

## Equality, equity, and reality of open access on scholarly information

Jeong-Wook Seo<sup>1</sup>, Hosik Chung<sup>2</sup>, Tae-Sul Seo<sup>3</sup>, Youngim Jung<sup>4</sup>, Eun Seong Hwang<sup>5</sup>, Cheol-Heui Yun<sup>6</sup>, Hyungsun Kim<sup>7</sup>

<sup>1</sup>Department of Pathology, Seoul National University College of Medicine, Seoul; <sup>2</sup>Contents Platform Lab, Naver Corporation, Seongnam; <sup>3</sup>Department of Information Service, Korea Institute of Science and Technology Information, Seoul; <sup>4</sup>Department of Information Infrastructure, Korea Institute of Science and Technology Information, Daejeon; <sup>5</sup>Department of Life Science, University of Seoul, Seoul; <sup>6</sup>Department of Food and Animal Biotechnology, College of Agriculture and Life Sciences, Seoul National University, Seoul; <sup>7</sup>Department of Materials Science and Engineering, Inha University, Incheon, Korea

### Abstract

The current statistic data on the open access (OA) journals and institutional repositories show some successes and increased awareness on OA in Asian countries. There are several concerns, however, in regards to the access and use of articles by researchers together with the continued increase of libraries' expenditure for journals. In the present article we introduce five solutions in the global and local perspectives. OA2020 initiative is a global initiative to transform existing journals to OA. Although the practical process of OA2020 remains a challenge, the transformation will increase OA without significant increase of journals and budgets for publishing. The promotion of the local and Asian journals is the second big challenge. Because these local or Asian journals still have important roles in the local research community, they should keep current publishing model of OA at the low cost but with high quality and the better access. The restructuring of the current library budget is the third challenge. The budget for periodicals should be reduced and the saved budget can be used to pay articles processing charge for OA and for purchasing monographs. The fourth important issue is 'the digital blind spot at the young unemployed and retired elderly'. These groups of poorly supported and potentially important researchers have to be considered as a priority issue to the policies on OA and scholarly knowledge. Lastly, we believe there should be different needs for other activities: optimization of the searchable database, governmental policy on open science and international cooperation on OA.

### Keywords

Asia; Library services; Open access; Open science; Periodicals

**Received:** July 29, 2017  
**Accepted:** August 5, 2017

**Correspondence to** Jeong-Wook Seo  
[jwseo@snu.ac.kr](mailto:jwseo@snu.ac.kr)

### ORCID

Jeong-Wook Seo  
<http://orcid.org/0000-0003-0242-1805>  
Hosik Chung  
<http://orcid.org/0000-0003-2760-8369>  
Tae-Sul Seo  
<http://orcid.org/0000-0002-7391-7595>  
Youngim Jung  
<http://orcid.org/0000-0001-7924-6967>  
Eun Seong Hwang  
<http://orcid.org/0000-0001-8580-8444>  
Cheol-Heui Yun  
<http://orcid.org/0000-0002-0041-2887>  
Hyungsun Kim  
<http://orcid.org/0000-0003-1499-8484>

This paper was presented in part at the Korea-OECD Workshop on Open Science, on 30 June 2017 at Seoul and at the 4th Asian Science Editors' Conference and Workshop 2017 on 7 July, 2017 at Ho Chi Minh City, Vietnam.

## Introduction

A new approach should give a fresh boost to open access (OA), the unrestricted online access to scholarly research articles. This is the result of an international conference in Berlin, where a process was initiated to transform subscription journals to OA. The key to this lies in the hands of the scientific institutions and their sponsors: public resources that are currently spent on journal subscriptions would have to be converted into OA publishing funds [1,2].

The main message is to take coordinated efforts of researchers and researchers' organizations from all over the world to transform most of the current subscription journals to OA journals. This view is endorsed by European Union [3]. There are many supporting documents from Organization for Economic Cooperation and Development (OECD) [4], Global Research Council [5,6], the Universities UK OA Coordination Group [7], and Harvard University [8]. Although general understanding on OA and open science is not exactly matching with the proposed strategy by the Berlin initiative, there is a consensus to promote OA in more active manner.

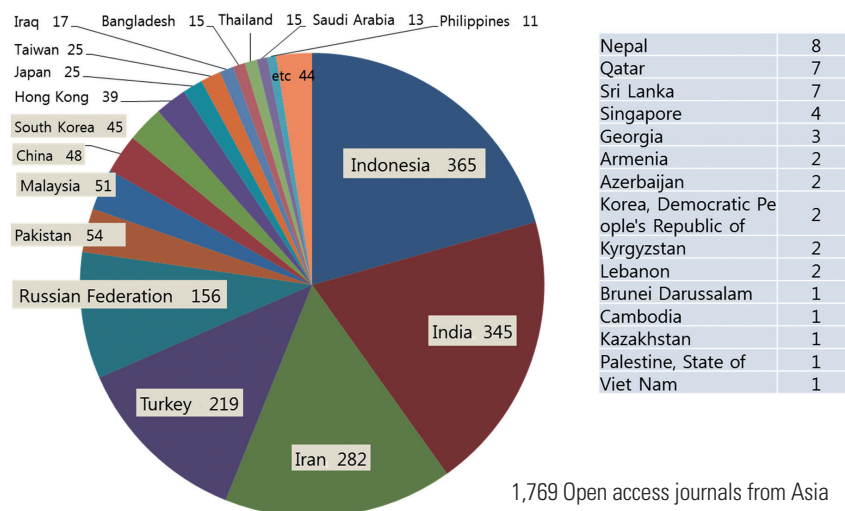
There are several practical concerns on OA when we consider the global and local research environments. The open science in a broader context is one of mega trends and OA, as well as open data, are keys to the open science [9]. As for the OA, there are so many different issues depending on their points of views. We now realize that OA is such a complicated task that previous activities and approaches were far from enough and accurate [10,11]. The promotion on the local journals published by local scientific societies is a major source of the dilemma in many Asian countries. Expansion of

journals and articles in international journals both by OA and subscription type journals is one major cause of difficulties by editors of local journals [12,13]. More practical issue for most libraries lies on the budget for the subscription of serials. A rapid and continuing increase of the serials expenditures is an overt issue but there are several hidden problems such as articles processing charges, expenditure for monographs and future budget plans. We could also find the issue of equity issue for local researchers on their access to the scholarly information. One recent study disclosed that we, authors at Seoul National University, published more in the OA journals than the global average but the citing references in our papers was much lower for OA journals than conventional subscription journals [12].

In this review, we would like to discuss the background information on the recent development of new concepts of OA in global and local perspectives. Furthermore, we would like to provide some strategies to promote open culture on publication and scientific research. Our particular interests are on the equity issue on the access to the scholarly information.

## General Understanding of OA in Asia

OA movements have been in two major directions; one to publish OA journals and the other OA repositories [7,14]. Publishing model of OA articles was mainly by launching new OA journals but the hybrid model was an alternative way to publish OA papers in the subscription journals by paying additional processing charges for the article. Series of so-called successful OA journals are founded, being PLoS, Hindawi, and BMC. There are much more examples of gold



**Fig. 1.** Numbers of Asian journals listed in the DOAJ (Directory of Open Access Journals) by countries.

OA journals and some of them are registered to the Directory of Open Access Journals (DOAJ) [15,16] after review process of DOAJ. Indonesia, India, Iran, Turkey, and Russian Federation are major OA publishing countries in Asia in the directory (Fig. 1) [17,18]. It has to be reminded that these results do not represent factual numbers of journals because the adoption rate for DOAJ and the attitude of editors to the DOAJ are different. Numbers of journals by Asian countries in the Web of Science database (Science Citation Index Expanded + Social Sciences Citation Index) show Japan, China, Russian Federation, Korea, and India as top five countries by the numbers of journals (Fig. 2). It is also reminded that journals indexed by these databases depend on the policy of these companies [19].

There is also a trend for subscription journals to produce

many new daughter journals so that the number of published articles from the OA together with the subscription journals increased rapidly.

The OA repositories are constructed by many institutions and they became popular through the D-space technology and Google Scholar. Numbers of institutional repositories in Asian countries show Japan, Turkey, India, Taiwan, and Indonesia as top five countries (Fig. 3).

### Partial Success of OA through the Gold and Green Roads

There is no doubt that new OA journals contributed to the better accessibility of scholarly information at least for articles

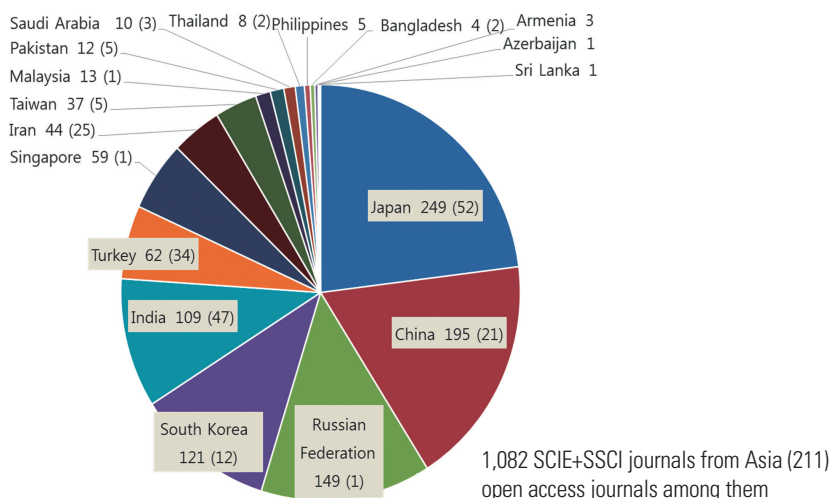


Fig. 2. Number of Asian journals listed in the Web of Sciences Science Citation Index Expanded (SCIE) + Social Sciences Citation Index (SSCI) by country based on Journal Citation Report 2015.

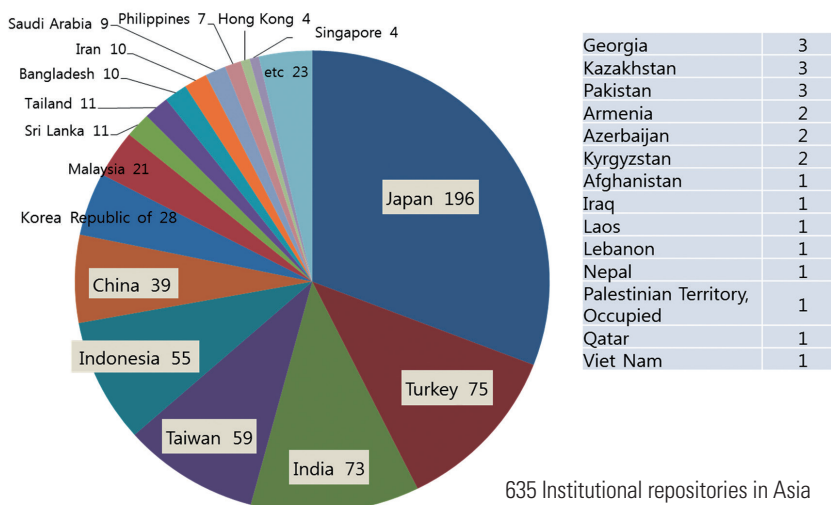
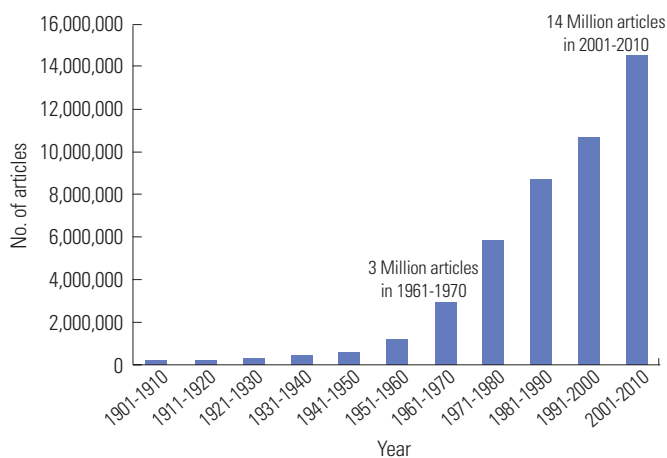
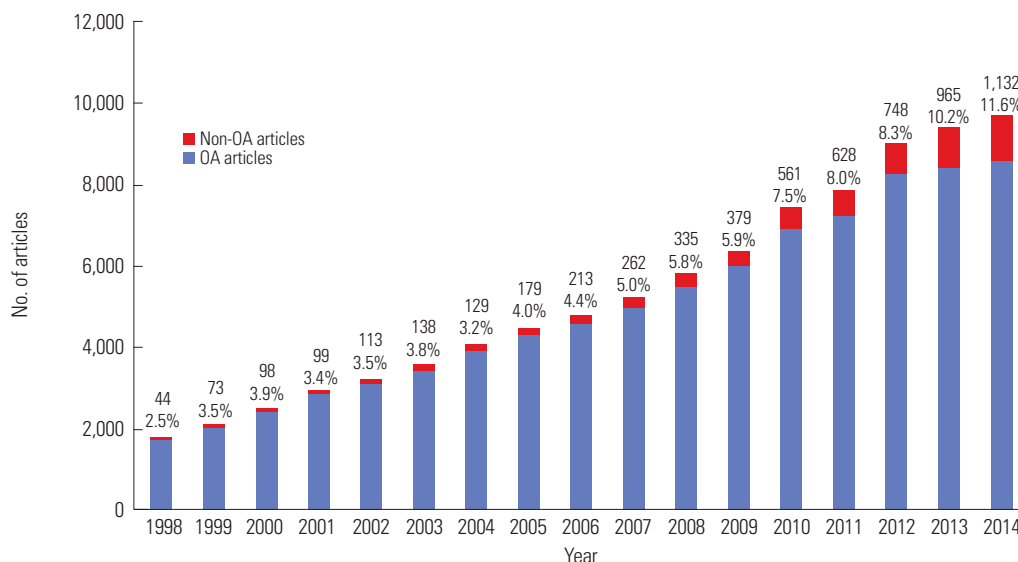


Fig. 3. Numbers of institutional repositories in Asian countries.

available through those journals [20,21]. But we have to evaluate the availability based on two factors: one is the absolute number of articles available free and the other is the proportion of these free articles relative to the total number of scholarly articles produced. We could produce a chart on the increase of the absolute number of articles produced during 10-year periods from 1901 through the Web of Science database (Fig. 4). We could also produce numbers of articles published in the gold OA journals and non-OA journals by researchers at Seoul National University as an example (Fig. 5). We understand that there are three main causes of the growth of total published articles: 1) the growth of research capacity by re-



**Fig. 4.** Numbers of articles indexed for 10-year periods from 1901 to 2010 by Web of Science.



**Fig. 5.** Numbers of articles published by researchers of Seoul National University in the gold open access (OA) journals and non-OA journals in years from 1998 to 2014.

searchers, 2) the technical development to produce more articles in low cost by publishing companies, and 3) the technical development of database management to accommodate more articles in the index. Through an evaluation on the proportion of OA articles published relative to the total number of articles, we could understand that the growth of non-OA articles is larger than the growth of OA articles. For instance while the number of articles and the proportion of OA articles increased, the increase in the number of non-OA articles is bigger than that of OA articles. The non-OA articles are still a majority of the literature for research scientists. The current OA movement alone was not successful to convert the existing subscription-based to OA journals [2,12].

Those subscription-based journals remained significant resources for information for researchers and there are more journals founded as new subscription-based journals. These new journals (either OA or subscription-based) together published new articles and it became a major increase of the amount of scholarly information. Two immediate results of the increased number of published articles are the financial burden to the library by subscribing new journals and the quality issue of these new journals [22]. Peer review process is often simplified in this era of journals overload. In addition, bibliometric indicators of research outcomes are distorted. The impact factor, for example, has different meaning due to imbalance and distortion among disciplines and expansion of articles [23]. Authors felt easier to publish their researches and they are open to temptation for duplicate or redundant publication. Publishers find it easier to produce more revenue by

publishing more articles in their journals. One of the extreme cases so-called predatory OA journals which are journals published only to make money by publishing articles without proper review processes.

The green roads, institutional repositories, could help articles accessed easily through Google Scholar but that did not make significant value to the publishing environment.

### Critiques on the Evaluation of the Research

The ultimate purpose of the journal publishing is to support the researchers for their knowledge sharing and production. Digital transformation influenced a lot and there are many positive effects for better productivity in the research. The publication issue is an exceptional case among those by digital transformation. Publishing journals have been contributed a lot to the research community and research scientists are very much proud of publishing their articles in the traditional journals. In general researchers have not paid attention to the economics and costs for their publishing.

There has been a strong tradition to review every available literature before they produce a new addition to the existing knowledge pool. Researchers, therefore, invested enough time and resources to get access to the literature even before the digital era. Researchers still think every literature has to be available at the library for their research. Two big changes are the rapid growth of the amount of information and the search and access to the full text became very easy unless there is an intentional block to this access by publishers. These changes gave researchers dilemma on whether to review all of them or review only a selected part of the literature. A very similar response took place by librarians. Libraries at universities tried hard and invested much to get access to the every available information so that researchers can review them all. But now it became not easy if not impossible to make all available at the library. So it is inevitable to select some of the e-journals to be included in the subscription journals list. Even more is that researchers don't like to have too much information. The current optimized approach on the information access is not a thorough comprehensive review but a selective process.

The number of published research articles has been the absolute indicator of good researchers particularly when they produce articles in a journal with a high impact factor. This tradition contributed to the increase of published articles and journals. More articles and more references produced an inflation of impact factors and the number of published articles and the impact factor of the publishing journal became a less credible indicator of a good research [24]. So the current evaluation strategy for researchers has to be changed from the number of SCI articles to quality of individual articles.

The library budget in this era of limited access to scholarly information is to be optimized. A traditional concept was that good libraries spent more money to get more information resources. Now the libraries have to be evaluated for the optimal acquisition of resources on both subscription-based resources and OA resources. The library budget in some cases can be reduced, which could be used to buy monographs for the missing library collection.

### Berlin OA 2020 Initiative

There are several baseline studies on the access of the scholarly information by United Kingdom [7,25]. The main concept of the Berlin processes introduced in 2015 was to transform existing subscription journals to OA. A fact-based rationale for the large scale transformation of the current subscription journals to OA is described in detail by Schimmer et al. [2]. In this strategy, the subscription budget is to be transformed into article processing charges paid by authors or their institutions. Key issue then will be the negotiation with publishers on the article processing charges for articles from each journal. Since the scientific publishing is a truly international activity, countries over the world should work together to solve issues related to journals publishing. Increasing proportion of OA is the key indicator of success but it was stationary at levels 5% to 10%. The transition of existing subscription journals to OA is the important and urgent strategy to stop the unwanted growth of published articles. Restructuring business models of journals and decreasing the number of journals are inevitable to keep the high quality of research papers in journals.

International collaboration is necessary for this negotiation. The initial step of this transition is to collect signed 'Expression of Interest: EoI' to make coordinated negotiating power against publishers. Five steps of action plans are framework, analysis, organizing, negotiation, and sharing. The sum of the budget paid by libraries for subscription is compared with a calculated sum of article processing charges of current articles in subscription journals. In addition, there are several ancillary processes necessary to make OA real [26-28].

### Local Journal and International Journals

Every academic and scientific societies have some intentions to publish a journal as a group product [29]. Publishing activity can be an indicator of academic excellence of the society [30]. The main target of authors and readers of the journal is the member of the society. This traditional role of a journal became less important by the advent of global communication and easy travels. But these local journals are still important nursing gardens for local researchers and, therefore, gov-

ernment should support these local academic activities. This is particularly true for academic societies in Asian countries. The national societies in these countries have long history of development but they are now challenged by international societies mostly based on the Western countries. Those local societies and local journals are important resources for their own research activities and these journals are the main resources to cultivate their academic activities.

The Korean Council of Science Editors [31] and Korean Association of Medical Journal Editors are associations of editors of local journals doing their best to improve their journals [32]. Similarly the Council of Asian Science Editors and Asia Pacific Association of Medical Journal Editors play a role on the regional international collaboration of scholarly journal publishing [33,34].

There is a trend to publish their research papers in the international journals. In 1995, for example, researchers at Seoul National University published 3,320 articles in 968 journals. Articles in Korean journals were 2,449 in 538 journals (74% by the number of articles). In 2014, the number of published articles grew to 9,082 articles in 3,308 journals. Articles in Korean journals were 2,155 in 733 journals (24% by the number of articles) (Fig. 6). This change is related in part to the growth of research outcome of the particular university but the other view is to find a relation to the increase of published articles in the world. Both international and national journals increase but researchers at Seoul National University published more articles and more to the international journals.

The case study of research activities at Seoul National University shows a tendency to publish in international journals but this does not mean that the national journal is less valuable in the country's perspective. There are some positive im-

plications for local journals and they have to be considered as nursing journals for young researchers in Korea. It is however also important to have local journals to get better competitive power to other journals. National or Asian journals have to be friendly more to both authors and readers. Editors' contribution to these journals is more to improve the quality of submitted articles than to select better articles. The biggest value to national or Asian journals is from authors and readers not from publishers. National or Asian journals should keep current publishing model of OA at the low cost but with high quality and better access. Strategic collaborative publishing among national or Asian academic societies is one solution and increased activities of editors of these journals will be the fundamental to this collaboration.

### Restructuring of Libraries' Budget is Necessary

The advance of information technology and the adoption of e-journal publishing were big challenges and chances for libraries and librarians [35]. The acquisition of electronic resources of books, e-journals and databases became an important role of librarians. Librarians select e-resources for user groups of the libraries and link those resources (purchased or freely acquired) to the user-friendly portals. It was rather an unexpected incident for librarians to see the rapid increase of the subscription cost of e-journals. Most of scholars and librarians at the early phase of e-journals expected to decrease the subscription cost of journals due to the advance of information technology [36]. Interestingly and unexpectedly the reality was completely the other way. The speed of the increase of the cost was so rapid that libraries could not react properly but they just struggled to find more budgets.

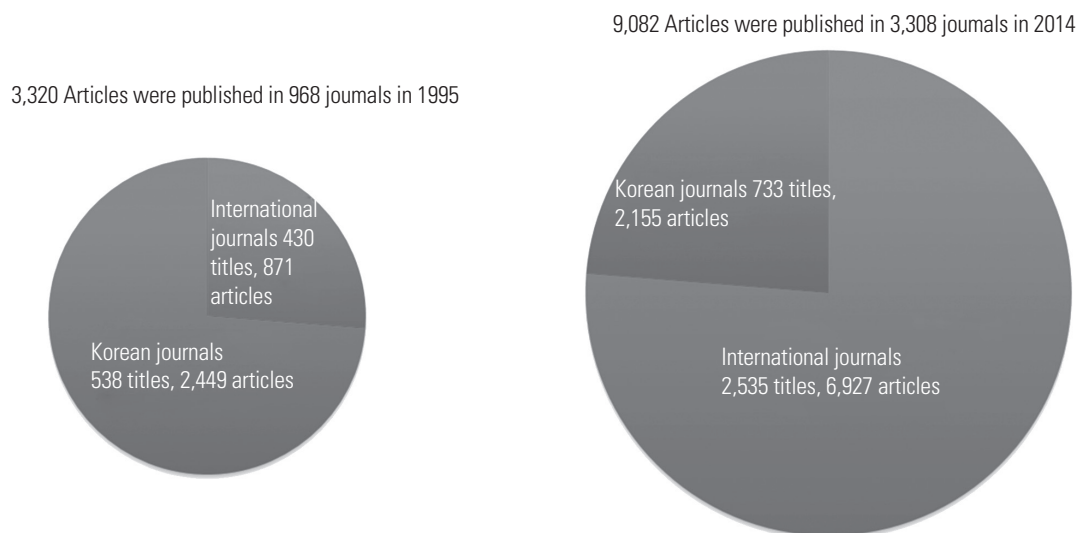
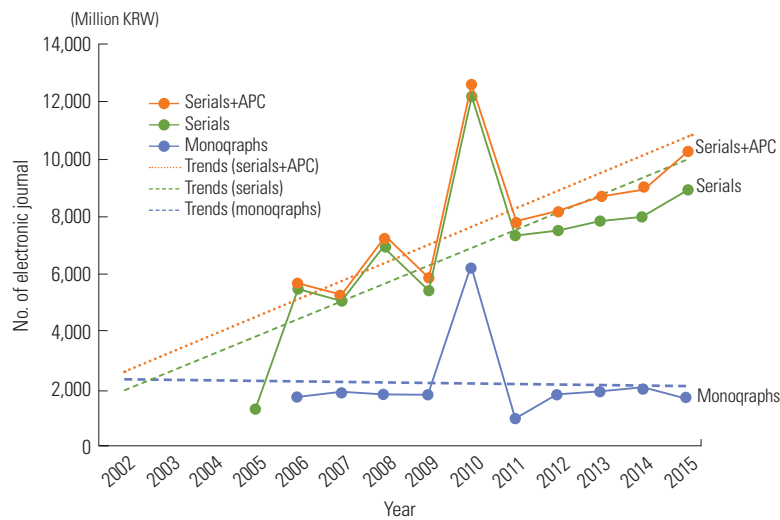


Fig. 6. Numbers of articles and journal titles of the published research papers by researchers of Seoul National University in 1995 and 2014.



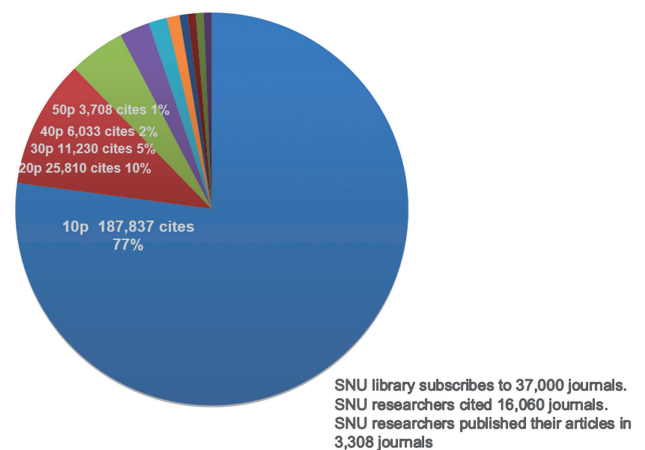
**Fig. 7.** Serials, monographs expenditure and sum of serials and article processing charges (APC) for open access article publishing at the Seoul National University Library in 2002 to 2015. KRW, Korean won.

OA was one of the reasonable approaches for librarians to combat the rising cost of libraries. By making OA journals they expected to decrease or at least slow down the rising cost of e-journal subscription. The reality is again completely the other way. There was no stop in the rising cost of the e-journals. From the expenditure trends in Association of Research Libraries libraries during 1986 to 2012, we could see no change of the increase of the journal cost by the intervention of OA in 2002 [37].

The crude data from the Seoul National University Library also show a similar pattern of the increased expenditure for serials whereas the expenditure for monographs remains constant (Fig. 7). Recent increase of articles published at OA journals produced an additional burden to the university budget because the sum of article processing charges of articles at OA journals became significant (Fig. 7).

Libraries and librarians in the traditional system were knowledge managers and they paid much attention to neither the budget of the library nor the budget of a research grant. During recent 20-year periods libraries and universities did not have enough time to re-thinking the library budget. They just struggled to find the budget to fill the blank. Excessive obsession with the subscription to periodicals has led to the reduction in spending monographs. This trend was universal to most research libraries.

We conducted an analysis of published journal titles on the 266,447 references from 7,433 articles in Science Citation Index journals published by Seoul National University researchers in 2014. A total of 92% (243,622) were journal articles, followed by monographs (15,420; 6%), proceedings (1,362; 2%) and others (thesis, patent, etc.; less than 1%). Those cited



**Fig. 8.** Analysis on the diversity of journal titles of cited references from 7,433 articles in SCI (Science Citation Index) journals published by researchers of Seoul National University in 2014. A total of 16,060 journal titles were ever used in the references of published articles but the library subscribes 37,000 journal titles. SNU, Seoul National University.

journal articles were from 16,060 journal titles. A total number of citation from top 10% of 16,060 journals were 187,837 cites occupying 77%. Next 10% occupied 10% (25,810 cites) followed by 5%, 2% and 1% (Fig. 8).

The diversity of journal titles of the published articles by researchers of Seoul National University was 3,308 journals. A total of 7,433 articles from 3,308 journals cited 243,622 references from 16,060 journal titles. The library of the same university subscribes 37,000 journals.

If we compare the current library budget with that of 20 years back, there is a tremendous difference and we have to

admit the current budget is extraordinary. The future system is expected to become worse than now. Libraries and librarians have to think about what they missed during 20-year-periods. More and more money to purchase serials and no money for monographs and others. It is time to think about restructuring the library budget or thinking back to the system before this inflation happened.

## Equality, Equity, and Reality

The digital library system supplies on-line journal articles on their desk top or mobile devices for those users supported by the library system. When a big university or a big company pay subscription fees, the digital library is a perfect solution. Most users from universities and large companies do not realize that someone paid the great big money for the subscription to support library users. A dramatic change happens when they are disconnected from the library after the change of their position. Student after graduation is one example. Then they realize that they are not in the institution-supported library system and they often use libraries in an unauthorized way such as borrowing the id and the password. After they find a job, they will use a new library system but with much less convenience. Those after retirement from the company or university are experiencing the same change. Those researchers from small companies, an unemployed person, those graduated the university, those retired from their job have no right to access the scholarly information which was bright and brilliant services in the digital era.

We recognize that this discontinuation of the access to the scholarly information is a cutting cliff for the young unemployed or the retired elderly. Because they enjoyed a very good access just before their graduation or their losing jobs, their separation from the knowledge resources is a critical discrimination issue for them. They have no access to knowledge to keep their capacity; they have no longer treated as a knowledgeable human being.

The current digital library system is very good for those in big companies and big universities but bad for those in small companies. Those unemployed young and retired elderly are 'digital blind spots' and they have no access to subscription-based information system. The famous cartoon by Story in Pictures [38] explains equality as giving people the same thing/s and equity as fairness in every situation. The reality of the digital library system is better supporting those with good research environment (Fig. 9A). The solution will be giving more support and reduce the barrier so that everyone can enjoy scholarly information (Fig. 9B). OA can increase access to the scholarly information to everyone but if the information is overload with full of junk papers without significant peer

review processes the audience will leave (Fig. 9C).

Immediate measures should be undertaken to solve this equity issue. Alumni membership or a subscription package for individual users could be a temporary solution which allows access to subscription-based journals for those who pay an annual membership fee. Extended coverage of OA journals will be a definitive solution for this equity issue.

## Other Activities

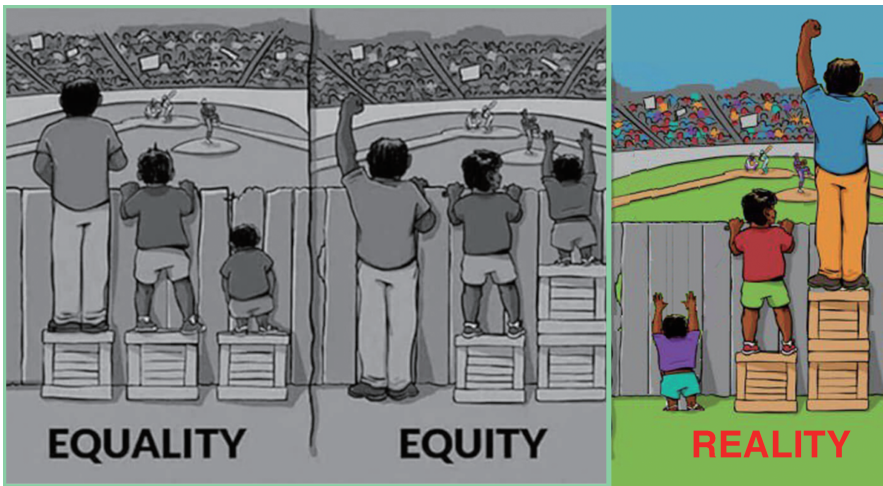
In this era of digital technology, search database should be produced as a common resource rather than individual libraries produce their database as was the case in the analog age. The optimization of the searchable database became a role of the society, community or the nation. In Korea, we have nationwide academic databases, National Digital Science Library by Korea Institute of Science and Technology Information [39] and Naver Academic by Naver Corporation [40], with a coverage for data on the local and the global journals and articles together. This expanded coverage is useful not only to find some articles but also for analysis and finding linking relations among these research articles. Continuous growth of the database is expected not only in the amount of data but also in the quality and functionality of the service.

One of the benefits from the nationwide database with extended global coverage would be to produce 'a library specific database' for accurate measurement of the demand of researchers of the university or institution, i.e. the analytical data on the cited references of articles produced by researchers in the institution. Databases available free on internet (Google Scholar, Naver Academic) and social media can be used for this analysis and these databases are strong supporters of OA articles better searchable and more valuable. Availability of local articles in the global databases is the key advantage to the scholarly databases (Web of Sciences, Scopus, etc.), which supports equity in access to articles from low impact, local journals.

The roles and responsibilities of the governmental policy makers and research funders are important. Their action plans are documented by OECD and Global Research Council. Problems exist however that the governmental actions by many countries are seemingly slow and bewildered. Active roles by governmental officers will help research and analytical data can be produced if the scholarly people, libraries and governmental institutions work together.

Lastly, it should be emphasized that the international cooperation is important on OA. Global nature of the research, research papers and their journals is the reason why the globe should work together.





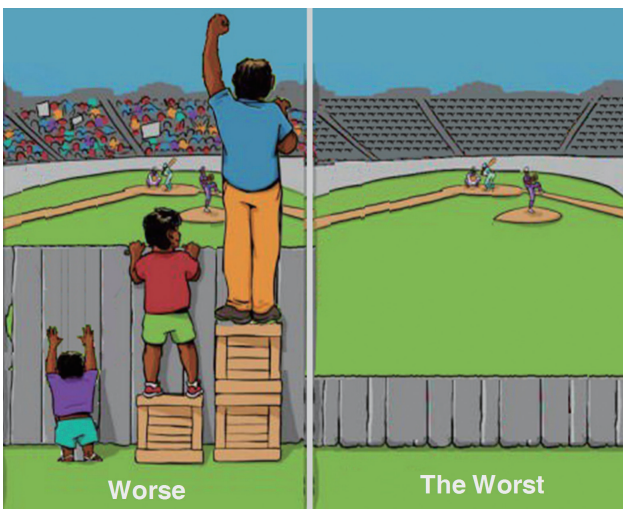
Equality, Equity: By Story in Pictures @storyinpicture <https://t.co/52oRXpCQag>  
 Reality: Modified by Kyeonghee Seo @kheees from original cartoon by Story in Pictures

**A**



Modified by Kyeonghee Seo @kheees from original cartoon by Story in Pictures

**B**



Modified by Kyeonghee Seo @kheees from original cartoon by Story in Pictures

**C**

**Fig. 9.** (A) Equality is giving people the same thing. Equity is fairness in every situation. The real situation is giving people different things to exaggerate the differences. (B) The issue is about the barrier and the support. Reducing the barrier and increasing the support can improve the situation. (C) If we do not intervene this digital divide on the access to the information, the future system will be the worst and users will no longer use the information [38].

## Conclusion

An increase of the number of research articles is overwhelming and this increase is partly due to the real increase of research products. The increase is also indebted by the advance of the digital technology which helped researchers write more papers, and stimulated publishers to publish more. These technical innovations on the scholarly articles have many positive values but there are some critical adverse effects.

Absolute increase of research articles itself has produced some burdens to researchers and research institutions. Researchers are suffering from too much to read and institutions are demanded by rapid and uncontrollable increase of the total publication costs: the sum of subscription fee of the library and the article processing charges for OA publishing. Over production of articles could compromise the quality and ethics in research and publication. OA was invented as a solution of the issue but it is now proven to be an incomplete solution.

We could summarize five groups of intervention necessary to the current publication overload. The first is the transformation of existing subscription journals to OS journals. The OA2020 is an ambitious initiative to stop publication expansion and to reduce publishing costs through this transformation process. Multinational and multidisciplinary collaboration is crucial to negotiate with publishers.

Editors and publishers of low impact local journals now get critical challenges because authors hardly submit their research articles to local journals. The increase of journals on both OA model and subscription model opened the acceptance gate too wide. Considering the special role of local journals in their local research environment, it should be encouraged to have authors submit to local journals and readers to use them. This support on local journals will help developing countries to build up their science and to reduce the gap between researches in developed and developing countries.

The library budget is now to be restructured or redistributed so that the current over-expanded budget for periodicals should be reduced. The surplus budget can be reused to pay article processing charges for OA publishing, to purchase monographs and to pay other ordinary expenditures of the library. The selection of journals for subscribing package become more important role of librarians. Their selection should be based on the researchers' interests not be influenced by the interests of publishers.

There is an important equity issue on the access to the scholarly information for those groups of poorly supported or potential researchers. They are the young unemployed after their graduation from the university and waiting for employment. The retired elderly also have a similar situation that they enjoyed scholarly knowledge when they were users of big

corporations. 'The digital blind spot of groups of young unemployed and retired elderly' are of important consideration because they are potentially important researchers. The equity issue within the country has to be considered as a priority issue to the policies on OA and scholarly knowledge sharing.

There are other activities necessary to promote OA. One is the production and use of database. Without searchable database the articles will no longer be used by scientists. The availability of database for extended coverage of local and global research papers is a crucial element of research infrastructure. The roles and responsibilities of the governmental policy makers and research funders are straightforward because OECD and Global Research Council have already agreed on the strategy and action plans on OA and their documents are available. In addition, international collaboration is particularly important for OA and open science.

The ultimate goal of OA is to make significant proportion of up-to-date, global/local, sound research articles searchable and accessible. Every endeavor has to be focused on researchers in a broader sense, which includes 'the digital blind spot of groups of young unemployed and retired elderly' and any potential researchers.

## Conflict of Interest

No potential conflict of interest relevant to this article was reported.

## Acknowledgments

This work is a product of collaboration and discussion among many scientists, editors of journals, copy editors, librarians, information scientists, and policy makers. Only a small number of participants are included to authors but there are many others contributed. Authors acknowledge their contribution in many different ways.

## References

1. New momentum for open access: Berlin Conference on the reorganisation of funding models for scholarly journals [Internet]. Berlin: Max-Planck-Gesellschaft; 2015 [cited 2017 Aug 1]. Available from: <https://www.mpg.de/9789484/berlin12-open-access-2015>
2. Schimmer R, Geschuhn KK, Vogler A. Disrupting the subscription journals' business model for the necessary large-scale transformation to open access: a Max Planck Digital Library open access policy white paper [Internet]. Max Planck Digital Library; 2015 [cited 2017 Aug 1]. Available from: <http://pubman.mpdl.mpg.de/pubman/>

- item/escidoc:2148961/component/escidoc:2149096/MPDL\_OA-Transition\_White\_Paper.pdf
3. Enserink M. European Commission considering leap into open-access publishing [Internet]. Science; 2017 [cited 2017 Aug 1]. Available from: <https://doi.org/10.1126/science.aal0977>
  4. Enserink M. In dramatic statement, European leaders call for 'immediate' open access to all scientific papers by 2020 [Internet]. Science; 2016 [cited 2017 Aug 1]. Available from: <https://doi.org/10.1126/science.aag0577>
  5. Zhang X, Lin L, Fournier J, Kuster S, Zaloum M, Grosvenor A. Review of implementation of the Global Research Council action plan towards open access to publications [Internet]. Global Research Council; 2014 [cited 2017 Aug 1]. Available from: <http://www.globalresearchcouncil.org/sites/default/files/pdfs/Review%20of%20Implementation%20of%20GRC%20Action%20Plan.pdf>
  6. Global Research Council. Action plan towards open access to publications [Internet]. Global Research Council; 2013 [cited 2017 Aug 1]. Available from: [http://www.globalresearchcouncil.org/sites/default/files/pdfs/grc\\_action\\_plan\\_open\\_access%20FINAL.pdf](http://www.globalresearchcouncil.org/sites/default/files/pdfs/grc_action_plan_open_access%20FINAL.pdf)
  7. Tickell A. Open access to research publications. Independent advice. London: Universities UK Open Access Coordination Group; 2016.
  8. Solomon DJ, Laakso M, Bjork BC. Converting scholarly journals to open access: a review of approaches and experiences [Internet]. Harvard Library Office for Scholarly Communication; 2016 [cited 2017 Aug 1]. Available from: <http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1026&context=scholcom>
  9. Guellec DJ. Global perspectives on open science. Paper presented at: Korea-OECD Workshop on Open Science: policy to practice; 2017 Jun 30; Seoul, Korea.
  10. Seo JW. Open access initiatives: achievements and challenges. Paper presented at: Korea-OECD Workshop on Open Science: policy to practice; 2017 Jun 30; Seoul, Korea.
  11. Seo JW. European policy on open access from 2020. Paper presented at: 4th Asian Science Editors' Conference and Workshop 2017; 2017 Jul 7; Ho Chi Minh City, Vietnam.
  12. Seo JW, Chung H, Yun J, Park JY, Park E, Ahn Y. Usage trends of open access and local journals: a Korean case study. *PLoS One* 2016;11:e0155843. <https://doi.org/10.1371/journal.pone.0155843>
  13. Seo JW, Ahn Y, Hong SY, Lee JW. Strategic planning of open access initiative of Seoul National University. Seoul: Seoul National University; 2016.
  14. Suber P. Open access overview: focusing on open access to peer-reviewed research articles and their preprints [Internet]. Boston, MA: Harvard Office for Scholarly Communication; 2013 [cited 2017 Aug 1]. Available from: <http://legacy.earlham.edu/~peters/fos/overview.htm>
  15. DOAJ. Directory of Open Access Journals: journals vs. articles [Internet]. DOAJ; 2017 [cited 2017 Aug 1]. Available from: <http://doaj.org/search>
  16. Bi X. Quality open access publishing and registration to Directory of Open Access Journals. *Sci Ed* 2017;4:3-11. <https://doi.org/10.6087/kcse.82>
  17. Wiryawan KG. The current status of science journals in Indonesia. *Sci Ed* 2014;1:71-5. <https://doi.org/10.6087/kcse.2014.1.71>
  18. Huh S, Cho HM, Kim H. Opinions of Korean science editors on open access policies, editorial difficulties, and government's support for publishing. *Sci Ed* 2015;2:55-8. <https://doi.org/10.6087/kcse.44>
  19. Mongeon P, Paul-Hus A. The journal coverage of Web of Science and Scopus: a comparative analysis. *Scientometrics* 2016;106:213-28. <https://doi.org/10.1007/s11192-015-1765-5>
  20. Miguel S, Tannuri de Oliveira EF, Cabrini Gracio MC. Scientific production on open access: a worldwide bibliometric analysis in the academic and scientific context. *Publications* 2016;4:1. <https://doi.org/10.3390/publications4010001>
  21. Kim K. Open access publishing in the internet age. *Sci Ed* 2016;3:1-2. <https://doi.org/10.6087/kcse.55>
  22. Khabsa M, Giles CL. The number of scholarly documents on the public web. *PLoS One* 2014;9: e93949. <https://doi.org/10.1371/journal.pone.0093949>
  23. Alberts B. Impact factor distortions. *Science* 2013;340:787. <https://doi.org/10.1126/science.1240319>
  24. American Society for Cell Biology. The San Francisco Declaration on Research Assessment (DORA). Bethesda, MD: American Society for Cell Biology; 2013.
  25. Finch J, Bell S, Bellingan L, et al. Accessibility, sustainability, excellence: how to expand access to research publications. Executive summary. *Int Microbiol* 2013;16:125-132.
  26. JISC Collections. Principles for Offset Agreements. London: JISC Collections; 2016.
  27. VSNU. The Netherlands: paving the way for open access [Internet]. VSNU; 2016 [cited 2017 Aug 1]. Available from: <http://www.magazine-on-the-spot.nl/openaccess/eng>
  28. Harvard University Library. Harvard Library Office for Scholarly Communication [Internet]. Harvard University Library; 2016 [cited 2017 Aug 1]. Available from: <https://osc.hul.harvard.edu/>
  29. Seo JW, An F, Han YM, Tao D. Dissemination of knowledge on health: multiple resources and multiple steps. *Basic Appl Pathol* 2011;4:35-7. <https://doi.org/10.1111/j.1755->

- 9294.2011.01106.x
30. Jawaid SA. Lessons learnt from the Asia-Pacific Association of Medical Journal Editors (APAME) Congress. *Pak J Med Sci* 2011;27:955-7.
  31. Kim K. Editing and publishing scholarly journals in the internet age. *Sci Ed* 2014;1:2-3. <https://doi.org/10.6087/kcse.2014.1.2>
  32. Seo JW. Medical journal editors' association in the Western Pacific Region. *Eur Sci Edit* 2010;36:102-4.
  33. Sakai Y, Sato K, Suwabe N, et al. International trends in health science librarianship part 11: Japan and Korea. *Health Inf Libr J* 2014;31:239-42. <https://doi.org/10.1111/hir.12074>
  34. Hwang Y, Lim YH, Ahn YK, et al. Trend analysis of scholarly publication by medical librarians. *J Korean Med Libr Assoc* 2013;40:1-12.
  35. Solomon DJ. Digital distribution of academic journals and its impact on scholarly communication: looking back after 20 years. *J Acad Librariansh* 2013;39:23-8. <https://doi.org/10.1016/j.acalib.2012.10.001>
  36. Schmitt J. Can't disrupt this: Elsevier and the 25.2 billion dollar a year academic publishing business [Internet]. Medium; 2015 [cited 2017 Aug 1]. Available from: <https://medium.com/@jasonschrmitt/can-t-disrupt-this-elsevier-and-the-25-2-billion-dollar-a-year-academic-publishing-business-aa3b9618d40a#.1d611bkia>
  37. Kyrillidou M, Morris S, Roebuck G. ARL statistics 2013-2014. Washington, DC: Association of Research Libraries; 2015.
  38. Story in Pictures. Equality and equity [Internet]. Twitter; 2016 [cited 2017 Aug 1]. Available from: <https://t.co/52oRXpCQag>
  39. KISTI. National digital science library [Internet]. Daejeon: KISTI; 2017 [cited 2017 Aug 1]. Available from: [www.ndsl.kr](http://www.ndsl.kr)
  40. Naver. Naver Academic [Internet]. Seongnam: Naver; 2017 [cited 2017 Aug 1]. Available from: <http://academic.naver.com>