absolute value; those containing the highest number of articles cited on the average, globally, or considering the domain; those which publish the highest number of articles; those which are cited by prestigious journals etc. They can be assessed according to objective criteria.

According to the data published on the World Bank webpage, in 2011 there were published 582,012 articles in the following domains: physics, biology, chemistry, mathematics, clinical medicine, biomedical research, engineering and technology, space and earth sciences, among which 176,189 in the euro zone.

Therefore, the connection between journals and the articles they publish is obvious. The main issue raised by both authors and editors is the value level of a certain journal, since the latter represents a real knowledge archive that puts together the various vuepoints of the researchers.

This paper aims to emphasise some bibliometric indicators of several open access journals belonging to Hindawi Publishing Company and Multidisciplinary Digital Publishing Institute (MDPI), and also, relying on the analysed bibliometric performances (percent of citable documents, impact factor and immediacy index), to establish whether a visibility increase would lead to a quality increase, expressed by the impact factor.

The bibliometric assessing of journals

The proposing authors submit their scientific articles, mainly depending on their research value (established by self-assessment) and on the value of the journal. The latter is based on economic and intellectual criteria. Among those belonging to the former category, we can mention: editing expenses, peer-review expenses, the number of subscriptions etc. Intellectual criteria include the quality of the journal, its visibility and number of citations. It is obvious that there is a close interdependence among these criteria. In the last decades, journals have been indexed in data bases and the indexation is determined by their meeting well-defined and quantifiable criteria.

The quality level of journals and the method of establishing it, have been a permanent concern of both editors and scientists (Rousseau 2002; Braun 2007).

Haensly et al. (2009) propose to establish the quality level of a journal in two ways:

- based on a survey made by means of a questionnaire asking the participants to rate a list of journals;

- based on the number of citations.

Rousseau summarised the ten characteristics of a quality journal by reviewing Zwemer (1970), and Garfield (1990). These ten criteria are (Vishwakarma and Mukherjee 2014):

1. Acceptance and rejection rates;
2. Subject and geographical representativeness of the editorial board;
3. Use of a critical refereeing system;
4. Promptness of publication;
5. Coverage by major abstracting and indexing services;
6. High confidence level of scientists using the journal in its contents;
7. High frequency of citation by other journals (impact);
8. Inclusion of abstracts/summaries in English;
9. Providing author(s) addresses (author reputation score); and
10. Providing complete bibliographic information.

We will further deal with criteria number 5 and 7, because we aim at the exclusive analysis of the main factors determining journal impact, the non-analysed criteria exerting a smaller influence on the impact. Data base inclusion is extremely important and, as we have already stated, it depends on meeting a series of *sine qua non* conditions. Of course, data bases have also other criteria to include a journal, among which we mention: regular journal issues, the editing quality, the uniform system of publishing papers, the uniform structure of the article etc. Data bases present and/or describe the content of the document by means of indexation. A data base is a corpus of information, belonging to one or more domains of knowledge, stored within a certain entity and organised so that the information can be accessed. Indexation is the process of analysing a document and assigning it some terms in order to be better described.

The criterion "Coverage by major abstracting and indexing services" is important only to the extent to which these services ensure articles/journals high visibility, thus making them acquire popularity. The indexation categories are called descriptors and they can be:

- a single key word;
- 2–3 key words;
- classifying codes, for instance those in *Chemical Abstracts*, those from *Derwent World Patents Index* etc.

Today, most data bases are made in electronic form by various entities, beginning with scientific publishing houses which issue scientific periodicals. These have their own data bases, usually based on subscription, i.e. on paying a fee in order to gain access. Few data bases are fully available through free access system.

The impact, generally defined as the effect or the influence produced by something, acquires a special significance with reference to articles and journals. In this respect, one can state that a journal is more or less important than other journals, in the same way in which an article can be more or less important than another.

The most widely used measure of the impact is the number of citations of the articles of a journal in another journal. The number of citations is a measure which results in the impact factor for journals (Okubo 1997; Moed 2005), the ratio between the number of citations and the number of articles for a period of 2 years. The impact factor was introduced by Garfield (1955, 1972, 1979). For each journal, the impact factor is calculated and published in the Journal of Citation Reports (JRC), resulting in various comparisons (Kulkarni et al. 2009) or a journal hierarchy (Annual Reviews rankings in Thomson

Reuters Journal Citation Reports 2015). The JRC includes more than 11,000 journals in 237 disciplines, from 82 countries. The 2015 Edition of the Journal Citation Reports (JRC) provides a combination of impact and influence metrics from 2014 data. Then, other impact indices are introduced, all of them being exclusively linked to the number of citations:

- *Hirsh index* introduced by J.E. Hirsch, seeks to establish a bibliometric criterion of quantifying the impact and relevance of research (Hirsch 2005) and also of journals (Braun et al. 2006);
- *eigenfactor* (Bergstrom 2007; Bergstrom et al. 2008; Eigenfactor 2016); *Eigenfactor.org* contains 115,000 reference items;
- *article influence score (AIS)* the Eigenfactor and the AIS are calculated considering the citations received over a 5 year period and can be consulted freely on the web page of eigenfactor.org (Ardent 2010);
- *g index* (Egghe 2006);
- *e index* (Zhang 2009); g-index and e-index are used in the assessment made by Publish or Perish (Harzing 2007);
- *SCImago Journal Rank,* developed by Scopus data base (Elsevier) (SCImago Journal and Country Rank 2016);
- *source normalized impact per paper (SNIP)* (Moed 2010) etc.

For calculating the Hirsch index, Thomson Reuters and other data bases such as Google Scholar consider self-citations. Studies on the topic (Glänzel and Thijs 2004) proved that "at a macro level" it is not necessary to exclude self-citations.

This paper does not intend to analyse all indexes, but just to mention them, considering that the impact is determined by the number of citations, these being numbered by three extremely important data bases: Web of Science, Google Scholar (through Publish or Perish) and Scopus (through SciMago). The reviewing concerns the journals indexed in their own data bases, except for Google Scholar, who reviews all web published publications. Sometimes, there are differences among the data offered by the above mentioned data bases (Garfield 1979; Archambault et al. 2009; Falagas et al. 2008; Abrizah et al. 2013; Bar-Illan et al. 2007).

Unlike Web of Science and Scopus, Google Scholar information access is free. The number of scholarly documents published in English on the web exceeds 114 million, of which about 100 million on Google Scholar and at least 27 million being free available documents (Khabsa and Giles 2014) (Fig. 1).

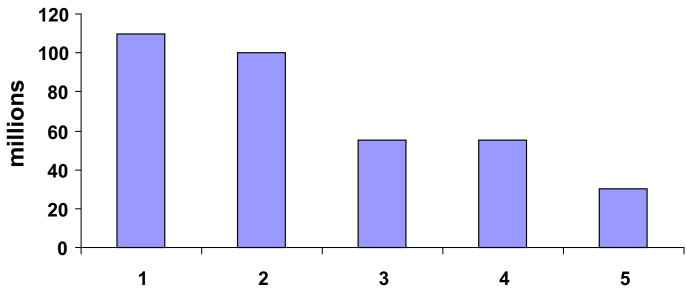

Fig. 1 Relative number of documents in data bases: *1* total; *2* Google Scholar; *3* Web of Science; *4* Academic; *5* PubMed (Khabsa and Giles 2014)

The open access concept

Free access to scientific information is a fundamental problem of contemporary society and, at the same time, a challenge of the 21-st century. Scientific and technical information, which is a type of commodity from the economic point of view, being integrated within the production and/or social area, allows a reasonable use of the means of production, improves goods and services, proposes new ones and takes part in the globalization phenomenon. Being in a competitional environment, enterprises must continuously innovate, improving their productivity, offering new products and services, entering new markets, which cannot be done in the absence of scientific and technical information, or of the results of research and development. Productivity and research progress (at country, region, institution or researcher levels) can be measured by using indices such as: the number of publications/letters patents, the number of citations, Hirsch index etc. The spread of scientific information, the dissemination of the results of research, was done, till recently, almost exclusively, by means of specialised journals, each having its own impact. Spreading scientific information involves two factors: time, determined by the distribution speed, and space, in the form of the distribution area. Scientific journals, privileged instruments of knowledge circulation, are, on the one hand, indispensable elements for a researcher's visibility and acknowledgement, and, on the other hand, a significant source of profit for editors, in case of subscription. Scholarly journals have become ever more expensive and, economically, they can be less and less affordable for libraries and research institutions. Thus, a university cannot make subscriptions to thousands of journals, pertaining to various domains of knowledge, and, consequently, the effects are a more reduced visibility of sciences in general, and a corresponding level of information. There is an opinion that the system based on subscription to thousands of journals does not work in the best interest of researchers, but in that of the editors who aim at improving their market position. For instance, in the financial year 2013–2014, Canadian universities spent over 360 million dollars to Library acquisitions (Statistics Canada 2015).

Walters (2008) estimates that the fees will increase each year with 1.4 % for books, and with 8.5 % for journals. The author, taking the year 2007 as reference (to which he assigns 100 %), considers that in 2025 the fees for journals will become with almost 500 % greater. Considering an annual increase of the budget of 3 %, for these price increases, the number of journal titles acquired will diminish till 2025 to less than one half of those acquired in 2007.

It is obvious that, at the same time, the editors are confronted with ever increasing costs caused by "peer review", editing and distribution. The notion of open access (OA) appeared in 2002, to solve the relation between the access to scientific information, on the one hand, and publishing, on the other. The notion was mentioned in The Budapest Declaration, following the initiative of The Open Society Institute (Budapest Open Access Initiative 2002), and had the declared purpose to eliminate the obstacles blocking the access to scientific information. In this statement, open access is defined as "making scientific literature available on line, freely and without restrictions". Among the supporters of the concept of open access, we mention: Bethesda Statement on Open Access Publishing—2003, Access to scientific information-Interacademy panel Mexic—2003, Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities—2003, Statement on open Access-International Federation of Library Associations—2004, and, more recently, The Joint Declaration on Open Science-ALEEA and European

Commission—2012, The Aachen Declaration-The Annual Meeting of the General Medical Library Association, Germany—2012 etc.

In Mexico, on December 4, 2003, the Science Academies of several countries made their position known referring to the access to scientific information. Among other things, they recommended:

- electronic access to journals must become free all over the world, a year after the publication for the researchers from developed countries and immediately for the researchers from the developing countries;
- the content of the journals and data must be presented in a standardised distribution format to facilitate the use.

According to the data published on the web, in January 2015, the number of open access journals in DOAJ (Directory of Open Access Journals) amounts to 10,128, BioMed Central editor includes about 270 journals, Hindawi 405 journals, Science Direct offers about 290 journals, De Gruyter Open about 350 journals, SpringerOpen about 200 journals etc. In 2012, Morisson opinionated that about 30 % of scholarly peer-reviewed journals are included in the open access system. At the same time, the number of Institutional Repositories which publish doctoral theses, technical reports, etc. has increased, and so has self-archivation.

The European Commission defines the two basic open access models in the following way [COM(2012) 401 final]:

- "*Gold open access* (open access publishing): payment of publication costs are shifted from readers (via subscriptions) to authors. These costs are usually borne by the university or research institute to which the researcher is affiliated, or by the funding agency supporting the research";
- "*Green open access* (self-archiving): the published article or the final peer-reviewed manuscript is archived by the researcher in an online repository before, after or alongside its publication. Access to this article is often delayed ('embargo period') at the request of the publisher so that subscribers retain an added benefit". The EC document also stipulates that the "embargo period" of "green open" model and the archived version at various moments in time, may depend on the agreement between publishers and authors.

The European Commission mentions that "as of 2014, all articles produced with funding from Horizon 2020 will have to be accessible:

- the articles will either immediately be made accessible online by the publisher ('Gold' open access)—up-front publication costs can be eligible for reimbursement by the European Commission; or
- researchers will make their articles available through an open access repository no later than 6 months (12 months for articles in the fields of social sciences and humanities) after publication ('Green' open access)".

Advantages of using open access

- Scientific articles become available all over the world, in various formats (tex, pdf), by means of a system which is secured and rather stable technically (Ardelean et al. 2014);

- Scientific information spread becomes universal, which has an immediate impact on the author. The impact factor multiplies in the case of free access articles. Lawrence (2001) has proven that free access increases the number of citations. From the data presented, it is obvious that the higher the number of articles available on the internet, the higher the number of citations. Lawrence (2001) calculated the mean of offline article citations and the result was 2.74, whereas the mean of on line article citation is 7.03, which means a 157 % increase. Thus, not only dissemination but also the visibility of researchers and that of their institutions, increase. Later on, Moed (2005) confirmed that. In time, the number of studies in a certain field grows, numerous articles studying the relation between downloads and citations (Morrison 2012; Harnad and Brody 2004; Zhang 2006; Eysenbach 2006; Koler-Povh et al. 2014; Gunasekaran and Arunachalam 2014; Schlögl et al. 2014; Bazrafshan et al. 2015), most of which prove the increase of visibility. Furthermore, Public Library of Science One Journal shows that in 2013, over a million articles were downloaded every month, and, consequently, about 20,000 articles have over 10 citations.
- Free access facilitates connections among researchers, laboratories, allowing direct links through e-mail, and also group discussions based on materials available to everybody. If the case may be, the authors can modify the preprint or they can withdraw it from the scientific circuit. The articles are indexed and various connections among data bases can be made, considering common keywords, the same authors, the same topics etc.
- Archives constitute stores which memorise researches at much lower costs than those of the traditional journals and, even if there are journals that require a fee to grant access, institutions can afford the costs.
- The period of time necessary to perform peer-review evaluation is shorter for open access journals. We give the following examples: Molecules (the first decision within 24 days after submission), International Journal of Molecular Sciences (the first decision within 24 days after submission), Oxidative Medicine and Cellular Longevity (within 57 days till the publication), Journal of Analytical Methods in Chemistry (within 33 days), Neoplasia (within 21 days), Journal of Diabetes Research (within 45 days till the final decision), International Journal of Nanomedicine (within 17 days from submission to the first editorial decision) etc.
- Electronic publication is rapid and the distribution space is enormous compared to the space covered by traditional journals.
- The data presented on paper do not meet the handling exigency, especially when a lot of information needs to be analysed, assessed and processed.
- Reputed journals which publish according to the open access system don't sacrifice quality, a proof being their ratios of acceptance, defined as the number of articles accepted for publication related to the number of submitted articles. It ranges between 3 and about 70 %, similar to that of the subscription-based journals. Acceptance ratios considered high by the reader don't necessarily lead to the impact factor decrease, i.e. of the scientific impact, and, consequently, we haven't been able to establish a clear correlation between the acceptance ratio percentage and impact factors. Some examples referring to the acceptance percentage, according to the web pages of the journals under discussion, are presented in Table 1.

Acceptance ratios have been proposed as another objective method for measuring the journal quality, but they are an imprecise measure when they are applied to a single

Table 1 Acceptance percentage for some open access journals

No.	Journal name	Acceptance rate	Impact factor (J.C.R. 2015)	Publisher
1.	Oxidative Medicine and Cellular Longevity	50 %	3.516	Hindawi Publishing Corporation
2.	Advances in Astronomy	27 %	1.657	Hindawi Publishing Corporation
3.	Bioinorganic Chemistry and Applications	30 %	2.081	Hindawi Publishing Corporation
4.	International Journal of Analytical Chemistry	20 %	1.000	Hindawi Publishing Corporation
5.	Mathematical Problems in Engineering	41 %	0.762	Hindawi Publishing Corporation
6.	Journal of Diabetes Research	34 %	2.164	Hindawi Publishing Corporation
7	Sensors	46 %	2.474	Molecular Diversity Preservation International
8.	Molecules	46 %	2.791	Molecular Diversity Preservation International
9	PLOS One	69 %	3.234	Public Library of Science
10.	PLOS Medicine	3 %	14.429	Public Library of Science
11.	PLOS Biology	Rejection rates are high	9.343	Public Library of Science
12.	Scandinavian Journal of Work, Environment and Health	7 %	3.454	Nordic Association of Occupational Safety and Health
13.	BMJ Open	60 %	2.271	BMJ Publishing Group
14.	AMBIO	28 %	2.289	Springer Open and Royal Swedish Academy of Sciences
15.	Journal of Literacy Research	4.74 %	0.656	Sage

journal, without considering the field and its journals, or the method of evaluating the articles (blind review or editorial review) (Haensly et al. 2009).

- Open access publishing journals have the possibility to inform their readers and authors regarding article metrics. Thus, Public Library of Science established that the following article information is relevant for its journals: viewed, cited, saved, discussed, recommended.
- In order to argue in favour of their research, in their articles, the authors can use texts graphs, tables etc. taken from open access journals, citing the source, because the journals observe the Creative Commons Attribution Licence, CC BY NC ND 3.0 or CC BY 4.0 (Creative Commons 2015).
- The concept ensures free and easy access to scientific information and to the first line of knowledge to poor countries and institutions, which cannot afford to subscribe to the numerous journals all over the world. We refer mainly to the scientific information in

the medical and biomedical domains and also to the impressive number of open access journals (Kurata et al. 2013).

- The open access journals provide the students with a rich and relevant documentation, and represent a viable support in elaborating works and in performing researches, ensuring in this manner the instruction through and for scientific research.

The disadvantages of using open access

- The publication fees (article processing charges-APC) required for an article by journals are extremely high and poor institutions (universities, research entities) cannot afford to provide financial support to all potential authors (Manista 2012). Nevertheless, there is also the variant of paying the fees from the budget of research projects or grants. We also mention the praise-worthy case of the non-profit fundation Beilstein-Institut in Germany, who is the editor of two journals which are tax-free for the authors and their affiliations. Beilstein Journal of Organic Chemistry and Beilstein Journal of Nanotechnology are financed by the fundation.

The analysis of the fees shows a certain direct proportional relationship between them and the impact factor. Table 2 presents a list of the publication fees of some journals belonging to Hindawi Publishing and to Multidisciplinary Digital Publishing Institute, but also to other reputed publishers.

Some publishing houses make deductions for the authors from low-and middle-income countries and ensure publication fee assistance, e.g. Public Library of Science. Björk and Solomon (2012) establish correlations between citation averages for open access journals using article processing charges (APCs) versus those that are free to publish for authors, compared to impact factors for subscription journals and draw the conclusion that “APC funded OA journals” average impact increased markedly in the period 1996–2001 and to a lesser extent in 2002–2011, nearly reaching the same level as subscription journals at about 3.2.

- Publication fees resulted in the appearance of numerous journals, some being quite old, but which haven’t been able to impose themselves in point of their visibility and prestige, thus, not being included in Journal of Citation Reports.
- The researchers of the phenomenon consider that the peer–review process may undergo a decrease in exigency, the danger being that of lowering standards in favour of the profit (Kurata et al. 2013).
- There is also the opinion that open access does not determine an increase of the citation number (Craig et al. 2007; Davis et al. 2008; Davis 2009). Thus, Craig et al. (2007) show that the journals published according to the open access system can attract a higher number of readers, compared to subscription-based journals, but did not mention any advantage of open access regarding the number of citations during the first year after the publishing. The same conclusion is also obtained as a result of the analysis of a number of 36 journals, covering the biological, medical, and multidisciplinary sciences, social sciences, and humanities (Davis 2011). Craig et al. (2007) point in fact that, apart from the accessibility to the paper, the number of citations is also decisively influenced by the scientific quality of the work, through its relevance and importance.

Ennas and Di Guardo (2015) have analysed a set of 1910 gold open access journals, by using Scopus SJR2012, DOAJ data base, and data provided by previous studies,

Table 2 Some publication fees

No.	Journal name	Publication fees	IF (JRC 2015)	Editor
1.	Oxidative Medicine and Cellular Longevity	1500 USD	3.516	Hindawi Publishing Corporation
2.	Advances in Astronomy	1200 USD	1.657	Hindawi Publishing Corporation
3.	Bioinorganic Chemistry and Applications	1250 USD	2.081	Hindawi Publishing Corporation
4.	International Journal of Analytical Chemistry	1200 USD	1.000	Hindawi Publishing Corporation
5.	Mathematical Problems in Engineering	2000 USD	0.762	Hindawi Publishing Corporation
6.	International Journal of Endocrinology	1750 USD	1.948	Hindawi Publishing Corporation
7.	Sensors	1800 CHF	2.474	Molecular Diversity Preservation International
8.	Molecules	1800 CHF	2.791	Molecular Diversity Preservation International
9.	PLOS One	1350 USD	3.234	Public Library of Science
10.	PLOS Medicine	2900 USD	14.429	Public Library of Science
11.	PLOS Biology	2900 USD	9.343	Public Library of Science
12.	Journal of Psychiatry	1519 USD	2.32 (S.S.C.I.)	OMICS Group
13.	Neoplasia	2200 USD up 8 pages	4.252	Elsevier
14.	ChemistryOpen	2500 Euro	3.250	Wiley
15.	Beilstein Journal of Organic Chemistry	Free of publication charge (the journal is financed completely by the Beilstein-Institut)	2.762	Beilstein-Institut (a non profit foundation) Germany
16.	Beilstein Journal of Nanotechnology	Free of publication charge (the journal is financed completely by the Beilstein-Institut)	2.670	Beilstein-Institut (a non profit foundation) Germany

concluding that the factors that influence the visibility are: language, country, years of activity and years in the DOAJ repository, publication fee, field of study, whether the journal has been launched as open access or converted, and type of publisher.

Wray (2016) appreciates that for social sciences and humanities, there are no data that could lead to a decisive conclusion that open access determines an increase of the citations number. The author cites 15 studies on this theme, from which only 7 present open access as an advantage for the increase of the citation number.

An analysis of the bibliometric performances of the journals published by Hindawi Publishing Corporation and Multidisciplinary Digital Publishing Institute (MDPI)

Our analysis is focused on journals belonging to Hindawi Publishing Corporation and Multidisciplinary Digital Publishing Institute (MDPI) considered as illustrative models for open access.

Hindawi publishes 405 journals, in fields like medicine, science, technology, social sciences, among which 51 are indexed in Journal Citation Reports (2015) and 65 in Emerging Sources Citation Index (ESCI 2015). The latter corresponds to a noteworthy percent of 16.05 % from the total number of journals.

We consider as main journal performance the number of citations (that allows the calculation of some scientometric indicators). From this standpoint, we will representatively analyse the performances of the journals belonging to Hindawi Publishing Corporation indexed JCR with calculated impact factor, and that also have data referring to the number of cited papers on 3 years intervals for each paper, for the period 2008–2013, calculated by SCImago (see Table 3).

Multidisciplinary Digital Publishing Institute (MDPI) publishes 160 journals, among which 30 are indexed in Web of Science (28 in Science Citation Index Expanded, one in Art and Humanities Citation Index, and one in both Social Sciences Citation Index and Science Citation Index Expanded) and 51 in Emerging Sources Citation Index. One should remark the admission of 51 journals in Emerging Sources Citation Index, that represents almost 32 % from the total numer of journals, and 39 % from the total number of journals non-indexed in Web of Science (130). In Table 4, the main bibliometric performances of MDPI journals are presented. For the analysis, we considered only the journals for which data could be collected, on at least the last 4 years. The sources of these data are: Journal Database, citefactor.org, researchgate.net and SCImago Journal and Country Rank.

The data presented in Table 3 show:

- the number of cited documents is in general strongly related to the impact factor, although the number of cited documents does not represent the number of citations (a paper can receive more than one citation). So, if the number of cited documents increases, the impact factor will also increase and vice versa (see positions 2, 3, 4, 10 etc.);
- a mild increasing trend of the number of cited documents in time but also of the impact factor, can be noticed (see positions 4, 5, 9, 10, 11, 15, 18,19, 20, 22-25, 28-30, 35, 36, 42). This moderate increase can be explained by the enhanced visibility ensured by open access;
- the biomedical journals possess an increasing trend of the number of citable documents and of the impact factor (see 10, 18, 20, 35, 39 etc.);
- from the total number of journals subject to analysis, those exhibiting a decreasing trend with respect to citation performances is relatively small;

Table 3 The bibliometric performances of some journals belonging to Hindawi Publishing Corporation

No.	Journals, ISSN Online	Journals' percent of cited documents				IF/immediacy index				
		2008–2010	2009–2011	2010–2012	2011–2013	2010	2011	2012	2013	2014
1.	Advances in Astronomy, 1687-7977	43.18	43.81	37.18	29.03	–	–	–	1.328/ 0.130	1.657/ 0.143
2.	Advances in Condensed Matter Physics, 1687-8124	57.89	36.51	33.33	30.19	–	1.158/ 0.125	1.175/ 0.113	1.013/ 0.156	0.862/ 0.143
3.	Advances in High Energy Physics, 1687-7365	64.71	55.56	53.85	47.57	1.846/ 1.000	4.522/ 0.107	3.50/ 0.404	2.624/ 0.634	2.203/ 0.508
4.	Advances in Materials Science and Engineering, 1687-8442	20.51	28.41	36.87	34.81	–	0.415/ 0.088	0.500/ 0.108	0.897/ 0.081	0.744/ 0.085
5.	Advances in Mathematical Physics, 1687-9139	96.0	96.2	95.79	97.87	–	–	0.459/ 0.00	0.532/ 0.423	1.100/ 0.209
6.	Analytical Cellular Pathology, 2210-7185	62.96	68.52	59.14	46.99	–	0.917/ 0.042	1.771/ 0.342	1.758/ 0.00	0.846/ 0.026
7.	Applied Bionics and Biomechanics, 1754-2103	46.25	38.2	43.62	27.38	–	–	0.483/ 0.118	0.470/ 0.083	0.255/ 0.050
8.	Archaea, 1472-3654	73.81	59.18	63.51	56	–	–	2.545/ 0.115	2.027/ 0.310	2.79/ 0.833
9.	Behavioural Neurology, 1875-8584	50.39	48.31	56.14	57.96	1.304/ 0.077	1.770/ 0.206	1.247/ 0.333	1.642/ 0.623	1.445/ 0.143
10.	Bioinorganic Chemistry and Applications, 1687-479X	23.16	32.32	38.05	56.32	0.949/ 0.093	0.716/ 0.125	1.165/ 0.344	1.661/ 0.167	2.081/ 0.154
11.	BioMed Research International, 2314-6141	69.71	72.78	73.77	60.96	–	–	–	N.A./ 0.154	1.579/ 0.265
12.	Canadian Journal of Gastroenterology and Hepatology, 2291-2797	55.49	54.52	54.91	51.72	1.550/ 0.211	1.206/ 0.338	1.532/ 0.452	1.966/ 0.479	1.981/ 0.545
13.	Canadian Journal of Infectious Diseases and Medical Microbiology, 1918-1493	35.53	42.31	32.58	34.34	2.225/ 0.160	1.538/ 0.083	1.020/ 0.027	0.487/ 0.088	0.685/ 0.123
14.	Canadian Respiratory Journal, 1916-7245	45.31	48.3	47.55	43.81	1.347/ 0.457	1.556/ 0.204	1.286/ 0.365	1.663/ 0.234	1.163/ 0.327

Table 3 continued

No.	Journals, ISSN Online	Journals' percent of cited documents				IF/immediacy index				
		2008–2010	2009–2011	2010–2012	2011–2013	2010	2011	2012	2013	2014
15.	Computational and Mathematical Methods in Medicine, 1748-6718	43.94	46.15	50.93	45.25	0.814/ 0.250	0.684/ 0.136	0.791/ 0.317	1.018/ 0.068	0.766/ 0.038
16.	Computational Intelligence and Neuroscience, 1687-5273	61.64	61.46	60.55	61.11	–	–	–	–	0.596/ 0.030
17.	Discrete Dynamics in Nature and Society, 1607-887X	41.92	44.14	42.8	37.95	0.967/ 0.202	0.688/ 0.109	0.820/ 0.244	0.882/ 0.233	0.877/ 0.183
18.	Disease Markers, 1875-8630	66.52	71.49	72.87	69.62	1.723/ 0.143	1.642/ 0.112	2.140/ 0.198	2.174/ 0.155	1.562/ 0.240
19.	Evidence-Based Complementary and Alternative Medicine, 1741-4288	87.79	96.94	98.2	97.9	2.964/ 0.433	4.774/ 0.321	1.722/ 0.412	2.175/ 0.320	1.880/ 0.235
20.	Gastroenterology Research and Practice, 1687-630X	47.31	46.2	59.27	64.71	0.509/ 0.068	0.978/ 0.238	1.615/ 0.176	1.502/ 0.162	1.749/ 0.209
21.	International Journal of Antennas and Propagation, 1687-5877	45.83	49.18	44.72	43.95	0.500/ 0.00	0.468/ 0.00	0.683/ 0.134	0.827/ 0.108	0.660/ 0.098
22.	International Journal of Distributed Sensor Networks, 1550-1477	35.29	44.66	51.23	43.29	0.067/ 0.00	0.203/ 0.00	0.727/ 0.119	0.923/ 0.154	0.665/ 0.143
23.	International Journal of Endocrinology, 1687-8345	58.06	65.63	68.33	71.61	0.727/ 0.646	1.867/ 0.088	2.518/ 0.366	1.515/ 0.221	1.948/ 0.296
24.	International Journal of Photoenergy, 1687-529X	51.72	58.02	59.82	51.3	1.345/ 0.179	1.769/ 0.219	2.663/ 0.671	–	1.563/ 0.247
25.	International Journal of Polymer Science, 1687-9430	36.36	35.71	44.72	45.28	–	–	0.765/ 0.224	1.322/ 0.016	1.195/ 0.089
26.	Journal of Analytical Methods in Chemistry (Journal of Automated Methods and Management in Chemistry 1999–2011), 2090-8873	42.86	25.0	42.31	35.62	–	–	–	0.948/ 0.042	0.792/ 0.174
27.	Journal of Function Spaces (Journal of Function Spaces and Applications 2003–2013), 2314-8888	38.0	34.04	35.77	31.0	–	–	–	–	N.A./ 0.122

Table 3 continued

No.	Journals, ISSN Online	Journals' percent of cited documents				IF/immediacy index				
		2008–2010	2009–2011	2010–2012	2011–2013	2010	2011	2012	2013	2014
28.	Journal of Healthcare Engineering, 2040-2309	41.67	52.17	39.6	50.0	–	–	0.662/ 0.156	0.468/ 0.120	0.757/ 0.071
29.	Journal of Immunology Research (Clinical and Developmental Immunology 2003–2013), 2314-7156	74.19	83.07	75.85	74.74					N.A./ 0.321
30.	Journal of Nanomaterials, 1687-4129	49.19	46.30	48.40	50.92	1.675/ 0.237	1.376/ 0.263	1.547/ 0.193	1.611/ 0.181	1.644/ 0.195
31.	Journal of Sensors, 1687-7268	60.98	55.45	52.38	41.18	–	–	–	–	1.182/ 0.015
32.	Mathematical Problems in Engineering, 1563-5147	39.79	43.5	59.9	39.83	0.689/ 0.535	0.777/ 0.131	1.383/ 0.408	1.082/ 0.242	0.762/ 0.145
33.	Mediators of Inflammation, 1466-1861	77.47	77.69	75.87	77.71	2.059/ 0.197	3.263/ 0.173	3.882/ 0.175	2.417/ 0.312	3.236/ 0.310
34.	Mobile Information Systems, 1875-905X	87.5	76.67	73.33	58.33	1.325/ 0.111	2.432/ 0.167	–	1.789/ 0.105	0.949/ 0.00
35.	Neural Plasticity, 1687-5443	60.87	71.67	79.08	77.62	–	2.000/ 0.088	2.864/ 0.418	3.605/ 0.242	3.582/ 0.442
36.	Oxidative Medicine and Cellular Longevity, 1942-0994	74.55	73.43	78.48	79.92	2.468/ 0.553	2.841/ 0.053	3.393/ 0.290	3.363/ 0.250	3.516/ 0.452
37.	Pain Research and Management, 1918-1523	62.9	57.25	65.25	62.07	1.515/ 0.429	1.967/ 0.163	1.042/ 0.059	1.39/ 0.286	1.518/ 0.22
38.	Parkinson's Disease, 2042-0080	15.07	53.91	66.83	70.2	–	–	–	2.098/ 0.208	2.01/ 0.067
39.	PPAR Research, 1687-4765	71.43	57.98	59.64	78.42	2.727/ 0.173	1.559/ 0.00	2.685/ 0.293	1.644/ 0.719	2.509/ 0.333
40.	Science and Technology of Nuclear Installations, 1687-6083	30.48	36.26	27.33	32.26	–	0.562/ 0.027	0.283/ 0.100	0.343/ 0.058	0.627/ 0.122
41.	Scientific Programming, 1875-919X	56.14	69.23	58.18	47.27	0.600/ 0.077	0.967/ 0.667	1.036/ 0.368	0.667/ 0.077	0.550/ 0.00

Table 3 continued

No.	Journals, ISSN Online	Journals' percent of cited documents				IF/immediacy index				
		2008–2010	2009–2011	2010–2012	2011–2013	2010	2011	2012	2013	2014
42.	Shock and Vibration, 1875-9203	32.26	37.74	36.28	48.52	0.260/ 0.074	0.260/ 0.133	0.535/ 0.047	0.608/ 0.148	0.722/ 0.085
43.	Stem Cells International, 1687-9678	27.27	66.67	69.52	73.31	–	–	–	2.806/ 0.467	2.813/ 0.282

Table 4 The bibliometric performances of some journals belonging Multidisciplinary Digital Publishing Institute (MDPI)

No.	Journals, ISSN	Journals' percent of cited documents					IF/immediacy index				
		2010	2011	2012	2013	2014	2010	2011	2012	2013	2014
1.	Energies, 1996-1073	52.38	66.0	70.71	69.0	78.28	1.130/ 0.204	1.865/ 0.224	1.844/ 0.285	1.602/ 0.276	2.072/ 0.288
2.	Entropy, ISSN 1099-4300	56.34	60.18	60.98	63.41	63.95	1.109/ 0.345	1.183/ 0.311	1.347/ 0.275	1.564/ 0.280	1.502/ 0.295
3.	International Journal of Environmental Research and Public Health, 1660-4601	56.7	70.84	75.36	75.24	72.0	–	1.605/ 0.210	1.998/ 0.201	1.993/ 0.261	2.063/ 0.309
4.	International Journal of Molecular Sciences, 1422-0067	71.72	77.23	78.33	77.68	82.31	2.279/ 0.290	2.598/ 0.205	2.464/ 0.313	2.339/ 0.543	2.862/ 0.398
5.	Marine Drugs, 1660-3397	83.0	87.75	89.29	89.48	86.13	3.471/ 0.474	3.854/ 0.404	3.978/ 0.428	3.512/ 0.406	2.853/ 0.602
6.	Materials, 1996-1944	61.45	59.85	70.10	71.42	74.47	–	1.667/ 0.231	2.247/ 0.222	1.879/ 0.331	2.651/ 0.353
7.	Molecules, 1420-3049	70.78	75.59	78.27	76.5	77.50	1.988/ 0.362	2.386/ 0.325	2.428/ 0.329	2.095/ 0.315	2.416/ 0.307
8.	Nutrients, 2072-6643	–	49.55	73.68	78.8	82.42	–	0.676/ 0.293	2.072/ 0.137	3.148/ 0.435	3.044/ 0.376
9.	Sensors, 1424-8220	73.0	68.5	74.0	73.95	65.86	1.774/ 0.201	1.739/ 0.375	1.953/ 0.321	2.048/ 0.348	2.245/ 0.363
10.	Toxins, 2072-6651	–	52.9	77.55	82.69	82.37	–	–	2.129/ 0.261	2.48/ 0.516	2.938/ 0.583
11.	Viruses, 1999-4915	44.2	64.97	79.3	80.0	86.39	1.00/ 0.390	1.50/ 0.270	2.50/ 0.233	3.279/ 0.489	3.353/ 0.516

The data presented in Table 4 show:

- with few exceptions, the analysed journals present an increase of the cited articles percent in time (as the number of cited papers does not represent the number of citations).
- a dependence of the impact factor on the cited articles percent cannot be noticed in all the cases; nevertheless, in some situations the increase of the number of cited papers leads to an impact factor increase (for instance positions 8, 10, 11), but there are also cases when an increase of the number of cited papers is accompanied by a decrease of the impact factor.
- for the cases analysed, although the journals are open access, a significant increase of the immediacy index cannot be noticed. The latter varies within a relatively small interval ($\pm 0.1-0.2$).

The common elements present in the bibliometric analysis of the journals presented in Tables 3 and 4, are:

- the variation in time of the analysed bibliometric indicators is not great, and the noticed increases, when case, are relatively small.
- for the cases analysed, a general direct relationship between the number of cited papers and the impact factor, as well as beween the immediacy index and the impact factor, cannot be established.
- the performances of journals are not only ascribable to open access (visibility). As has been previously shown, the authors that have analysed the open access concept, proved that there are many factors, alongside visibility, that determine journal impact.

Conclusions

The debate on the topic Open Acces versus Non Open, though initiated about 10 years ago, continues up to now, resulting in many analyses and controversies. Most of the analyses point out the advantages of both authors and journals by increasing their visibility and impact. We agree that the higher the impact, in terms of the number of citations, the higher the visibility, and that open access ensures maximal visibility. Thus, there are many OA journals with rather high impact factors. At the same time, we should mention that there are also very many OA journals with a modest impact, referring to their number of citations in Google Scholar (through Publish or Perish), not to mention Web of Science citations.

Our analysis performed on several journals belonging to Hindawi Publishing Corporation and Multidisciplinary Digital Publishing Institute and following some bibliometric indicators, cannot precisely indicate whether the enhanced visibility provided by open access will lead to an increase of the citations number. We regard visibility as a necessary, but unsufficient condition for impact increase. Many researchers demonstrated that, apart from visibility, other elements influence the journals' impact factors, and in this respect, it can be considered that the quality of the presented research is decisive.

The two analysed publishers present an important number of journals that entered in Emerging Sources Citation Index (16 % for Hindawi group and 32 % for MDPI, calculated from the total number of journals), that proves that visibility can result, to a certain extent, in bibliometric performances.

As well, the open access to scientific literature constitutes a real advantage for students—especially those found in the stages of performing researches and elaborating works—therefore it contributes to their training.

In our view, the greatest disadvantage is represented by publication fees, called by some journals Article Processing Charges, which become higher and higher. Consequently, it is necessary to establish a balance among publication fees, acceptance percentage and JRC impact factor, together with the diminishing of publication fees.

At the same time, we propose that those authors who attract a significant number of citations of the journal should benefit from a discount on Article Processing Charges. The best reason is that such authors increase the value of the journal.

Irrespective of the article value, the editors should ensure an ever greater visibility of the journals, providing a competent and exigent peer review.

A European Commission Communication identified open access as a core means to improve knowledge circulation and thus innovation in Europe, and established a set of measures to be applied at European level (Communication 2012).

As Máire Geoghegan-Quinn, former European Commissioner for Research, Innovation and Science, stated "Putting research results in the public sphere makes science better and strengthens our knowledge-based economy."

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