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The impact of digitalization in the dissemination of knowledge: impact indexes and open access in the social sciences and humanities

In this paper, the authors unveil the challenges that knowledge dissemination and preservation faces in the 21th-century. From the development of the printing press to the rise of the Internet, the geographies of academic knowledge seem to have remained concentrated in concrete regions of the world. This paper examines the structure of these concentrations of knowledge in the particular case of knowledge dissemination within the Social Sciences and Humanities. First the paper looks briefly into the relationship between memory preservation and the changes that the material forms of information support have suffered in recent years. Then, it goes on to explore the challenges of a globalized world economy and the impact of the publication industry and on its uneven distribution, pointing out the unbalances and deficiencies across world zones. The research also looks at issues of environmental degradation, e-waste, and digital graveyards in certain areas of the globe in an attempt to seek avenues for future responsible action.

Key words: Academic publications, impact Indexes, Social Sciences and Humanities.

Асунсьон Лопез-Варела, Н. Альджанова

Влияние оцифровки в распространении знания: влияние индексов и открытый доступ в социальных и гуманитарных науках

В данной статье авторы раскрывают проблемы распространения и сохранения знаний в XXI веке. С развитием книгопечатания до появления интернета география академического знания, кажется, по-прежнему сосредоточена в конкретных регионах мира. В статье исследуется структура этих концентраций знаний в конкретном случае распространение знаний в области социальных и гуманитарных наук. Рассматривается отношение между памятью сохранения и изменениями, произошедшими в последние годы. Исследуются вызовы глобализованной мировой экономики и влияние промышленности публикации на ее неравномерное распределение, указывая на дисбалансы и дефициты по всем мировым зонам. В исследовании также рассматриваются вопросы экологической деградации, электронных отходов и цифровых кладбищ в определенных районах земного шара в попытке поиска путей для будущей ответственной деятельности.

Ключевые слова: академические издания, влияние индексов, социальные и гуманитарные науки.

А. Лопез-Варела, Н. Альджанова

**Білім таратуда сандаудың әсері:
әлеуметтік және гуманитарлық ғылымдардағa
берілген мүмкіндіктер және индекстер ықпалы**

Бұл мақалада авторлар XXI ғасырда білімді тарату және сақтау мәселелерін ашады. Кітап басу заманынан бастап интернет пайда болғанға дейін академиялық білім географиясы әлі де әлемнің белгіленген аймақтарында шоғырланған. Мақалада бұл концентрациялардың құрылымы әлеуметтік және гуманитарлық білімдер саласында білімнің таралуының нақты жағдайында зерттеледі. Әуелі сақтау жады мен өзгерістер арасындағы қатынас, ақпараттық қолдаудың материалдық формалары соңғы жылдары өткерген белестері қарастырылады. Одан кейін ғаламданған әлем экономикасының үндеулері және олардың әркелі таралуына басылым өнеркәсібінің әсері, барлық әлем аймақтары бойынша дисбаланс пен тапшылыққа сілтей отырып, қарастырылады. Сонымен бірге зерттеу жұмысында болашақ жауапты қызметтің жолдарын табу мақсатында Жер шарының белгілі бір аймақтарындағы экологиялық деградация, электронды қалдықтар, сандық молалар мәселелері қарастырылады.

Түйін сөздер: академиялық басылымдар, индекстер ықпалы, әлеуметтік және гуманитарлық ғылымдар.

In the course of human history knowledge has been preserved in different ways. James O'Donnell and Walter Ong are among the scholars who have shown the importance of changing material formats for the preservation of cultural memory. Following their accounts, varied writing materials were used before the invention of paper in Ancient China in the 1st century CE. In Asia different types of wood and bamboo staves were often inscribed. The ancient codices of Pre-Columbian America (Maya and Aztec cultures) were also made of long folded strips of paper made of wood bark or plant fiber with a layer of whitewash. Documents of importance were inscribed on soft metallic sheets such as copperplate because leaves and paper were not as durable in the hot, humid climate. Important manuscripts were inscribed on brass, copper, ivory and even gold sheets and plates. Papyrus was used by the Egyptians as far back as the 1st-dynasty (2600 BCE). The Romans used wax-coated tablets that could be reused, codex made of wood for taking notes and other informal writings. Parchment was also used for some Egyptian 4th-dynasty texts and even in the Assyrian and Babylonian cultures, which generally impressed their cuneiform writing on clay tablets. For example, in the Talmud, Moses writes the first Torah Scroll on a split cow-hide. Rabbinic and early Islamic texts were also found on parchment, which was more resilient than papyrus to humid conditions. The codex was an improvement over the roll or scroll (made of papyrus, bamboo, etc.) because it took up less storage space. The codex or book was a huge technological advance. It was cheaper, more portable and easier to use. It also permitted non sequential access, and made easier the task of organizing documents in a library. The development of block printing and movable clay type in the 11th-century in China were the first steps to the introduction of molds made of durable alloy of lead, tin and antimony, molds by a German goldsmith called Johann Gutenberg in the 1450s. Printing presses were subsequently established all over Europe, and all genres of writing became adapted to this technology. Systems of headings and subheadings, page numbering, index or table of contents were introduced by 1600, allowing for cross references to be made more easily. In academic and scientific works footnotes and endnotes were introduced to support arguments, offer evidences or clarify some points to the reader.

Before the invention of printing, all books were in manuscript form, a laborious process of writing, assisted by a vast number of calligraphers, illuminators and binders that produced a unique scholarly copy, only accessible to churches, universities and rich noblemen. The primary effect of the invention of printing was therefore to render multiplication of copies of a book cheaper and more expeditious. The expansion of printing presses also contributed to the enormous diffusion of learning and translations from other cultures. However, knowledge distribution has always occurred in the context of power relations, with the result of exclusion for many areas of the world whose knowledge was based on instruments of oral transmission, for instance, or whose influence upon other areas was weaker for several reasons, as in the case of African nations. In the 20st-century, the lower cost of digital technologies are creating novel possibilities but also new problems.

The first consequence of digitalization has been the multiplication of world knowledge at an unprecedented speed. The information explosion was fostered by the ever-increasing rate of publishing, together with the advent of other means of information storage and transmission such as the radio, the cinema and, in the beginning of the 21st century, electronic publishing. While this prompts important questions regarding the impact of media on the creation and reception of academic knowledge, it is also necessary to inquiry on the production of academic knowledge: who are the producers and how distribution takes place in different parts of the globe.

From the development of the printing press to the rise of the Internet, the geographies of academic knowledge seem to have remained concentrated in concrete regions of the world. Although initially the Internet raised hopes that knowledge distribution might become de-centralized, the fact is that it is still produced in particular locations such as California Silicon Valley, the Greater Boston area of the US, and in certain countries in northern Europe like the United Kingdome or The Netherlands. Digital information storage, reproduction and distribution have continued to function in the context of power structures, whether political or economic (on this, see, for example, work by Mark Poster and Manuel Castells)**.**This paper examines the structure of these concentrations of knowledge in the particular case of knowledge dissemination within the Social Sciences and Humanities.

Because forms of communication in Social Sciences and Humanities exist in biographical, bibliographical, social, and historical contexts, research in these fields employ a wide variety of types of sources. Social Sciences and Humanities scholars are interpreters of documents, documents that take multimodal forms of information support, from videotapes to musical scores, clay tablets, manuscripts, letters, diaries, archival records, entries in dictionaries and encyclopaedias, library catalogues, and also paintings and etchings. Social Sciences and Humanities disciplines rely on wide reading of primary texts, and access to background information – secondary texts- that help inform the work and gain awareness of current research and to identify cross-references. Although most primary sources are in text form, other types of materials, such as films, paintings, and various artefacts, are central for some scholars. Such wide-ranging research implies a need for complex forms of access to information and archival stability.

The initial concerns about the stability of digital resources have given way to a confident and steady digitalization of much type of documents, images and other forms of knowledge preservation. In recent years, in view of the large amount of digitalized documents in the World Wide Web, every area of social activity shows trends towards greater quality assessment in order to limit the scope of the plethora of writing now available. The explosion of accessible online publications has triggered debates on the quality of academic research. Quality used to be measured in terms of clear objectives and methods, evaluation by peers (peer-reviewing) and citations of works that presented ideas of particular impact and influenced professional respect for the author. Increasingly, quality and impact of research is measured by means of quantitative tools, indexes that employ metric indicators to account for citations, a practice present in the realm of the sciences (i.e. medicine) for some decades. Metrics not only signal citations, they are useful in analysing changing patterns of research and development by accessing knowledge contents published in academic journals. They are also useful tools for assessing, reviewing, evaluating and mapping contents published in these journals, and in predicting future trends. They also serve to enhance global visibility and availability of knowledge contents published in these journals.

Metrics seem to be becoming more and more important in promotion decisions and as part of academic accreditation processes, appointments, promotions, awards, salaries and so on. At present, there are several large databases of citation reports available on the Internet. They are also called citation indexes, as they establish the value of research publications based on the preconception that the number of times an article is cited is an indication of its scientific value. This also helps establish the reputation of scholars and of the journals that publish their work. These databases index the addresses of authors, which allow analysis of the regionalization of scientific production – what countries, institutions or cities are the most active in a specific area – and the analysis of collaboration patterns. However, they differ in the type of publications they register, which only partially overlap. To be indexed in these citation databases, journals need to fulfil strict criteria.

The earliest known citation index is an index of biblical citations in rabbinic literature, attributed to Maimonides in the 12th century. The Web of Science was originally part of the International Scientific Institute set up by Eugène Garfield in Philadelphia in 1964, and more recently part of the

Thomson Reuters Group. The Web of Science covered initially the field of the hard sciences, including research and review articles, editorials, case studies, research methods, opinion papers, observations and reports on research and development, abstracts of dissertations or articles, proceedings papers, bibliographies and so on, Now it includes the Science Citation Index, the Social Sciences Citation Index, and the Arts and Humanities Citation Index, which was launched in 1978 with over a thousand journals (now it covers almost 2000 journals). Journals of Citation Reports appear annually for publications in the Science Citation Index and Social Sciences Citation Index but there is none for the Arts and Humanities Citation Index. These reports provide more complex maps of citations across authors and even journals. Initially the Arts and Humanities Citation indexed only journals published in English. In recent years more non-English journals are being included, although the ratio is still unbalanced. In 2011 Thomson Reuters announced the launch of a book citation index to account for the impact of books and book chapters, very frequent in the humanities. Open Access journals are also covered in the Web of Science. Thomson Scientific, as it is also called, uses several sources to locate journals that meet their selection criteria. These include J-Stage [1]. Scientific Electronic Library Online [2] and the Directory of Open Access Journals at Lund University [3].

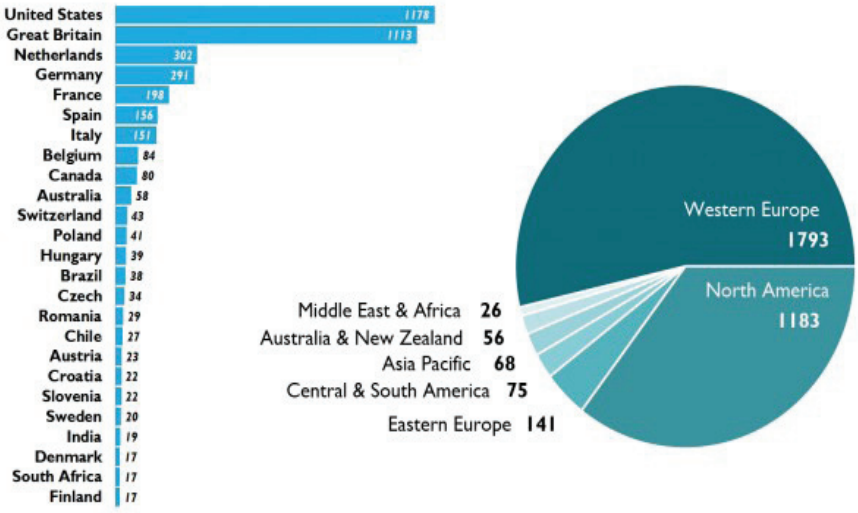


Figure 1 – The number of Humanities titles covered in Scopus for the top 25 countries with most Humanities titles covered (November 2012) and the Regional distribution of the number of Humanities titles covered in Scopus per region (November 2012). Source: Scopus; reproduced in Meester [5].

With 50 million records. 21,000 titles. 5,000 publishers, Scopus is the largest abstract and citation database of peer-reviewed literature, set up by the Amsterdam based publishing group Elsevier. Elsevier publishes 250,000 articles a year in 2,000 journals [4]. Scopus indexes 29 million records, including references, going back to 1995 (84% include abstracts) and 21 million pre-1996 records going back as far as 1823, more than 20,000 per-reviewed journals, of which 2,600 are open access journals. It also includes 370 book series. The database includes the SCImago Journal and Country Ranks which is a portal that includes the journals and country scientific indicators developed from the information contained in the Scopus database. SCImago Journal Rank uses PageRank algorithms to measure citations depending on the prestige of journals instead of the impact factor used in the WOK. The total number of Arts & Humanities articles in the 2012 Scopus database was a little over 1 million, just over 2% of the total. The geographical distribution of the titles is 25% for the United Kingdom, (4,157 journals), only 25% for the rest of Europe/Middle-East/Africa, 37% for North America, 12% for Asia/Pacific, and 1% for South America (http://info.scopus.com/docs/content_coverage.pdf; see Scopus Facts and Figures). English is the dominant language of publication in the Arts & Humanities (77%). The

graphic below also shows that the higher number of publications and publishers coincide with English speaking regions, although 500 English language titles have a second publication language. However, Scopus only covers journals that publish articles in other languages if they include titles and abstracts in English. In total 32 different languages are covered, but many areas of the world are underrepresented with respect to Humanities content [5].

Daphne van Weijen's research shows that publications in English vary from country to country and that power relations among countries, and also among research topics, encourage more or less publications in languages other than the national one. For example, researchers from the Netherlands and Russia are more likely to publish in English than those in France and Spain. She has found that regardless the number of speakers of each language, French is generally the second publication language of choice, followed in more or less the same order by German, Spanish and Italian.

As many publications in the Social Sciences and Humanities are not published in journals but in books, the Scopus Books Enhancement Program was set up to index around 75,000 books by the end of 2015. The selection policy takes into account aspects like the reputation of the publisher, the composition of the books list and expected impact of the books.

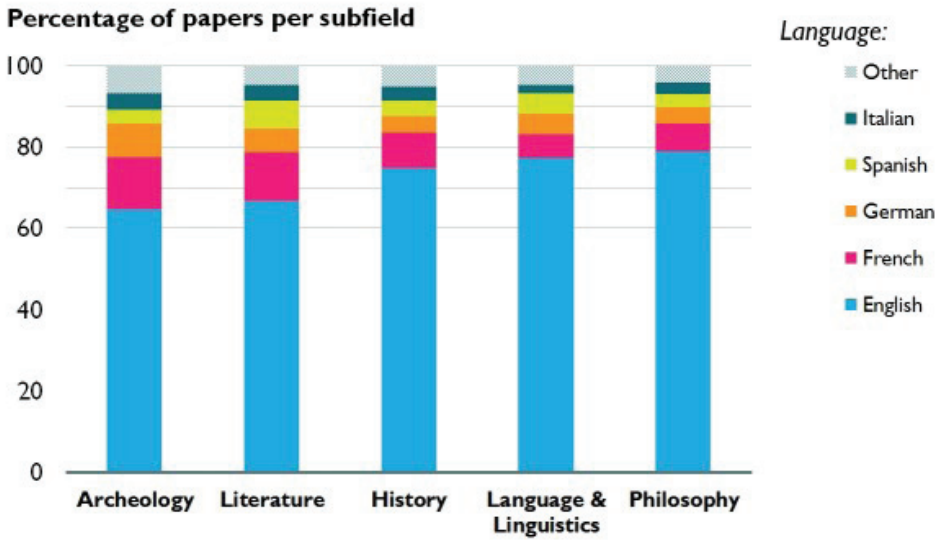


Figure 2 – Overview of the percentage of papers published in the top five languages per subfield of the Humanities (in 2008 – 2012), ordered by percentage of English use from least (left) to most (right). Source: Scopus; reproduced in van Weijen [6]

Google Scholar, launched at the end of 2004. It is a data mining program specializing in scientific literature. Its index includes most peer-reviewed online journals in Europe and America. Through its «cited by» feature, Google Scholar provides access to abstracts of articles that have cited the article being viewed, a feature similar to Scopus and Web of Science indexes [7]. The index has been criticized because the algorithm it uses ranks first highly cited papers, which in turn appear in top positions and subsequently gain more citations.In 2007, Ann Will Harzing, an Australian academic specializing in information technology conducted an independent comparative study between Google Scholar and the Web of Science. She concluded that Google Scholar seems to provide better coverage for publications in the Humanities and Social Sciences, especially books. Harzing also showed that academics who have made a significant impact on their fields show good citation metrics, but that the reverse is not necessarily true. In other words, that weak citation metrics might not only be caused a lack of impact on the field. It also depends on the size of the field, on the choice of book of journal publication (books have lower impact as yet) and, most importantly, on the language used in publication, with English achieving greater dissemination and impact. Some authors [9, 10] found that USA and UK based journals are both significantly over-represented in the Web of Science and Scopus, and that this over

representation was stronger for the Social Sciences and Humanities [6]. Others (Meho& Yang) argue that Google Scholar includes a larger number of publications in other languages and indexes documents in French, German, Spanish, Italian and Portuguese [11]. Elsevier/Scopus journals were not accessible through Google Scholar until after 2007.

Problems shared by all three indexes, Web of Science, Scopus and Google Scholar, are punctuation of names (diacritics, apostrophes, hyphens and so on), for Spanish authors frequently use two surnames (father's + mother's). These difficulties produce serious errors in search results, and authors who are assigned to wrong papers (on this see i.e. Fröhlich). Another great concern is the fact that these metric indexes are part of commercial activities within large publishing corporations. For instance, the results of international rankings of academic institutions (i.e. Times HigherEducation, World University Rankings, World Report College Rankings) have a strong impact in policy and decision making, university funding and student and staff admissions. Thomson Reuters is involved in the ranking business in several ways. For example, the Times Higher Education World University Ranking has been powered by Reuters since 2009 [12]. While some institutions, research organizations and university libraries have revelled against this monopoly (the most famous initiative of protest and recommendations is named, *The SanFrancisco Declaration on Research Assessment;* one of the first organizational signers was TheAcademy of Sciences of the Czech Republic; other initiatives include *Retraction Watch* http://retractionwatch.wordpress.com and *PubPeer*. https://pubpeer.com), the commercial activities of the Reuters and Elsevier groups have spread the common belief in diverse nations (in Europe –i.e. Spain or Austria; in Asia –i.e. China and Taiwan) that the coverageof journals by these indexes is *per se* a grant for high quality [13]. TüürFröhlich's recent paper also points out that the global dominance of citation indexing and their products (i.e. citation counts andjournal impact factors) have devastating consequences mainly for Social Sciences and Humanities. As noted before, national language publications get fewer citations and are less valued in evaluations, adding to the strong pressure to conduct research and publish in English.

In June 2007, the European Science Foundation launched a program to evaluate journals in the Social Sciences and Humanities, publishing the European Reference Index for the Humanities. It classifies journals into three rated categories: A – high ranking international publications; B – standard international publications with a good reputation; and C – important local or regional journals in Europe. Note that even a C rating is a good rating. The European Reference Index for the Humanities, aimed initially to identify, and gain more visibility for top-quality European Humanities research published in academic journals in, potentially, all European languages. It is a fully peer-reviewed, Europe-wide process, in which 15 expert panels sift and aggregate input received from funding agencies, subject associations and specialist research centres across the continent. European Reference Index for the Humanities includes good, peer-reviewed research journals in 15 broad disciplines of the Humanities. The 15 fields are: Anthropology (Evolutionary); Anthropology (Social); Archaeology; Art, Architectural and Design History; Classical Studies; Gender Studies; History and Philosophy of Science; History; Linguistics; Literature; Music and Musicology; Pedagogical and Educational Research; Philosophy; Psychology; Religious Studies and Theology [14].

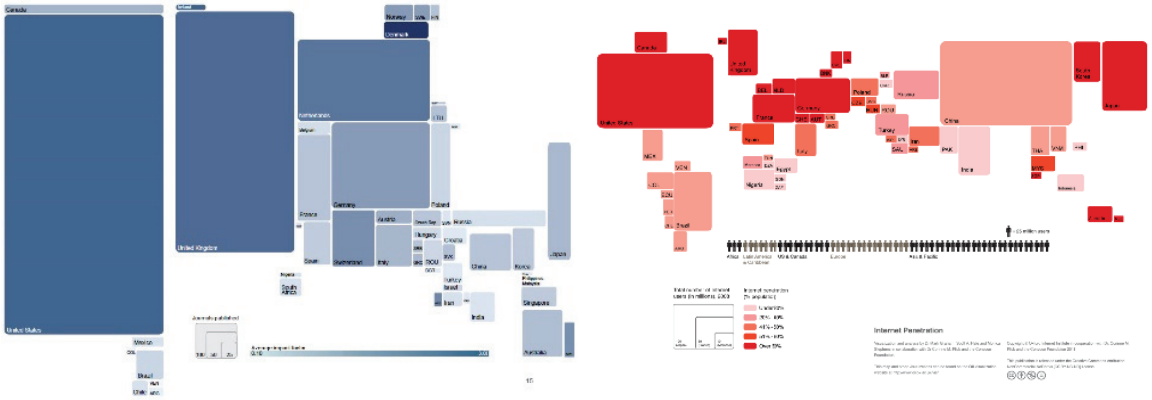
The European Reference Index for the Humanities has no bibliometric tool and the *Observateur des Sciences et des* Techniques was established with the specific mission to produce indicators on impact indexes based on the journals inventoried by the European Science Foundation. The European Strategy Forum on Research Infrastructures [15] is the European Union organism in charge of exploring new forms of evaluation for the Social Sciences and Humanities. In 2008 a letter was signed by sixty editors of journals in the category of «history and philosophy of science» who pleaded against the development of journal lists with classifications in terms of A, B, and C in order to defend the reputations of their journals against this intervention (see http://cordis.europa.eu/infrastructures; see also «Journals under Threat»). The European Science Foundation hastened to declare that the rankings were not meant as judgments of quality.

In 2010 Michèle Dassa and Christine Kosmopoulos published «Une étude comparative internationale des bases de données des revues scientifiques en sciences humaines et sociales» where they showed that despite efforts to include multilingual indexes, English is a dominant language in academic publishing not only because of large number of journals published in the United States and United Kingdom. Many English-language journals are also published in the rest of the world. Approximately

60% of English-language books are produced through the «Big Six» publishing houses: Random House, Penguin, Hachette, Harper Collins, Simon & Schuster and Macmillan.

The fact that Western citation indexes are so important to academic rankings only serves to reinforce the dominance of the English language in research, even if publishers that control a relative large number of journals are less clustered in the Social Sciences and Humanities than they are in the Sciences. These organizations are mainly Springer, Wiley-Blackwell, Elsevier and Taylor & Francis. Even collaborative repositories of knowledge, such as Wikipedia show similar asymmetries. Some of Wikipedia articles about places, events or any other locatable articles are geo-tagged with a pair of latitude and longitude coordinates so that when downloaded it is possible to determine the number of articles per country (regardless of language), 84% of which come from Europe and North America. China, which is home to the world's biggest population of Internet users and is the fourth largest country on Earth contains less than 1% of all geo-tagged articles. Similarly, the number of geo-tagged biographies in Wikipedia seems to show that there are more famous people in the West than anywhere in the world User-generated Content in Google, that is, knowledge indexed by Google shows similar asymmetries (on this see online graphs at http://wikiproject.oii.ox.ac.uk/networks/). It is thus important to point out these asymmetries in knowledge distribution.

In 2011, the Convoco Foundation in cooperation with Oxford Internet Institute of the University of Oxford issued a report titled *Geographies of the World's Knowledge* which explores the differences in editing and publishing patterns between languages. Some of their graphics are reproduced below.



http://www.zerogeography.net/2011/09/geographies-of-worlds-knowledge.html.

Figure 3 – The graphics below summarize the statistics gathered by the Organization for Economic Co-operation and Development that supervises economic progress and world trade in all areas. The statistics refer to the 2006-2009 time period and register publication count per country as well as citation rates. Results confirm some of the findings of the Convoco Foundation [16]

The strong pressure on Social Sciences and Humanities scholars to publish in indexed journals of high impact is counterbalanced by the rapidly growing domestic indexing policies. However, scholars report cross-pressures. On the one hand, pressures to publish in English for an international audience and in international indexed journals supported by academic administrations. At the same time, publication in the national language is also required to reach domestic audiences. Many national journals offer translated versions in English side by side with original versions in other languages. Spain, Portugal and Latino-America have their own index *Latindex*in order to ensure coverage in these national languages. India's first citation index was established in 2010, including also coverage of abstracts and a directory of Indian journals and several of their national languages. In China the Library of the Chinese Academy of Sciences has produced the Chinese Science Citation Database since 1989. Nanjing University has focused on social science and arts and humanities journals, and has produced the Chinese Social Sci-

ence Citation Database since 1997. In 1999, Nanjing signed a contract for the cooperative development of the Chinese Social Science Citation Index with Hong Kong's Science and Technology University. The purpose of the Taiwan Humanities Citation Index project, as presented by Kuang-hua Chen (2004) is to construct a citation index for humanities journals published in Taiwan [17]. The Taiwan Humanities Citation Index project is supported by the Centre for Humanities Research of the National Science Council, Republic of China (www.hrc.ntu.edu.tw/). In 1999, the National Science Council established two project-based research centres: the Social Science Research Centre and the Centre for Humanities Research. The main tasks of the two centres are to produce the Taiwan Social Science Citation Index and the Taiwan Humanities Citation Index, respectively. Languages are recorded as English, Chinese, Japanese, French, German, Italian, Spanish, Russian, Korean etc. (see Hicks and Wang and also the *National Taiwan NormalUniversity Academic* Excellence Professor Award Provisions [18].

OECD countries	1990-1993	1994-1997	1998-2001	2002-2005	2006-2009
1. Switzerland	1,24	1,30	1,29	1,30	1,34
2. United States	1,42	1,39	1,38	1,34	1,31
3. the Netherlands	1,22	1,25	1,25	1,26	1,28
4. Denmark	1,19	1,17	1,24	1,25	1,27
5. Great Britain	1,11	1,12	1,15	1,17	1,20
6. Sweden	1,18	1,15	1,16	1,13	1,13
7. Iceland	1,08	1,08	1,05	1,10	1,13
8. Canada	1,12	1,13	1,13	1,10	1,12
9. Belgium	0,95	1,00	1,01	1,08	1,12
10. Norway	0,98	1,01	1,06	1,10	1,11
11. Ireland	0,92	0,91	1,00	1,03	1,11
12. Australia	1,03	1,03	1,04	1,05	1,08
13. Germany	0,85	0,94	0,98	1,01	1,08
14. Finland	1,03	1,09	1,09	1,05	1,07
15. Austria	0,82	0,94	0,94	1,00	1,03
16. France	0,89	0,94	0,95	0,98	1,00
17. New Zealand	0,93	1,00	1,02	0,96	1,00
18. Israel	0,98	1,01	1,00	0,99	0,96
19. Italy	0,82	0,87	0,92	0,93	0,94
20. Spain	0,89	0,82	0,84	0,89	0,93
21. Portugal	0,73	0,80	0,85	0,88	0,93
22. Luxembourg	0,45	0,61	0,73	0,90	0,93
23. Greece	0,63	0,71	0,78	0,84	0,89
24. Japan	0,85	0,82	0,81	0,79	0,81
25. South Korea	0,75	0,71	0,80	0,82	0,81
26. Estonia	0,48	0,66	0,67	0,71	0,79
27. Hungary	0,55	0,63	0,67	0,76	0,75
28. Slovenia	0,71	0,63	0,65	0,69	0,74
29. Chile	0,52	0,59	0,63	0,70	0,68
30. the Czech Republic	0,35	0,49	0,55	0,63	0,68
31. Turkey	0,59	0,63	0,67	0,67	0,67
32. Mexico	0,61	0,61	0,60	0,61	0,60
33. Poland	0,45	0,49	0,51	0,53	0,51
34. Slovakia	0,21	0,35	0,38	0,45	0,51
BRIC-countries	**1990-1993**	**1994-1997**	**1998-2001**	**2002-2005**	**2006-2009**
China	0,43	0,50	0,63	0,80	0,88
India	0,45	0,47	0,54	0,64	0,66
Brazil	0,56	0,61	0,63	0,66	0,61
Russia	0,18	0,24	0,27	0,30	0,30

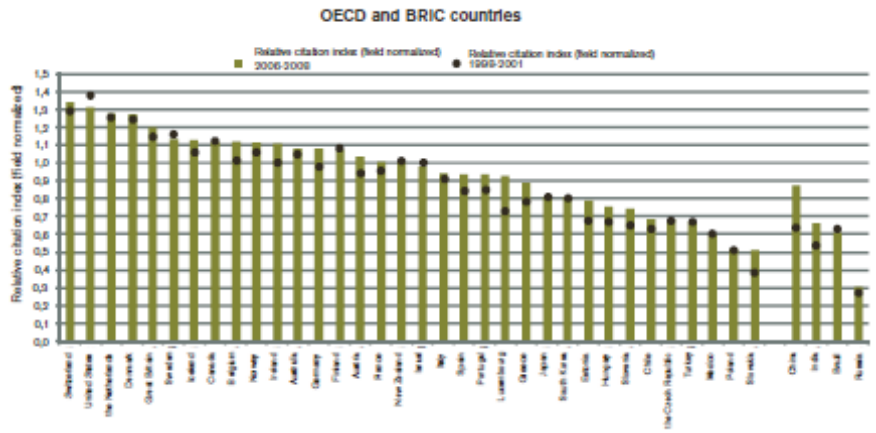


Figure 4 – Field normalized citation index for Organization for Economic Co-operation and Development and BRIC (Brazil, Russia, India and China) countries in the years 1990-2008.
Citation rates equal to or greater than the world average (1.00) in bold

Academic authors in the Social Sciences and Humanities produce a large number of articles, book chapters and books, and their interest generally lies outside the commercial life of publications, since most of these authors hold positions in universities and research centres. In many cases, they are happy to have the results of their intellectual efforts widely disseminated and read. A recent article by former Harvard University Librarian Robert Darnton in the New York Review of Books (May 22,2014) exposes some of the controversies surrounding academic publishing [19]. He claims, for instance, that the average prices of scientific periodicals have dramatically increased, and journal subscriptions soared from $33 in the 1970s to over $30,000, as in the case of the *Journal of Comparative Neurology*. Darnton also claims that 42% of all academic articles are published by the three giant groups Reed Elsevier, Wiley-Blackwell, and Springer [19].

Paradoxically, in many cases, publication follows research produced with public funds, not just in the USA. The article also describes the struggle to maintain White House directives on Fair Access to Science and Technology Research Act and the socio-economic benefits of open access and open source software systems that translate in an increase in productivity. Journal subscriptions were also boycotted in several universities in European and in the United States, with the Faculty Advisory Council on the Library of Harvard University passing a resolution condemning the price increases as unsustainable. Darnton also explains the flipped system present in open-access journals, where publication expenses are greatly reduced. Again, at Harvard, a program called Harvard Open-Access Publishing Equity subsidizes this type of processing fees. A consortium called Compact for Open-Access Publishing Equity promotes similar policies among twenty-one institutions, including Massachusetts Institute of Technology, the University of Michigan, and the University of California at Berkeley.

Online Open Access is building up in digital repositories at universities throughout the world. One of the first full text Open Access academic journals in precisely, Comparative Literature and Culture Web, edited by Steven Tötosy, one of the first advocates of Open Access. Another example is the Digital Access to Scholarship Platform at Harvard University. DASH, as it is called, includes 17,000 articles registering over three million downloads from all over the world. In their recent article «Electronic Journals, Prestige, and the Economics of Academic Journal Publishing» (2014), Tötösy and Joshua Jia discuss the oligopoly of the current publishing industry [20]. They argue that while scholar scholars do not receive payment for work published after research frequently developed with public funds, publishers earn significant profit margins by selling the work back to academics. Scholars are often satisfied with the benefits of gaining professional respect, international recognition, promotion or tenure within their respective fields, and perform scholarly peer-reviewing on a voluntary basis, as part of their academic profile and tasks. In turn, universities increase their reputation by employing prestigious scholars. Thus, Tötösy de Zepetnek and Joshua Jia discuss how these tendencies are multiplying in recent years by the additional prestige coming from ‘impact factor’ indexed publications. The authors argue for a more equitable model of knowledge management against what they describe as a «colonialism of knowledge» [21].

Several organizations, such as Knowledge Unlatched is established in 2012 in the UK, supports Open Access monograph publishing. Libraries pay a single title fee to a publisher in return for a book made available in Creative Commons licence and open access in repositories such as OAPEN or HathiTrust Digital Library. The larger the consortium the lower the per-library cost of securing open access for each book. While electronic editions of the books are available everywhere free of charge, the subscribing libraries (more than 250 at this point) have the exclusive right to download and print out copies. Similar projects are Open Edition Books in Marseille (France), Open Book Publishers in Cambridge (UK), which has produced forty-one books in the Humanities and Social Sciences since its foundation in 2008.

In the United States, the Boston based Digital Public Library of America was set up in 2013 with a grant from the Bill and Melinda Gates Foundation. It covers over seven million books as well as other online collections free of copyright (mostly published before 1923 but also some that is post-1923 but used for educational purposes) that come from over 1,300 institutions. Initially, Google Book Search project also made available snippets or short passages of books. Gradually Google set out to digitize the entire volumes and create a database that would be accessible in digital form at a fixed cost. The project failed because many books were covered by copyright. Darnton explains how Digital Public Library of America differs from Google Book Search in its non-profit character, its volunteer work and its horizontal system that links digital

collections already in possession of the participant institutions such as the New York Public Library and Urlich database or the Smithsonian Institution, as well as other spin-off projects such as the Emily Dickinson Archive recently developed at Harvard. Digital Public Library of America includes works in more than four hundred languages and 30% of users come from outside the US.

Likewise, Europeana is a database with digitalized donations from over 2,000 institutions across Europe, including national museums and libraries, local and regional archives, research institutions, universities, etc. They are making available in free open access millions of books, paintings, films, museum objects and archival records that have been digitised throughout Europe. Plans for the database started in 2005 and the first prototype was launched in 2008 as European Digital Library Network (EDLnet). The new updated version started in 2009 and new translation features were incorporated in 2011. Like in Digital Public Library of America, the digital objects that users can find in Europeana are not stored on a central computer, but remain hosted with each cultural institution. The project has a number of associated spin-offs, many of them funded from the e-Contentplus programme of the European Union.

In May 2013, a global initiative called the San Francisco Declaration on Research Assessment was launchedin order to address the misuse of the journal impact factor for research assessment. The declaration was initiated by the American Society for Cell Biology together with a group of editors and publishers of scholarly journals, and ithas attracted over 10000 signatures from individuals as well as major journals and research organizations from all over the world. The declaration argues that the Journal Impact Factor, as calculated by Thomson Reuters, was originally created as a tool to help librarians identify journals to purchase, and NOT as a measure of the scientific quality of research in an article. Furthermore, it adds that the Journal Impact Factor has a number of well-documented limitations that include citation distribution in terms of specific fields and, importantly that the Journal Impact Factors «can be manipulated (or «gamed») by editorial policy» and that «data used to calculate the Journal Impact Factors are neither transparent nor openly available to the public.»(n/p) Thus, San Francisco Declaration on Research Assessment recognizes the need to improve the ways in which the outputs of scientific research are evaluated and offers recommendations for all groups involved -funding agencies, academic institutions, journals, organizations that supply metrics, and individual researchers. Among the recommendations, and along the lines of the research carried by Steven Tötösy de Zepetnek and Joshua Jia and cited above [20], the need to capitalize on the opportunities provided by online publication, and considers a broad range of impact measures including qualitative indicators of research impact, such as influence on policy and practice. They also recommend presenting Journal Impact Factor metrics in the context of a variety of journal-based metrics (e.g., 5-year impact factor, Eigen Factor, SCImago, h-index, editorial and publication times, etc.) in order to encourage a shift toward assessment based on the scientific content of an article rather than publication metrics of the journal in which it was published. Finally, they also recommend removing or reducing reuse limitations on reference lists in research articles and make them available under the Creative Commons Public Domain Dedication.

Besides issues of impact indexing, content access and languages, the rising growth of electronic texts poses major disposal issues. Those who dreamt that new technologies would end with the indiscriminate cutting of trees are now faced with the even more worrying problem of what to do with products such as arsenic, cadmium, brome flame retardants, lead, hexavalent chromium and mercury used the manufacture of computers and screens. Tons of toxic-laden electronics continued to be dumped in African countries such as Nigeria even after the passing of laws regulating electronic waste disposal.

Despite recycling campaigns promoted by prominent manufactures of computer equipment, encouraged by governmental actions, less than 15% of computers are recycled. Recycling can cost up to 50 euros and it is only recently that computer companies are paying for these costs. Organizations such as Envirocycle, Earth 911 or pbs.org, encouraged computer donation or recycling. In the U.S. the Environmental Issues Council (www.eiae.org) developed the Consumer Education Initiative CEI to inform consumers about recycling issues. The US Environmental Protection Agency EPA (www.epa.gov) also provides a recycling guide. Apple National Recycling Services offers an excellent list of recycling services in the U.S, Canada, Japan, Taiwan and different countries in Europe.

Europe took the lead in addressing the e-waste problem by proposing in1999 an ambitious system of «Extended Producer Responsibility». In 2001, the

European Union Parliament adopted a directive that requires producers of electronics to take responsibility – financial and otherwise – for the recovery and recycling of e-waste. A second directive requires manufacturers to phase out the use of hazardous materials. More and more voluntary programs are also emerging. They face challenges such as: finding mechanisms to attract customer participation, establishing cost-effective collection for discarded products, identifying uses for returned materials and achieving cooperation where multiple firms are involved.

To conclude, technology has enhanced scholarship in a number of important ways. Electronic formats provide many advantages over print, especially for search and retrieval. Searching for information, writing, revising, reworking texts and receiving feedback from colleagues is now faster and easier. However, scholars feel less in control when browsing and publishing in the World Wide Web. Databases and online digital libraries are in the process of developing high level criteria for services that support the acquisition and markup of key texts and other types of information. Peer-reviewing and impact indexing metrics are quality indicators that support these practices and mobilize the expertise of other academics in citing research. Patterns of research practice offer guidelines that disclose the context of academic scholarly processes of publication, and of the role of private and public institutions in ensuring the wide dissemination of information, balancing copyright and creative commons issues, and devising mechanisms to ensure collection of discarded polluting materials. Global cooperation and coordination is the biggest challenge faced.

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