Growing Trend towards Open Access Publishing at Global Level: An Analysis of Directory of Open Access Journals (DOAJ)

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ABSTRACT

Technology has revolutionized every sphere of human activity and so has it taken into its savvy the publishing world. Publishers are somewhat compelled to adapt to hybrid publishing techniques, whereby they have started offering both print and electronic format of published material, especially the way people have started showing keen interest towards the electronic documents. Increased demand for online electronic sources of information by netizens has given a good run to publishing houses to publish their documents in electronic format. Publishing scholarly content in the electronic format has gone one step ahead where it has switched over from closed format to open access. The present study has been undertaken with the view to assess the growing trend towards the open access publishing, whereby conventional means of publishing are being gradually overlooked by authors and good writers. The present study revolves round the data taken from Directory of Open Access Journals during the last decade, one of the largest open access databases which listed 8518 open access journals all over the world on its website in different languages and subjects on the day of data retrieved viz. Dec 31, 2012.

Keywords: Open Access (OA), DOAJ, Open Access Publishing, Open Access Journals, Online Documents, E-Documents, Netizens, Hybrid Publishing.

INTRODUCTION: - the concept of open access journals has come into being with the advent of technological boom whereby most of the activities and services which previously people used to undertake by moving from place to place or through conventional means, have got altogether transformed to online, and this won't have been possible had humans not exploited and embraced technology in its desired form. The concept of open access can be traced back to 1990[1] when people perhaps for the first time realized how technology supported by Internet can prove instrumental in publishing scholarly peer reviewed material free of cost.

Budapest Open Access Initiative (BOAI), Bethesda and Berlin Declarations are the founding grounds which came into existence only with the aim to advocate and emphasize on Open Access. This was followed by few more developments in the open access movement and the coming into being of Directory of Open Access Journals in 2002 was simply an outcome of first Nordic conference on scholarly communication in Lund/Copenhagen in October 2002 [2]. DOAJ became functional on May 12, 2003 with the launch of 300+ journals. Since the floating of idea and being instrumental in coming into being of DOAJ, Lund University since then has been playing a very vital role in hosting, maintaining and partly funding the directory covering free full text scientific and scholarly journals in almost all subjects and languages. Open access movement received further boost when people realized the need and importance of open access publishing and the need thereon to sensitize people by creating public awareness towards open access. This got supplemented with the monetary aid to the tune of 1.3 million dollars by Open Society Institute (OSI) in June 2004 and co-funded by SPARC [3].

Of the late, the concept of open access publishing has started receiving greater acceptance among the scholarly community; more and more journals have started making their content available free on web. It was in the year 2001 when scientific community realized the need and importance of open access publication which as a result received greater attention compared to print, distribution cum reach of published material or research output on net is far greater and wider. Suber 2003[4] is of the view that scholarly literature should be freely available online.

At the global level, more and more authors have switched over to open access publishing format thereby shunning the conventional methods of making available their scholarly work. Availability of content free of cost in itself has raised interest among information seeker towards the OA journals. More and more authors are citing open access journals in their work and above all people have started believing that in order to increase the outreach of their work it's better to make available research output free of cost to public. Open access has also somewhat weaned the interest among the younger generation towards the closed access documents.

Loan, Fayaz., et al (2008), in his study entitled 'Indian contribution to open access publishing: a case study of DOAJ and OpenDOAR highlighted about the trend of open access publishing in

India by evaluating the statistical data of DOAJ [5]. Von Paul Vierkant (2012) in his recent study entitled Visualizing Open Access; Global distribution of open access items discussed about the top twenty five (25) countries of the world contributing to DOAJ[6]. Solomon David J & BBo-Christer Björk, while analyzing the data of DOAJ discussed about the publishing fee in open access journals: source of funding and factors influencing choice of journal [7].

All these facts and many other similar things support present study to have an analysis of DOAJ data which on the data of analysis was hosting 8518 journals. The present study is also being under taken with the view to assess growing trend towards the open access publishing at global level. Open access has also opened up new vistas towards the publishing of greater amount of research output carried out at global level and making the same available to its seekers all across globe free of cost. Constant and continuous growth in publishing scholarly content in open access format advocates the authenticity and reliability of content being published through open access format.

REVIEW OF LITERATURE: - A good number of studies have already been carried out on open access publishing, most of these studies revolve round the quantitative measurements of the growth of OA publishing be it journals, the amount of articles published in these journals during a particular period and many more. Technology indeed has revolutionized every sphere of human activity and the boom in number of open access journals corroborates this fact. The increasing interest among the scholars towards open access publishing and the impact factor of these journals is more noteworthy.

Wells, A (1999) [8] the University of Sheffield, in his early and pioneering study conducted in 1998 on open access journals, compiled a list of 387 journals which on average used to publish 18 articles annually. Wells compilation proved very significant tool in furthering his research on open access, Gustafasson, T (2002) [9] in his study observed that nearly 50% of the journals compiled by wells were gone inactive.

Crawford, M (2002) [10] in his study on free open access journals while evaluating the data of Association of Research Libraries observed that nearly 85 scholarly refereed journals were

published freely. Crawford in his study observed that only 51% of these journals were published actively these he divided into two groups viz. journals with small success which steadily published around ten articles annually and strong survivors which published around hundred articles annually. The study of Crawford revealed that survival, sustenance and success of open access journals do depends upon various factors, firstly the acceptance and popularity of journal among good writers and the amount of research output these journals are able to let public access freely and in time. Secondly it is imperative that quantity of publishing is not itself going to guarantee the survival of journal unless it is not supported by the quality. Quality of the content published in a document is far more important that quantity.

Morris, S (2006) [11] in his study conducted on 1213 open access journals listed on Directory of Open Access Journals (DOAJ) [12] observed that on average each journal published 42 articles annually. Morris in her study do observed that a good number of journals which were not born open access but converted to later date. On the similar lines Björk, Roos and Lauri [13] conducted study on 100 open access journals from Ulrich web periodical database, the authors in their study observed that on average 34.6 articles are published annually by these journals. Dallmeier Tiessen et al. in their study conducted on SOAP (Study of Open Access Publishing) studied 2823 active English language journals in 2009 [14], the authors observed that on average journals published 43 articles annually.

Ware, M and Mabe, M (2009) [15] in their study the stem report - An overview of scientific and scholarly journals publishing observed that scholarly journals during the last three centuries have gown on a steady rate of 3.5% annually, while as articles have grown at the rate of 3%. This study is being seen important in the light of growing trend towards the open access publishing. Edgar, B and Willinsky, J (2010) in their study conducted on editors and the managers of the journals of Open Journal System (OJS) observed that although majority of journals on the OJS platform were born open access but a good number of journals who were either born as print or electronic with closed access have later turned to open access and only a meager 7% of them have uploaded their back issues to their archives [16]. With regard to ISI indexing of open access journal articles McVeigh ME (2004) [17] in his study observed that most of the ISI indexed

include the subjects categories like Medicine, Life Science, Mathematics, Physics and a few more science subject.

The open access model varies considerably as what should be made available freely and up to what extent. The Sherpa model of open access publishing provides the guidelines about the posting of articles mostly identified with different colours [18]. Now-a-days one can see even the articles published in closed access journals published in the electronic format are made available free of cost to public. This kind of growing trend can be seen with the publishers like, Springer, Wiley-Blackwell, Taylor and Francis, OUP, and many more. On the similar pattern Gold Open Access is about making available either whole of the content or part of it freely accessible to public. During the year 2008 nearly 8.5% of all the scholarly content was made available through Gold OA. Nearly 62% of all the Gold OA is Direct OA and nearly 14% content constitutes the delayed OA. Even authors or institutions can make available their content free of cost from the beginning by paying for it what is commonly known Hybrid OA which too constitutes nearly 24% of the total content [19].

On the similar pattern we have Green OA which is about self-archiving the work by author, which mostly consists of manuscripts of the pre-prints of the accepted work or even the actual published work. Authors can upload their works on their personal homepages or to institutional repositories. There are also subject based repositories where authors can host their work like, ArXiv covering a range of research topics; PubMedCentral hosts articles on Life Science and Biomedicine. In 2008 an estimated 11.9% of all the scholarly articles published were made available through Green OA [20].

NEED, PURPOSE AND IMPORTANCE OF STUDY:-Information seeking behavior of the public in general and academia in particular has changed significantly during the last two decades purely due to information Technology. Publishers are more or less compelled to switch over to e-publishing and this e-publishing has taken publishing one step farther, where scholarly published content is made available to readers free of cost in the form of open access journals. The increasing amount of research results published in the open access format for justified

reasons was taken into consideration to put forth the concept more clearly with some facts and figures.

The study is also important from the point of that there is constant and continuous growth in open access journals, the number of countries believing in open access publishing has increased considerably over the period of time. More and more journals which previously used to publish research results in closed access format have started switching over to OA format. All these things have definitely raised the questions over the existence of OA publishing format, the reasons of their increasing popularity and the purpose which these journals ultimately serve. The study is also intended to help further the investigation in future at any given point of time.

OBJECTIVES OF THE STUDY

The present study has been undertaken with the following objectives

- To find and understand the geographical distribution of Open Access Journals.
- Growth of open access journals at global level during the last decade
- New entrant countries contributing to open access publishing
- Major contributors to open access publishing
- To analyze frequency distribution of Open Access Journals.

SOURCE & METHODOLOGY:-

The study began with literature review on open access movement and to evaluate the growing trend towards the open access publishing services of Directory of Open Access Journals was used for accessing data related to the study, accessible at (http://www.doaj.org/doaj). Directory of open access journals database contained more than 8500 open access scientific and scholarly journals on the date, covering almost all the subject areas in major languages of the world. On the date of mining data from the directory, 8518 open access journals were registered with the said directory all across the globe. The data retrieved from the directory was put to excel format for better analysis and understanding to achieve the set objectives.

DATA ANALYSIS:-

Data analysis of the present study has been undertaken mostly by putting data to excel format for executing common operation like, addition, subtraction, drawing percentage etc. in case of table-1 and Table-2 percentage in parenthesis has been drawn by subtracting figures of corresponding year and in all cases the percentage has been drawn up to the two decimal places only.

Table-1 Growth of open access journals at global level during the last decade viz. 2002-2012

S.No	Total number of journals in DOAJ										
Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
No of Journals	34	552	1098	1661	2142	2679	3515	4272	5729	7264	8518
% age increase	(00.00)	(1523.52)	(98.91)	(51.27)	(28.95)	(25.07)	(31.20)	(21.53)	(34.10)	(26.79)	(17.26)

(Figures in the parenthesis indicate percentage)

During the analysis, it emerged that there is a steady increase in the number of open access journals as we progress form the year 2002 to 2012. During the year 2003 there is considerable increase in the open access journals when compared with the OA journals published during the corresponding year. During the year 2002 only 34 OA journals were published and the number increased to 552 OA journals during the 2003, an increase of over 1523%. Except for the year 2004, which showed growth of 98.91% from the corresponding year, the growth for the rest of period remained almost steady with the percentage increase of OA Journals ranging from 20 to 50 percent. From the figure-1, a steady increase in the journals can be easily seen, represented by the blue line and the red line representing the sharp increase in journals during the year 2003 and thereon a downward slope of the curve can be seen. The average percentage growth each year during the entire period was observed as 185.86%, which is almost an increase of twice the journals to that of newly introduced journals during the corresponding year.

Table-2 Year wise growth of newly introduced open access journals

S.No	Year wise growth of journals										
Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
No of Journals	34	518	546	563	481	537	836	757	1457	1535	1254
% age increase	(00.00)	(1423.52)	(5.40)	(3.11)	(-14.56)	(11.64)	(55.67)	(-9.44)	(92.47)	(5.35)	(-18.30)

(Figures in the parenthesis indicate percentage)

From figure-2 like in earlier analysis, in terms of percentage increase there is a sharp increase in the newly introduced Journals in the open access format during the year 2003. From 2004 onwards there is a mixed trend in the growth of newly introduced open access journals. The negative percentage growth was observed during the years 2006, 2009 and 2012. From the tabulated figures, the trend towards the growth of increase in the number of newly introduced open access journals from the year 2002 to 2012 is almost steady. Despite negative growth during the few years at almost regular intervals of time, the overall growth as we move from the year 2002 to 2012, compared to 34 journals introduced in the year 2002, 1254 journals were introduced in the year 2012. The average percentage growth each year during the entire period remained at 155.48%, which is almost three times increase in the newly introduced journals during the corresponding year.

Table-3 Country wise major contributors of newly introduced open access journals

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
No of Journals	34	518	546	563	481	537	836	757	1457	1535	1254
Major Contributors	U.S 16 (47.05)	U.S 197 (38.03)	Brazil 117 (21.42)	U.S 86 (15.27)	Brazil 51 (10.60)	U.S 87 (16.20)	U.S 177 (21.17)	U.S 105 (13.87)	U.S 159 (10.91)	U.S 217 (14.13)	Brazil 141 (11.24)

(Figures in the parenthesis indicate percentage)

In this tabulation, attempt was made to highlight year wise major contributors of newly introduced open access journals compared to newly introduced OA journals at global level.

From the tabulation and bar graph representation it is evident that US has been the leading country to introduce maximum number of OA journals almost every year except during the year 2004, 2006 and 2012 which were dominated by Brazil. Brazilian contribution to introduction of OA journals during the said years on average remained more than 14%. Dominance of US in introducing new OA journals is evident from the fact that during the year 2002 and 2003, US contributed more than 47% and 38% journals respectively. On average US alone contributed more than 20% newly introduced open access journals at global level during each year of its being major contributor to introduce new OA Journals. US and Brazil together introduced 19.99% OA journals on average during each year.

Table-4 Distribution of countries contributing to Open Access Publishing at Continental Level

Continent	No of Countries	No of Journals	%age country share	%age share in OA publishing	%age share at Global Level	%age share at Continental level
Europe	43	3165	35.53	37.15	22.16	91.48
Asia	34	1477	28.09	17.33	17.52	77.27
Africa	18	477	14.87	5.59	9.27	33.33
North America	14	1749	11.57	20.53	7.21	60.86
South America	10	1407	8.26	16.51	5.15	83.33
Oceania	02	243	1.65	2.85	1.03	14.28
					194 (62.37)	

(%age share at global and continental level have been drawn as per the figures available on world atlas website accessed on 10/12/2012 (total countries 194)

The present tabulation reflects the distribution of open access journals at continental level. As per the figures retrieved from DOAJ, 121 countries were contributing to open access publishing at global level, which constitutes 67.37% counties of the world, and the trend is going on to its progressive side. With this much number of countries believing in open access publishing itself means that the concept of open access publishing has received greater acceptance and no sooner the whole world may be seen contributing to open access publishing. From the tabulated figures and in the bar graph representation, Europe is the major contributor to open access publishing at

global level with 3165 journals constituting 37.15% share, followed by North America with 1749 journals comprising 20.53%. Asia with its 1477 journals constitutes 17.33% remains at third place followed by South America with 16.51% aggregating 1407 journals. Africa constitutes 5.59% share with its 477 journals followed at last by Oceania with 243 journals comprising 2.85% share.

From the percentage point of view at the country, continent and global level keeping in view the number of countries contributing from each continent, Europe leads the table with 43 countries, thereby constituting country share of 35.53% among OA publishing countries, global share of 22.16% and at continental level 91.48%. Europe is followed by Asia with 34 countries contributed to OA publishing, constituting OA country share of 28.09%, global share of 17.52% and at continental level 77.27 countries contribute to open access publishing. Africa with 18 countries contributing to OA publishing stands at third place, followed by North America with 14 countries, then South America with 10 counties and Oceania with 02 countries.

The interesting thing which gets reflected in this tabulation is that North America with only 14 countries constitutes 20.53 % of the total global OA journals with US as top most contributors from the continent. 37.62% of the global countries are yet to venture in to open access publishing, but with the increasing popularity to OA publishing these figures are likely to come down during the next couple of years.

Table-5 Countries publishing 100 and above Open Access journals

S.No	Name of the County	No of open access journals
01	United States	1270 (14.90)
02	Brazil	801 (9.40)
03	United Kingdom	575 (6.75)
04	India	463 (5.43)
05	Spain	442 (5.18)
06	Egypt	350 (4.10)
07	Germany	259 (3.04)
08	Canada	255 (2.99)
09	Romania	249 (2.92)
10	Italy	230 (2.70)

11	Turkey	210 (2.46)
12	Colombia	201 (2.35)
13	France	175 (2.05)
14	Iran	166 (1.94)
15	Poland	142 (1.66)
15	Chile	141 (1.65)
16	Argentina	134 (1.57)
17	Switzerland	134 (1.57)
17	Mexico	126 (1.47)
18	Australia	123 (1.44)
19	New Zealand	120 (1.40)
20	Japan	106 (1.24)
21	Rest of the world	1846 (21.67)

(Figures in the parenthesis indicate percentage)

Above tabulation is intended to highlight the world's top contributors of open access, publishing more than 100 open access journals. But putting the 100 OA journals criteria, only 20 countries could find their place among the top contributors of OA publishing. United States tops the list with its contribution of 1270 journals constituting along 14.90% of total open access publishing. US is followed by Brazil, United Kingdom, India, Spain, Egypt to Japan etc. contributing 9.40%, 6.75%, 5.43%, 5.18%, 4.10% with Japan standing at the bottom of the table with its contribution of 1.24% of total global OA publication. From the above figures it is apparent that world's top twenty countries contribute nearly 80% of the total OA publications and the rest of the world just 21.67%. 6672 journals are being alone published by world's top 20 countries constituting a share of 78.33% and the rest 101 countries contribute 1846 journals only having share percentage of 21.67%.

Table-6 Top contributors to open access publishing at continental level

Continent	**Africa**	**Asia**	**Europe**	**North America**	**Oceania**	**South America**
Country	Egypt 350 (4.10)	India 463 (5.43)	U.K 575 (6.75)	U.S 1270 (14.90)	Australia 123 (1.44)	Brazil 801 (9.40)

(Figures in the parenthesis indicate percentage)

To evolve the top contributors of open access publishing at continental level it was imperative to analyze the data at continental level. All 121 OA publishing countries were put to their respective continents to which they belonged and thereafter from each continent country contributing maximum number of open access journals with percentage share at global level was drawn. From the above figures it emerged that from Africa, Egypt leads the table with 4.10% contribution to open access publishing at global level by publishing as many 350 journals. From Asia, India emerged at top with 463 journals accounting to 5.43% contribution. U.K leads the table from Europe with 575 journals, as such contributing 6.75% open access publishing at global level. U.S with 1270 Journals leads the table from North America, accounting to 14.90% open access publishing. U.S not just leads the table at continental level but also at the global level with maximum number of OA journals. Form Oceanic only two countries contribute to open access publishing, both moving almost neck to neck, however it is the Australia which tops the table with 123 journals and thereby contributing 1.44% to OA publishing. Brazil from South America tops the table with 801 OA journals, contributing 9.40% to OA publishing.

Table-7 Year wise growth of countries entering into Open Access publishing at global level

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
No of Countries with %age increase	9 (0.00)	48 (433.33)	57 (18.75)	67 (17.54)	72 (7.46)	81 (12.50)	93 (14.81)	103 (10.75)	109 (5.82)	116 (6.42)	121 (4.31)

(Figures in the parenthesis indicate percentage)

The above tabulation is about the growth of countries entering into open access publishing on year to year basis. From the above figures and growth curve thereof, during the year 2002 only 9 countries used to publish OA journals. In 2003 the number grew to 48 countries an increase of 433.33%. Accordingly, new entrant countries during the years 2004, 2005, 2006, 2007 grew at the rate of 18.75%, 17.54%, 7.46% and 12.50% respectively. Towards the last quarter of the decade there is also steady growth of new entrant countries with percentage growth of 10.75%,

5.82%, 6.42% and 4.31%, observed during the years 2009, 2010, 2011 and 2012 respectively. On average new entrant countries grew at 52.37% per annum. On the whole from the year 2002 till 2012 there is a growth of more than 1244 % and looking at the trend lines the number of counties entering into OA publishing keeps on increasing while as the growth percentage trend is towards decline for the obvious reason as most of the countries have already joined the OA league.

Table-8 Year wise %age share of countries entering into Open Access publishing at global level

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
No of Countries	9	48	57	67	72	81	93	103	109	116	121
%age increase	0 (0.00)	39 (81.25)	09 (15.78)	10 (14.92)	5 (6.94)	9 (11.11)	12 (12.90)	10 (9.70)	6 (5.50)	7 (6.03)	5 (4.13)

(Figures in the parenthesis indicate percentage)

Analysis of Table-7 and Table-8 may appear similar, but when we minutely observe the analysis we can find how the two tables along with analysis and findings is considerably different. In this table analysis has been carried out for the percentage share of new entrant countries during the each single year. During the year 2002 only 9 countries were in OA publishing, while as during the year 2003 there were 48 countries an increase of 39 countries which as per above table constitutes the growth of 433.33%, but when we correlate things differently in terms of share of new entrant countries during that particular year it stands at 81.25%. The interesting thing about this tabulation is we get clear picture of the new OA publishing entrant countries. Accordingly, during the year 2004, 2005, 2006 and 2007 percentage share of the new entrant courtiers was 15.78%, 14.92%, 6.94%, and 11.11%. Similarly the share remained at 12.90%, 9.70%, 5.50%, 6.03% and 4.13% for the years, 2008, 2009, 2010, 2011 and 2012 respectively.

Table-9 %age increase or decrease in growth of countries with corresponding year entering into Open Access publishing at global level

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
No of Countries	9	48	57	67	72	81	93	103	109	116	121
%age increase	9 (0.00)	39 (333.33)	09 (-76.92)	10 (11.11)	5 (-100.00)	9 (80.00)	12 (33.33)	10 (-16.66)	6 (-40.00)	7 (16.66)	5 (-28.57)

(Figures in the parenthesis indicate percentage)

The table has been crafted to depict the year wise increase or decrease of percentage growth of new entrant countries when compared to growth of countries during the corresponding year. From both tabulated figures and the graphical representation, the growth during the years 2003 and 2007 remained at 333.33% and 80% respectively, which is highest during the entire decade. During the years 2004, 2006, 2009, 2010 and 2012 negative growth was recorded, which remained at -76.92%, -100.00%, -16.66%, -40.00% and -28.57% respectively. During the years 2005, 2008 and 2011 there was steady growth of increase in OA Journals which on average remained around 20.36%. From the tabulation and graphical representation, a mixed trend in the increase and decrease of growth of new OA entrant countries when compared to their corresponding year, while as on the whole average growth of OA journals with corresponding years from 2002 to 2012 remained at 21.22% which is quite encouraging.

CONCLUSION: - From the above analysis we can conclude that open access publishing has almost become the order of the day. Participation of more than 120 countries in the OA publishing, which constitutes almost two-third of the world countries, corroborates the fact that the trend towards OA publishing has already grown by leaps and bounds and is still on to make it a global order. Open Access publishing has in-fact opened up new vistas for publishing scholarly content.

While analyzing the figures of growth in open access publishing during the last decade, on average the OA Journals have grown at the rate of over 155% per annum with US and Brazil

the two largest OA publishing countries. This momentum of OA publishing was maintained by these countries during the entire decade and for that matter if we check the human development index of both these countries and US is far ahead of the rest of the world and Brazil is moving in at brisk pace to make it soon the developed country. Example of OA publishing as set by US and Brazil in turn should give insight to rest of the world about the advantages of OA publishing were by county and its countrymen can easily convert intellect into resources. We should not undermine the contribution of OA publishing in the growth and development of these two countries. To supplement this assumption we have got also the example of countries publishing more than 100 OA journals, which surely are the world's top 20 developed countries. Even at continental level, countries like, Egypt, India, U.K, U.S, Australia and Brazil the top most contributors to open access publishing form their respective continents are also equally developed nations, where Egypt and India can be easily seen progressing manifold day-in and day-out. On average new countries entering in to open access publishing grew at the rate of over 52% with considerable percentage of share in total open access publishing.

In all open access publishing has proved a great boon to both information seeker and its producers. Open access publishing has increased the frequency of publishing research results without any charges, which used to be missing in earlier or closed formats. The growing trend towards open access publishing is going to encompass entire globe by next couple of years. Unquestionable authenticity and reliability of these journals can be seen from the fact that most of these journals are peer reviewed with good impact factor. Research output has increased considerably; overcoming space and time constraints is one more added advantage of OA publishing with increased efficiency and greater satisfaction.

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