Open Access to scientific information in Croatia : increasing research impact of a scientifically peripheral country

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Increasing Research Impact of a Scientifically Peripheral Country

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"Open Access may increase both the visibility and impact of research results of a peripheral scientific community. This is the key message of the study of Open Access in Croatia. Croatia is a transition country on a small R&D budget, with low visibility of local journals and with high price barriers to the mainstream scientific information. Using the examples of Hrčak, the Croatian portal of scientific journals, and several repositories, the study illustrates the process of raising awareness and support for Open Access in the Croatian scientific community, among governmental bodies, publishers, scientists, libraries."

Jelka Petrak, PhD

"During the last decade, Open Access has become an important means of communication in science. The author discusses scientific communication, its history and development... and describes two ways of achieving OA. The most valuable part of this book is the study of OA in Croatia, which is the first exhaustive examination of the kind. The author concludes with constructive recommendations for further OA promotion in Croatia, involving publishers, libraries and governmental bodies..."

Ana Barbarić, PhD

INTRODUCTION

Scientific communication is the essence of scientific process - without communicating research results, science itself would never prosper. When did it start exactly? Was it thousands of years ago when a primitive human being discovered the first connection between two phenomena? How did he inform other human beings about his discovery? We cannot know the answers to the questions but we have to be aware of the fact that discovering fundamental principles started a long time ago, and ever since, it has depended on communication between human beings. Today we know that there are no isolated principles in the history of science – each fact leads to another, one truth is a stepping stone to a new one – Galileo had to precede Newton, Darwin could only come after Cuvier.[1] And again, nothing of the above could be possible without communication.

In the centre of our interest will be scientific communication today, especially free communication of peer-reviewed scientific papers on the Internet, and especially in peripheral scientific communities. First of all, Open Access (OA) will be defined and the global movement will be described. We will try to summarise its history that had begun much earlier than the first OA initiatives were launched at the beginning of the 21st century. Croatia will be taken as an example of a small, transition country with peripheral scientific community. Our study of OA in Croatia will have two parts, as there are two ways of achieving OA. The first part of the research (study of OA journals) will be longer and detailed, as there are many more OA journals in Croatia than OA repositories. The data for the first part of the research was gathered in June 2010 and they refer to the year 2009. Data for the second part, the study of OA repositories, was gathered in October 2010. We will try to demonstrate that, despite all the differences between scientifically mainstream and peripheral countries, OA has its future in all of them.

[1] Williams, Henry Smith. *The story of modern science.* New York; London: Funk and Wagnalls Co., 1923, p. 2.

1. SCIENTIFIC COMMUNICATION

1.1 Beginnings of formal scientific communication

As was mentioned earlier, the history of science begins very early in the history of mankind. However, modern science, the kind we practice nowadays, as well as modern formal scientific communication, is about 350 years in age. Great 17th century philosophers, Francis Bacon and René Descartes, are usually considered to be the founders of modern science. The century is a turning point in the history of three fields closely connected to the development of science - intellectual property rights, library science and scientific communication.

When discussing the very important issue of intellectual property rights protection, Andrew Maunsell has to be mentioned. He published, in 1595, *The catalogue of English printed books*, the first catalogue where printed books are listed by the authors' family names.[2] The first scientist who published his results in order to protect his intellectual property was Galileo Galilei – in 1610 he published the results of his observations of sunspots wanting to protect his intellectual property.[3] During the 17th century, the *Stationers' Company* (*Worshipful Company of Stationers and Newspaper Makers*) held a monopoly over the publishing industry in England and was officially responsible for enforcing copyright regulations (until the passage of the *Statute of Queen Anne* in 1709). The Company's role was supported by the *Licensing act* in 1642. John Milton's response to the parliament was published in 1644 in a document entitled *Aeropagitica: A speech of Mr. John Milton for the liberty of unlicensed printing to the Parliament of England*. Another important philosopher for the history of copyright was John Locke who published, in 1689, *Two Treatises of*

[2] Horvat, Aleksandra. *Knjižnični katalog i autorstvo* (*Library catalogue and authorship*). Rijeka: Naklada Benja, 1995, p. 95.
[3] Lycos retriever, "Galileo Galilei," http://www.lycos.com/info/galileo-galilei--johannes-kepler.html, (accessed October 04, 2010).

Government. According to him, property arises from labour – a man is the only owner of everything he produces. That was the basis for all the future discussions on intellectual property rights.

Development of libraries and library science also began in the 17th century. Great libraries were founded all over Europe – Bodleian Library (Oxford, 1602), Biblioteca Ambrosiana (Milan, 1607), Biblioteca Angelica (Rome, 1614), Bibliothèque Mazarin (Paris, 1643), Alessandrina (Rome, 1661) and others. In 1627 Gabriel Naudé wrote *Advis pour dresser une bibliothèque* where he suggested that libraries should be public institutions that serve science – library acquisition should include all the important works from all scientific fields, including prohibited books. The document was translated into English in 1661. Gottfried Wilhelm Leibniz was another important 17th century philosopher and librarian, one of the founders of library science. His essay on the best ways of reforming library science was published in 1668 (*Meditation über die Best Art, das Buchwesen zu reformieren*).[4]

The most important moment for scientific communication is the year 1665 when the first two scientific journals were launched - *Journal des Sçavants* in France (January 1665) and *Philosophical Transactions* in England (March 1665). Growth of knowledge and education lead to establishing those journals – they evolved from the need of finding new way for faster and more reliable dissemination of scientific information, as a guarantee to a reader that the information he/she reads is worth using as a starting point for new researches.

The first scientific journals were revolutionary events in the history of, not only science, but whole mankind. They were preconditions of faster and more intense science development that affected all segments of human life. At the very beginning, the journals dealt with general issues, but later new journals covering specific fields were launched. In his book *A history of scientific and technical periodicals* D. Kronick mentions two kinds of scientific journals between the years 1665 and 1790. Only 25% of the journals were published by scientific societies, i. e. had some kind of financial support. The rest of the journals (75%) had not published their issues on a regular basis.[5] The number of scientific journals has increased since the 17th century – there were two journals in 1665, about 10 journals in 1750, 100 in the year 1800, 1000 in 1850 and approximately 10 000 in the year 1900. According to some presumptions, the number of scientific journals increases ten times every 50 years. The reason

[4] Hebrang Grgić, Ivana. "17. stoljeće: prekretnica u razvoju modern znanosti (17th century: a turning point in the development of modern science)." *Vjesnik bibliotekara Hrvatske* 50, no. 1/2 (2007): 89-95.

[5] Kronick, David A. *A history of scientific & technical periodicals: the origins and development of the scientific and technical press 1665 – 1790*. Metuchen, N. J.: The Scarecrow Press, 1976, p. 53.

for such a growth is increasing number of scientists and development of science itself – there are more and more scientific fields and more and more findings that have to be published and discussed.

In the 1920s some ideas of making replacements for scientific journals have showed up. By that time, there was so much scientific information and so many scientists willing to publish results of their work that the publishing processes become too slow. Technological development was not fast enough to meet scientists' needs. They depended on mail when communicating with editors; editors depended on mail when communicating with peer-reviewers. Once published, journals were distributed, again, by mail. Means of transport at the beginning of 20th century were too slow to carry all the printed information as fast as the scientists wanted and needed. That is the most important reason why W. Davis founded the *American Documentation Institute* (today *American Society for Information Science*, *ASIS*) whose aim was launching one big journal instead of many smaller ones. The journal should have pointed out the most important research results and topics. After that, the institute, as well as editors and editorial boards, should have forwarded the full information on demand.[6]

Another scientific journals opponent was J. D. Bernal. He was not content with the existing system of scientific communication – he thought there had been too many journals with too many published papers (what would he think today?).[7] His idea was to make off-prints the basic communicational units among scientists – editors and editorial boards should not spend their time on publishing new journals, but on archiving and distributing off-prints. Off-prints should be sent to academic institutions and scientists on demand. Bernal's idea was tested by the *American Society of Civil Engineers*, the *Chemical Society* and the *Physical Society* (London), unsuccessfully.

If we look back at Davis and Bernal's ideas from today's point of view, we can notice that they are similar to what happened with scientific papers in the age of the Internet – scientific papers can be published and distributed separately, we need less time to find information, we have numerous databases with search engines that help us when harvesting, browsing and searching for information. Although their ideas had not lived, it is fascinating how they anticipated the future of scientific communication. They noticed the problem, they had the solutions, but they did not have the technology.

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[6] Šercar, Tvrtko. *Komunikacijska filozofija znanstvenih časopisa (Communication philosophy of scientific journals)*. Zagreb: Globus, 1988, p. 48.

[7] Bernal, John D. "Provisional scheme for central distribution of scientific publications." In *Royal Society Scientific Information Conference*. London: The Royal Society, 1948: 253-258.

Traditional scientific communication concept had been challenged once again between the years 1961 and 1967 when *Information Exchange Groups* (*IEG*) were organized. Their aim was not to replace scientific journals, but to upgrade them. *IEG*s were launched in the USA and each of them should have covered specific scientific field. The point was speeding up communication between world's scientists, but the system failed because of some shortcomings: insufficient quality control, small number of users (7 groups with 3600 members), too high expenses per member. Eighty per cent of the information distributed through *IEG*s was published later anyway.[8] Again, we can see how similar the *IEG*s are to today's practice of distributing some information in less formal ways (e. g. by e-mail). Today we do not have problem with the number of users (every scientist in the world has the access to the Internet), costs of distribution are low, but one problem remains – lack of quality control in informal ways of scientific communication. That is the reason why journals still exist and still are the basis of scientific communication.

1.2 The three magic circles

If we try to analyze the way of communicating in science, we can say that the basic concept of journal editing remains the same throughout the centuries – authors send their manuscripts not asking for remuneration, editors read them and decide whether to publish them or not. Once accepted, papers are published in journals and sold to readers. Nevertheless, we cannot say that the things have not changed at all. Technology has changed; the number of scientists, scientific institutions and journals has increased; information flow is faster than three and a half centuries ago.

As the time has passed by, one editor was not always able to decide on all the submitted papers, great range of topics was too much for only one person to deal with. The peer-review process was set up and more scientists were involved in deciding whether submitted papers were worth publishing. It is the scientists' need for high-quality and reliable information that is the basis for further research and scientific communication.

[8] Houghton, Bernard. *Scientific periodicals: their historical development, characteristics and control*. London: Clive Bingley, 1975, p. 47.

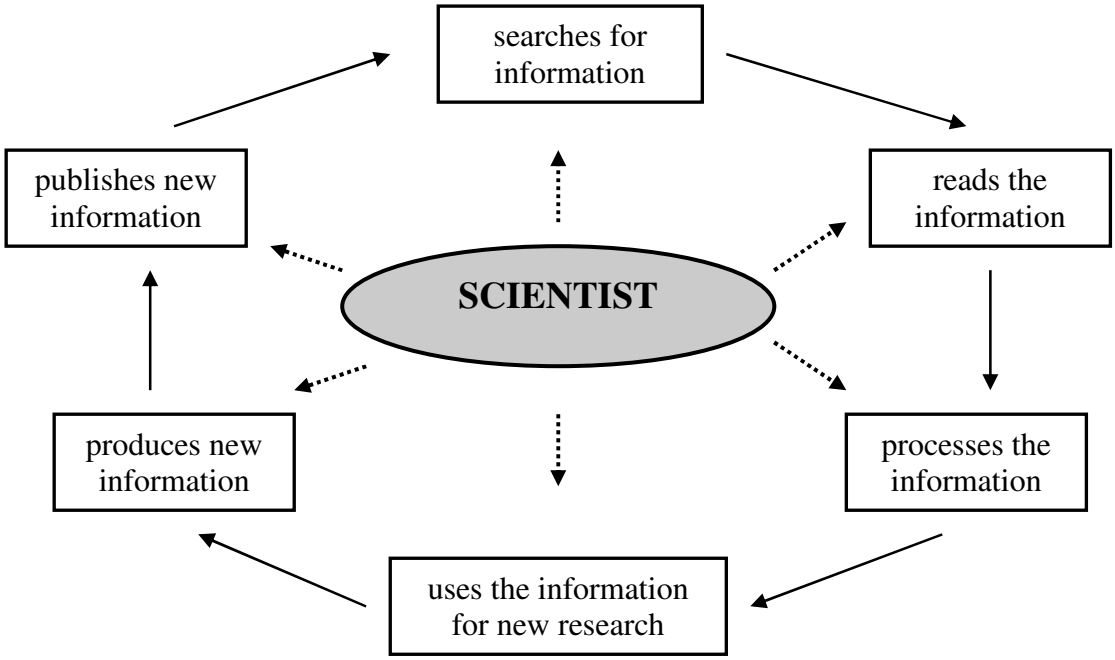

Figure 1: The first "magic" circle with a scientist in the centre

Here we come to the first "magic" circle in scientific communication where the scientist is in the centre, with the double role – he is both user and producer of scientific information. The roles are connected; scientist never leaves one role for another. His/her work has to be published, but it is impossible if the results are not based on the earlier published high-quality results. As shown in the Figure 1, the scientist is in the centre of scientific process – he searches for scientific information, he reads it, evaluates it and uses it for further research. Based on it, he produces new information that is, once published, the basis for new research. The circle actually never ends and the scientist with his double role stays always in the centre. All the other professions connected to scientific communication – publishers, librarians, editors and others – are here to help scientist to find, use and distribute scientific information.

Another "magic" circle arises from the previous one, involving, besides scientists, the other two participants of scientific communication – libraries and publishers – who help scientists in finding, publishing and disseminating information. Today, scientists could not exist without libraries and librarians, especially those in their institutions. Library catalogues, printed and electronic material, large scale of databases purchased by libraries – those are irreplaceable tools for a scientist who is in perpetual search for information. Libraries are, therefore, an important link in a chain of scientific communication. Another link is publishers. The common expression – *Publish or perish* – means that what is not published does not

exist. Every scientist wants to publish his/her work somewhere. There are three main reasons for publishing – scientists want other scientists to know about their research results so their work could be evaluated (by peer-reviewers as well as by readers); scientists want to protect their intellectual property rights (i. e. they want to have a proof that they are producers and owners of the information), and, last but not least, scientists want to make profit from their work.

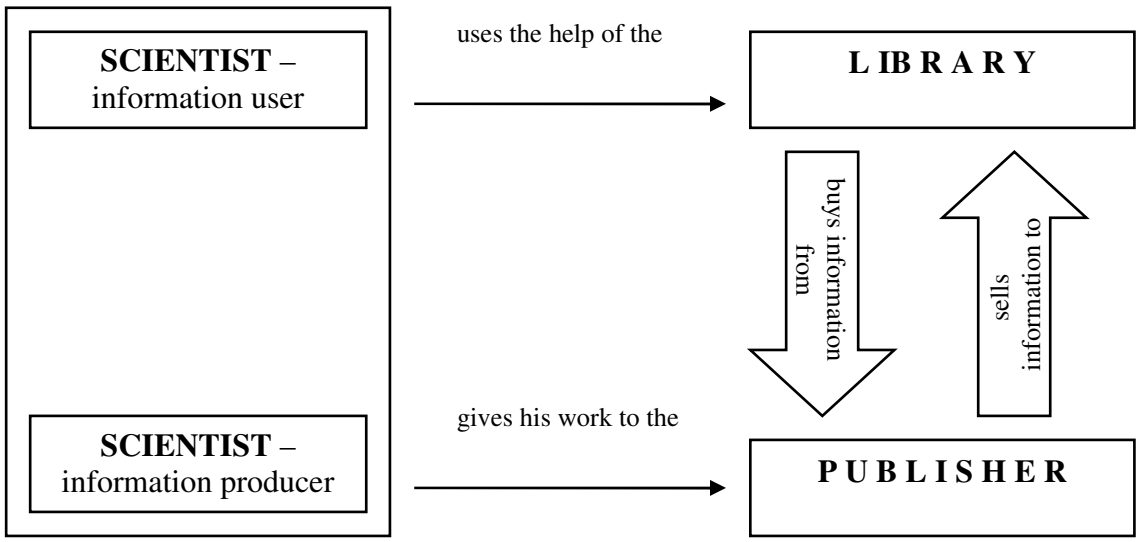

Figure 2: The second "magic" circle with the three subjects – scientist, library and publisher

The early publishers were scientists themselves, i. e. their scientific institutions and associations. The publishers had only one aim – to make scientific information publicly available for the purpose of further science development. Today, not-for-profit publishers are a minority, especially in scientifically mainstream countries. First commercial publishers appeared at the end of 19th century, but their full expansion began after World War II when publishing houses realised that they could make a profit out of scientists' need for high-quality information. Big commercial publishers have several great advantages – they can publish more journals, they have larger incomes and therefore, they can take more risk publishing new journals or raising subscriptions.[9] Figure 2 shows the second circle in scientific communication, that includes scientists (with their double role), libraries and publishers.

[9] Oppenheim, Charles. "Progress in documentation: developments in digital journals." *Journal of Documentation* 57, no. 2 (2001): 260-283.

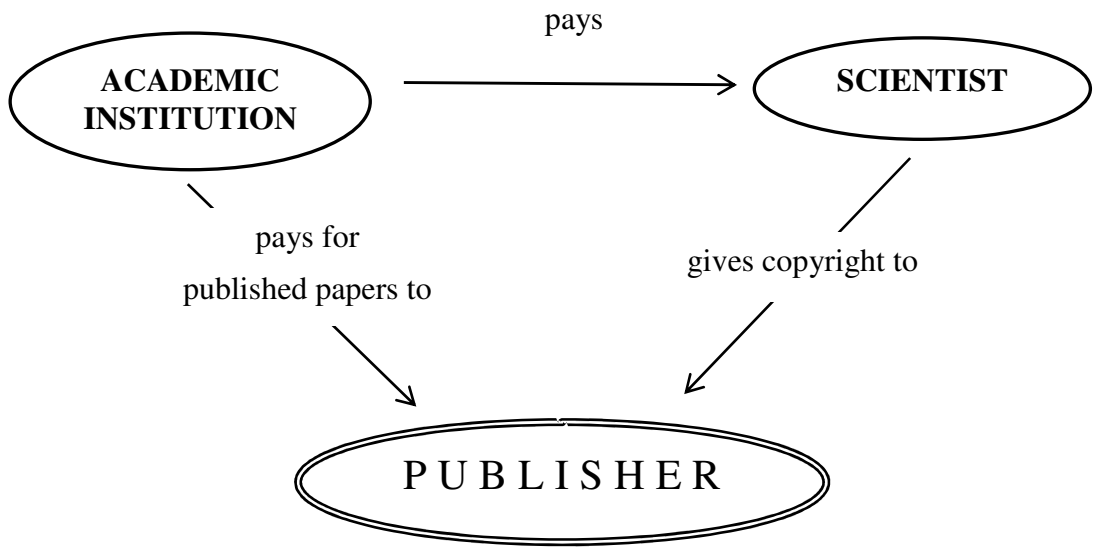

Figure 3: The third "magic" circle – publishers' profit

The third circle shows publisher's financial advantage. He receives two valuable things – subscribers' money and scientists' copyright. Commercial publishers take advantage from both scientists' roles - their need for publishing research results (when scientists are producers of scientific information) and their need for finding new evaluated information (when scientists are users of scientific information). Academic institutions pay their employees (i. e. scientists) for their work. Published papers, based on the research the institutions pay for, have to be bought back by the same institutions. So, we can see that, in the third circle publishers are "double winners", and academic institutions are "double losers". Scientists remain in the middle – they get their pay checks (whose amount depends, among other elements, on quality and quantity of published information), but they have to give up their copyright.

1.3 Scientific journal crisis – how to solve the problem?

Now when the three circles are explained, it is not difficult to understand how scientific journal crisis (or "serial crisis") emerged. More and more important scientific journals have been overtaken by commercial publishers who started raising subscriptions. They did not count on individual subscribers, but on institutional ones (e. g. number of individual subscriptions decreased by 50% in the USA from 1975 until 1995[10]). Higher subscriptions

[10] King, Tenopir. "Trends in scientific scholarly journal publishing in the United States." *Journal of Scholarly Publishing,* 28, no. 3 (1997): 135-170.

were not a big problem at the beginning. Libraries continued renewing them because scientific journals were the most important information source for their users and the most wanted material type in their collections. Librarians decided to cut some other expenses in order to keep the subscriptions. But then publishers, encouraged by scientists' continuous need for quality information, continued upraising subscriptions without fear of losing subscribers. Librarians were desperate; their role of acquiring information for their users was jeopardized. Scientists were desperate, too; there was a big threat to their future work – what will they do, how will they continue their researches without access to all the information they need?

The "serial crisis" culminated at the end of 1980s and at the beginning of 1990s, when the subscriptions became so high that libraries started cancelling them. At the same time, scientists' needs have not changed – their constant need for information conflicted with libraries' inability of acquiring it. Something had to be done immediately. Luckily, at the time the crisis culminated, a new option had opened, thanks to technological development – the possibility of electronic publishing. In 1991 the first electronic database with free access to full-text articles was launched – Paul Ginsparg's *ArXive*.[11] It seemed like a good solution – but numerous problems emerged instantly. To make a general overview of a variety of standpoints at the beginning of electronic publishing, we will set out some pro and contra arguments.

The loudest opponents to electronic publishing were commercial publishers, although there were some opponents among the scientists. Publishers had established a perfect system of publishing printed scientific journals with good profit. That is the reason why they were afraid of any new ideas that could lead to losing their subscribers, and therefore their profit. The following reasons were contra electronic publishing:

- Printed journals have existed for more than three centuries, and, despite several crises, attempts at replacing them were unsuccessful. Microfilms and microfiches are a good example of such an attempt – they were cheaper to produce and to distribute, but reading devices were not so cheap and situated mostly in libraries. For the users it was easier to use printed material than microforms. Today, we have the problem of a small number of reading devices, as they are not produced anymore. Electronic material could have the similar destiny, according to electronic publishing opponents.

- Paper is a universal medium, it is durable and portable. We can today read records written on paper centuries ago, without using modern technology. But today it is hard to find

[11] Arxive.org, http://www.arxive.org, (accessed October 04, 2010).

technology that could support the use of, for example, 5.25¨ floppy disks (that were in use only a short time ago).

- The expense of reformatting data records and/or the expenses of maintenance of old reading devices are too high.

- Who will take care of electronic material archiving? Libraries and archives traditionally take care of printed material. They also started to collect electronic material because of saving both space and money. But can they archive such material for future generations?

- The reason why all the earlier ideas of creating substitutes for journals failed is that all of them emerged form information industry and not from information users. The electronic publishing also emerged from information technology, not from the users.

- Reading printed text is easier than reading electronic text on computer monitor. People like to make printed copies of electronic text anyway.

- Language could also be a problem. English is a dominant language on the Internet. Special equipment and software is needed for using, for example, some Asian languages (with non Latin script).

- Copyright issues can be problem, as well. Free access to information is hard to control. It would take additional effort for publishers to protect and control any electronic record they publish.

- Change of electronic documents' location on the Internet can also be a problem. A scientific journal found on one web site today, can easily be replaced tomorrow and therefore impossible to find and cite using the old reference.

- Quality control that is guaranteed in printed scientific journals is impossible on the Internet. It is easy to publish on the Internet and there is a high risk of accumulating worthless information. What will happen with peer-review in electronic environment?

- There is a possibility that scientists in less developed countries would not have the same possibility to access all the electronically published information.

- Electricity supply could also be a problem. One small breakdown could cause temporal or permanent lost of a number of records.

- Libraries still want to have printed versions of journals and their users still prefer to use printed versions.

Electronic publishing proponents, mostly libraries and scientists, had their answers to all the reasons contra electronic publishing. Its most important advantages are:

- Quick information distribution – the information could be delivered as soon as it is created. The scientific journal editing process, as well as peer-review process, is much faster than in the printed environment. Thanks to that, results of scientific researches could be published faster, and, therefore, used sooner for future researches.

- Searching for information is easier – databases are searchable by authors, publishers, keywords, words form titles, institutions etc. Information that is found using search engines is precise and accurate.

- Accessibility – scientific information could be accessible to everyone via the Internet. Any scientist, anywhere in the world, at any moment, can access the information if he had the necessary hardware and software.

- Links to other information can broaden and facilitate information searches.

- Scientists throughout the world could discuss problems and results – two scientists who had never met before and will probably never meet, can collaborate, even work on the same research and the same paper.

- In the electronic environment there is a possibility of publishing sounds, motion pictures, 3D models, high resolution photographs etc. That is not possible in traditional print environment.

- Beside time savings, there are also money savings when publishing electronically. It is easier to make new copies of electronic than of printed texts.[12]

- It would be cheaper for scientists and their institutions in developing and transition countries to buy hardware and software to access the Internet, than to pay higher and higher subscriptions to the journals every year. Developed countries could, as well, help less developed countries to acquire necessary equipment. [13]

- Although it is truth that we do not know enough about a lifetime of a CD ROM, floppy disc, USB memory stick, DVD or a Blu-ray; we know that the paper can be destroyed by inappropriate humidity or temperature.

[12] Treloar, Andrew. "Electronic scholarly publishing and the world wide web." *Journal of scholarly publication* 27, no. 3 (1996): 135-150.
[13] Eisenberg, Daniel. "The electronic journal." *Journal of scholarly publishing* 20, no. 1 (1988): 49-58.

- Quality control can remain the same in electronic environment; the peer-review process could be carried out, even faster. Also, some additional ways of quality control are possible as well.[14]

- Copyright issues will not be problem, especially for authors. Scientists give their rights to publishers anyway. It would be better if their work was publicly available on the Internet to anyone interested in it.

Electronic publishing proponents pointed out the two things that had to be done to solve the scientific journal crisis – (a) scientific publishing should be controlled by the authors and (b) electronic publishing should be accepted by the scientists as soon as possible.

At the end of this short overview, we have to note that electronic publishing opponents were right regarding shortcomings of some aspects of the new way of communication, but the future will show that the problems are not unsolvable.

1.4 The fourth revolution of human mind

One interesting question raised up from the discussion on the future of electronic publishing – is it a new revolution of the human mind? S. Harnad mentions the three revolutions in the evaluation of human communication and cognition, each of them accelerating human thought and causing further developments. The first revolution was language – each word had been given its meaning and communication was speeded up. Human beings became the first and only species able and willing to describe the world they live in. The second cognitive revolution was the advent of writing – information had been given the opportunity to be carried throughout space and time. Thanks to the second cognitive revolution, we have records of knowledge that date centuries ago. The third revolution was Gutenberg and his print press. It enabled information to be carried even faster, and that was of a great importance for faster development of all fields of human activities, including science. Harnad poses the question whether the invention of binary code and IT development is the fourth revolution of human mind.[15] If we look back in history, people always needed a time distance before judging some historical events. Socrates, for example, did not believe in

[14] McCallum, David L. "Proposed principles for electronic scholarly publishing projects: (25/02/97)," http://www.schoolnet.ca/vp-pv/cesn/e/princips.htm, (accessed October 28, 2010).
[15] Harnad, Stevan. "Post-Gutenberg galaxy: the fourth revolution in the means of production of knowledge." P*ublic-Access Computer Systems Review* 2, no. 1 (1991): 39-53, also available at: http://www.ecs.soton.ac.uk/~harnad/papers/harnad/harnad91.postgutenberg.html, (accessed October 28, 2010).

writing (that does not make him a bad philosopher, but, ironically, everything we know about him, we know thanks to written records). Not everyone was aware of the importance of printing press at the time it was invented (although Martin Luther considered it "a gift from God"). So, is it too early to say that electronic communication is a new revolution in the means of production of knowledge? Did the revolution happen "over night", or does it have its history? Will the revolution have effects on traditional writing? [16]

We can say that, besides all the other historical facts and development of science, the turning point was the end of World War II. W. Bush published in 1945 an article where the idea of machine storage and search of information is emphasized. He mentions the Memex machine anticipating the invention of computers and computer networks.[17] The first computer network was *ARPANET* (*Advanced Research Projects Agency Network*) created by *Massachusetts Institute of Technology* and the *United States Department of Defense* in 1969. The term Internet was in use during the 1970s but in the late 1980s the term started to be used as the name of the network and at that time the first Internet service provider companies were formed. In the year 1997 there were about 177,000,000 Internet users in the world, in 2000 there were 360,985,492 Internet users, that number increasing to 1,966,514,816 by the end of June 2010.[18] The number is quiet impressive and it does not let us ignore the fact that the Internet has become an important communication channel.

All of the problems that electronic publishing opponents had mentioned are being solved. Although there are some new ways of controlling scientific papers quality in the electronic environment (such as open peer commentaries,[19] automatic reviewing[20] or Guild Publishing Model[21]), quality control mechanism remains the same. The new ways of control are good because they involve more commentaries from more experts, but they also have some shortcomings, like the impossibility of controlling who the commentators are or prejudging

[16] Ferris, Sharmila P. "Writing electronically: the effects of computers on traditional writing." *Journal of electronic publishing* 8, no. 1 (2002), available at: http://quod.lib.umich.edu/cgi/t/text/text-idx?c=jep;view=text;rgn=main;idno=3336451.0008.104, (accessed October 29, 2010).
[17] Bush, Vannevar. "As we may think." *The Atlantic Monthly*, July 1945, available at: http://www.theatlantic.com/unbound/flashbks/computer/bushf.htm, (accessed October 29, 2010).
[18] Internet world stats, "Internet usage statistics: the Internet big picture: world Internet users and population stats," http://www.internetworldstats.com/stats.htm, (accessed October 29, 2010).
[19] Harnad, Stevan. "Scholarly skywriting and the prepublication continuum of scientific inquiry," http://www.ecs.soton.ac.uk/~harnad/Papers/Harnad/harnad90.skywriting.html, (accessed October 29, 2010).
[20] Nadasdy, Zoltan. "Truly all-electronic journal: let democracy replace peer review," http://www.press.umich.edu/jep/03-01/EJCBS.html, (accessed October 29, 2010).
[21] Till, Jim. "The "Guild publishing" model," http://www.ecs.soton.ac.uk/~harnad/Hypermail/Amsci/1889.html, (accessed October 28, 2010).

the quality of a paper regarding the reputation of author's institution. Nowadays, classical peer review process is still crucial for evaluating scientific papers and journals.

New methods of encryption are developed, so the unauthorized changes of texts are not possible. Thanks to identifiers, such as Digital Object Identifier (DOI), digital objects can be identified regardless of their current Internet location. Intellectual property rights are being managed, and publishers have developed new models of charging access fees for the information they publish.

If we turn back to the question about the fourth revolution, we can say – yes, the fourth revolution is definitely in progress. Electronic publishing has changed the way people communicate, not only in science. It did the same thing as the previous three revolutions – speeded up communication process.

2. OPEN ACCESS TO SCIENTIFIC INFORMATION

2.1 Definitions of Open Access

The first ideas about electronic journals that could be freely available on the Internet as well as the ideas about archives of scientific papers date from the early 1990s. In 1990 W. Gardner proposed publishing electronic psychology journals using the term "electronic archive".[22] The same term was used by P. Ginsparg in 1991 when he set up *ArXive,* the first digital archive of scientific papers. Today, the term archive is rarely in use – it is replaced by the term "repository" or, sometimes, "e-print service". One of the reasons for giving up the term "archive" is homonymy – the expression "archive" is used on journals web sites for accessing digital collections of older journal issues. The term "Open Access" (OA) came in to use at beginning of the year 2002 when the first Open Access initiative – *Budapest Open Access Initiative* (*BOAI*) – was launched. The term and its acronym are today usually used as a part of the terms related to Open Access, e. g. OA publishing, OA repository, OA journal and OA policy.

The most important event for OA development was *Budapest Open Access Initiative*. *BOAI* arose from a meeting held in Budapest, organized by the *Open Society Institute* in December 2001. The main goal of the meeting was to accelerate progress in making world scientists' research articles freely available on the Internet. The result of the meeting was a historical initiative that is a statement of principles and strategies for achieving free access to scientific information. The initiative introduces the term "Open Access" that will soon be adopted by worlds' scientists, publishers, libraries, scientific institution and other users of scientific information. The initiative is crucial for defining Open Access as well as for

[22] Gardner, William. "The electronic archive: scientific publishing for the 1990s." *Psychological Science* 1, no. 6 (2006): 333–341.

promoting it worldwide. All the other initiatives and statements are based on the *BOAI*. The basic definition of Open Access (in the BOAI written in lower case) is very simple: Open Access is the free and unrestricted online availability of scientific journal literature. Open Access should permit any users "to read, download, copy, distribute, print, search, or link to the full texts of the articles, crawl them for indexing, pass them as data to software, or use them for any other lawful purpose, without financial, legal, or technical barriers other than those inseparable from gaining access to the Internet itself."[23] The initiative begins with the statement that an old tradition and a new technology have converged to make possible an unprecedented public good. The old tradition is traditional scientists' willingness to publish the research results in scientific journals without remuneration. The new technology is the Internet. The public good that is mentioned in the statement is worldwide electronic distribution of peer-reviewed journals that should be freely and unrestrictedly accessible to everyone. Accelerating research, enriching education and sharing learning can only be possible by removing access barriers. If so, scientific literature will have maximal usability and it will unite humanity in a common intellectual conversation and quest for knowledge. Besides peer-reviewed journal articles, unreviewed pre-prints could also be freely accessible and then commented by colleagues. As the *BOAI* says, it has to be shown that Open Access is economically feasible, it gives readers the opportunity to use relevant information and it gives authors readership, better visibility and impact. The *BOAI* states that freely available peer-reviewed journal articles are not costless to produce but the cost is lower than the cost of producing and disseminating traditional printed and subscription-based journals. It will be necessary to find new cost recovery models and financing mechanisms, but "the old tradition and the new technology" give the world the opportunity to save money and to expand the scope of dissemination.

The *BOAI* recommends two ways to attain Open Access to scientific literature. The first one is self-archiving, i. e. depositing journal articles in open electronic archives (that will later be called Open Access repositories). If those archives conform to the standards created by the *Open Archives Initiative*, search engines could search through all the archives as one. The second way of achieving Open Access is publishing articles in new generation journals - Open Access journals. They will ensure permanent OA to all of their published articles without charging subscription or access fees. All the participants of scientific communication are encouraged to find new methods for covering the expenses of producing OA journals. They are also encouraged to find new ways of making the transition from the traditional

[23] Budapest Open Access Initiative, http://www.soros.org/openaccess/read.shtml, (accessed November 02, 2010).

scientific information dissemination to Open Access. In the final part of the *BOAI*, governments, universities, libraries, journal editors, publishers, foundations, learned societies, professional associations and individual scholars are invited to help removing barriers to Open Access. By October 2010 the *BOAI* was signed by 5322 individuals and 539 organizations.

Another important initiative was *Bethesda Statement on Open Access publishing* that arose from the meeting held in April 2003 at *Howard Hughes Medical Institute* in Chevy Chase, Maryland. The purpose of the document is to stimulate discussion within the biomedical research community on how to proceed, as rapidly as possible, to the widely held goal of providing Open Access to primary scientific literature.[24] The statement consists of four sections – the first one defines Open Access publication, and is followed by reports of three working groups. According to the statement, Open Access publication is a publication whose authors and copyright holders grant free, unrestricted and worldwide access to it. They also give a license to copy, use, distribute and transmit the work publicly as well as to make and distribute derivative works in any digital form and for any responsible purpose. Authors should be properly acknowledged and have the right to make printed copies for personal use. Final versions of the work, as well as all supplemental materials in a suitable standard electronic format, should be deposited immediately upon initial publication in at least one online repository (in the statement, the term "repository" is used instead of the term "electronic archive" that was used in the *BOAI*). The repository should be supported by an institution or organization that encourages Open Access and enables interoperability and long-term archiving (e. g. *PubMed Central*). Institutions and funding agencies working group reported that the organizations would sponsor scientific research to promote new knowledge for the public benefit. They encourage Open Access publishing to maximize the benefit to scientists and the public throughout the world. They are aware of some costs and are willing to help fund the necessary expenses of publication under the OA model of individual papers in peer-reviewed journals. The libraries and publishers working group reported that they believed OA will be an essential component of scientific publishing in the future. Libraries proposed to develop and support mechanisms to make the transition to OA publishing and to provide examples of the mechanisms to the community. Libraries will give high priority to educating users about the benefits of OA and will highlight OA journals in their catalogues and other databases. Publishers committed to provide an OA option for any research article they publish. They will also work to develop tools to facilitate publication in standard

[24] Bethesda statement on Open Access publishing, http://www.earlham.edu/~peters/fos/bethesda.htm, (accessed November 02, 2010).

electronic formats suitable for archiving and efficient searching. Publishers will try to ensure that OA models requiring author fees will not cause disadvantages and barriers for scientists from developing countries. Scientists and scientific societies working group endorse the principles of Open Access. They recognize that publishing is a fundamental part of research process and its costs are the major costs of doing research. Scientific societies affirm their support for Open Access and their commitment to achieve OA for all the works they publish. Scientists will manifest their support for OA by publishing in, reviewing for and editing OA journals as well for the journals that are making a transition to OA. Scientists and scientific societies commit to educate their colleagues, their members and the public about the importance of OA.

The third important OA initiative is *Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities*. The declaration is the result of the *Conference on Open Access to Knowledge in the Sciences and Humanities* that took place in Berlin in October 2003. The Internet is recognized as an emerging functional medium for knowledge distribution and new possibilities of information dissemination through OA on the Internet are supported.[25] *Berlin Declaration* repeats some of the definitions from the previous two initiatives (the *BOAI* and the *Bethesda Statement*). The further progress is intended to be made by encouraging researchers to publish in OA, by encouraging the holders of cultural heritage to support OA, by developing ways to evaluate OA contributions in order to maintain the quality standards, by advocating recognition of OA publications in promotion and tenure evaluation and by encouraging software development, metadata creation and publication of individual articles. It is necessary to find solutions that support further development of the existing legal and financial frameworks in order to facilitate optimal use and access.

The three initiatives (usually called the *3B initiatives* according to the first letters of the cities they were signed in) were the basis for further definitions of OA. S. Harnad defines OA as free, immediate, permanent online access to the full text of research articles for anyone, web wide.[26] For H. Morrison, OA literature is "free online for anyone, anywhere, to read, download and use, providing that the author is properly cited. To be fully Open Access, literature must be freely available as soon as it is published, if not before (as a pre-print)."[27]

[25] Berlin declaration on Open Access to knowledge in the sciences and humanities, http://oa.mpg.de/openaccess-berlin/berlindeclaration.html, (accessed November 02, 2010).
[26] Harnad. Stevan. "What is Open Access," http://www.eprints.org/openaccess, (accessed November 02, 2010).
[27] Morrison, Heather. "Open Access for librarians in developing countries," http://eprints.rclis.org/6597/1/OADeveloping.pdf, (accessed November 02, 2010).

To help understand OA, P. Suber states the incomplete realizations of OA (i. e. steps that are in the right direction but only partially fulfilling OA definitions). The steps are: online but not free; free and online but not full-text; free online pre-prints but not post-prints; free online pre-prints and post-prints but only some time after print publication; free online special issues but not regular issues; free online searching but not reading; free online reading but other uses limited; free online use but only one article at a time; free online but only text (not charts, illustrations…); free online current issue, but not previous issues; free online back issues, but not the current one; free online but only some period after toll-access publication, or only for a limited time; free and online only after article acceptance and before it is published; free only for registered users; free online access only to editor-selected articles; free online access only to author-selected and prepaid articles (i. e. true OA for the selected articles but not for the journal they are published in).[28] The main goal of OA is removing price and permission barriers. OA is compatible with copyright, peer-review, career-advancement, indexing and other features and supportive services associated with conventional scholarly literature.[29] OA literature is online, free of charge and free of most copyright restrictions. Lately, some discussions have been opened about the difference between the terms "Open Access" and "free access".[30] The first expression became a business model where the author (or his/her institution) pays for the possibility of Open Access. The second term means the access that does not have to be paid for.

As defined in the *BOAI*, there are two ways of achieving OA – OA repositories and OA journals. The first one is usually called "green route to OA" because the publishers have to give "green light" for self-archiving articles that are published in their journals. At the beginning of the OA movement, OA repositories were meant to be only a tool for bridging the problems during transitional times, until all the technical and legal conditions will be ready for achieving "golden route to OA", i. e. publishing in OA journals.

[28] Suber, Peter. "Lists related to the Open Access movement," http://www.earlham.edu/~peters/fos/lists.htm, (accessed November 02, 2010).
[29] Suber, Peter. "Open Access overview," http://www.earlham.edu/~peters/fos/overview.htm, (accessed November 02, 2010).
[30] Holmes, Neville. "Free access is not Open Access," http://www.binarylaw.co.uk/index.php/2007/10/11/free-access-is-not-open-access/, (accessed November 02, 2010).

2.2 Green route to OA – OA repositories

A digital repository manages and stores digital content providing access to it. OA repositories are based on self-archiving; i. e. depositing full-texts of scientific papers (either pre-prints or post-prints). It is supposed to be done by the authors themselves, sometimes with help of librarians or other information specialists. Self-archiving was firstly proposed by S. Harnad in the year 1994 – he called upon all the authors who write only for science impact, not for money, to deposit their work on the net so it could be accessed for free to anyone. The proposal lead to the numerous discussions on the Internet and they were published afterwards.[31] Even before his proposal, Harnad wrote about the advantages of the Internet in the process of scientific communication. He used the term "scholarly skywriting" for the possibility of sending electronic massages to individuals or groups and making information visible to all in a very short time.[32]

All the articles deposited in a repository are called e-prints. E-prints can be pre-prints or post- prints. Pre-prints are unreviewed (author's) versions deposited before they are sent to a journal for peer-review. Those articles are completely the author's property and he/she can do with them whatever he/she wants, including making them publicly available on the Internet. Before sending an article to a journal for peer-review, the copyright holder is the author himself and at that moment self-archiving cannot be banned. Post-prints are articles accepted for publication in a peer-reviewed scientific journal, or the articles that are already published in such a journal. Copyright owner of those articles is publisher, so he has to give permission for self-archiving. If the publisher does not allow self-archiving, the author can anyway self-archive pre-print with an additional document describing all the changes that had been done before the final version was accepted for publishing. There are two possible versions of post-prints - author's version and publisher's version. The content is the same, but the publisher's version went through final editing; it is usually in PDF format that looks exactly like the version published in the journal. Publisher's version is sometimes called "publisher's PDF".

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[31] *Scholarly journals at the crossroads: a subversive proposal for electronic publishing* edited by Ann Shumelda Okerson and James J. O'Donnell, 1995, www.arl.org/scomm/subversive/toc.html, (accessed November 02, 2010).

[32] Harnad, Stevan. "Scholarly skywriting and the prepublication continuum of scientific inquiry," http://www.ecs.soton.ac.uk/~harnad/Papers/Harnad/harnad90.skywriting.html, (accessed October 29, 2010).

Institutional repositories, the most common type of OA repositories, are defined by *SPARC* (*Scholarly Publishing and Academic Resources Coalition*), an international alliance of universities, research libraries and organizations, as "digital collections capturing and preserving the intellectual output of a single university or a multiple institution community of colleges and universities." OA institutional repository (IR) has to be institutionally defined, scholarly, cumulative, perpetual, open and interoperable.[33]

There are many advices and suggestions how to set up an OA repository. One of them is a guide to setting up and running digital repositories developed by JISC *infoNet*, the UK's advisory service for managers in the education sector.[34] Another interesting project is an *Australian OAK Law Project* that published a guide to developing OA repositories.[35] A valuable attempt of summarizing all the suggestions and experiences was I. Kuchma's lecture on 23 steps in setting up an OA repository. At the beginning, that management of the institution approves the implementation of an IR. Also, a server has to be in place to host the IR and an IR manager has to be identified. Repository working group has to undertake high level management of a repository on behalf of the institution (key stakeholders have to be included in the group – policy makers, academic staff, library staff, technical support staff and others). Roles and responsibilities for IR development have to be defined and needs analysis has to be conducted to help defining the vision, initial goals, target content and other important issues. Available software systems have to be evaluated; licensing and copyright issues discussed. It is important to give a repository an appropriate name and to build and present a business plan to management (a good example of a business plan is the *University of Pretoria* Digital repository business plan[36]). A very important step is deciding on the IR policy that has to include OA policy, metadata standards, selection criteria, preservation details etc.[37] Once a repository is set up, its manager and the working group should keep monitoring server capacity; stay updated through mailing lists; by reading articles and attending conferences.

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[33] Association of Research Libraries, "The case for institutional repositories: a SPARC position paper," 2002. http://www.arl.org/sparc/bm~doc/ir_final_release_102.pdf, (accessed November 02, 2010).

[34] Joint Information Systems Committee, "The digital repositories infoKit," 2009. http://www.jiscinfonet.ac.uk/infokits/repositories/index_html, (accessed November 02, 2010).

[35] Pappalardo, Kyleie; Fitzgerald, Anne and Fitzgerald, Brian. "A guide to developing Open Access through your digital repository," 2007. http://eprints.qut.edu.au/archive/00009671/01/9671.pdf, (accessed November 02, 2010).

[36] Stellenbosch University, "University of Pretoria digital institutional research repository business plan example only," http://ir.sun.ac.za/wiki/files/business_plan.doc, (accessed October 29 2010).

[37] Kuchma, Iryna. "How to start: setting up repositories." In *Open Access to the achievements of Slovenian scientists: Proceedings of the 4th joint conference of the Special Libraries Section and the Academic Libraries Section of the Slovenian Library Association*. Ljubljana: Zveza bibliotekarskih društev Slovenije, 2010: 147-151.

One of the steps mentioned above is choosing appropriate software. The software has to satisfy the institution's needs. *Open Society Institute* published in 2004 a brochure that could help institutions in choosing appropriate software.[38] The software systems described in the document had to satisfy the three criteria:

- they have to be available via an Open Source license (i. e. they have to be freely available, modified, upgraded and redistributed);

- OAI-PMH (*Open Archives Initiative – Protocol for Metadata Harvesting*) compliance (to ensure that each implementation can participate in a global network of interoperable research repositories);

- they are currently released and publicly available.

According to the *OpenDOAR* (*Directory of Open Access Repositories*) statistics, at the beginning of 2009 the most used software systems were *DSpace* and *EPrints* and that has not changed until October 2010 (Table 1). The same situation is in the *ROAR* (*Registry of Open Access Repositories*). The most frequently used software systems in both *DOAR* and *ROAR* repositories are shown in the table (for the years 2009 and 2010).

software	DOAR		ROAR	
	2009	2010	2009	2010
DSpace	368	617	375	690
EPrints	245	288	286	347
Bepress	51	-	77	100
OPUS	51	54	29	40

Table 1: The most frequently used software systems in the *DOAR* and the *ROAR* in 2009 and 2010

Open Archives Initiative (OAI), which develops and promotes interoperability standards to facilitate the efficient dissemination of content, is crucial for OA repositories interoperability. The initiative has its roots in an effort to enhance access to e-print archives as a means of increasing the availability of scientific communication. One of its projects is *Open Archive Initiative - Protocol for Metadata Harvesting* (OAI-PMH), a low-barrier mechanism for repository interoperability. Data providers are repositories that expose structured metadata

[38] Open Society Foundations, "Open Society Institute: a guide to institutional repository software," http://www.soros.org/openaccess/software/OSI_Guide_to_Institutional_Repository_Software_v3.htm, (accessed November 02, 2010).

via OAI-PMH and Service providers then make OAI-PMH service requests to harvest that metadata.[39]

Another very important issue for self-archiving is publisher's self-archiving policy that can be checked on the *SHERPA/RoMEO* website (for some publishers). On the website publishers are given four colours depending on their self-archiving policies. Green publishers allow depositing both pre-print and post-print; blue publishers allow archiving post-print (final author's draft or publisher's version); yellow publishers allow pre-print archiving and white publishers do not formally support self-archiving.[40]

Publisher's colour	Total no. December 2008	Total no. June 2010	Total no. January 2011
green	141	220	230
blue	97	196	242
yellow	54	75	76
white	145	295	346
Total	**437**	**786**	**894**

Table 2: Total number of publishers in 2008, 2010 and 2011 according to SHERPA/RoMEO project

In January 2011 there were 894 publishers on the list - 230 green publishers, 242 blue publishers, 76 yellow publishers and 346 white publishers. Table 2 shows the numbers comparing to the total numbers of each colour for December 2008 and June 2010. It is obvious that the number of publishers that support self-archiving increased.

A great help for authors when deciding on copyright issues are Creative Commons (CC) licenses. *Creative Commons*, a not-for-profit organisation found in 2001, develops technical infrastructure that consists of a set of copyright licenses and tools. CC licenses are based on copyright and they work around the world and last as long as applicable copyright lasts. The licences offer standardised way to help creators retain copyright while allowing others to copy, distribute and make some uses of their work ("some rights reserved").

When choosing a license, licensor answers two questions:

1. Do you allow commercial uses of your work?
2. Do you allow modifications of your work?

[39] Open Archives Initiative, "Open Archive Initiative Protocol for Metadata Harvesting," http://www.openarchives.org/pmh/, (accessed November 02, 2010).
[40] Securing a Hybrid Environment for Research Preservation and Access, "Publisher copyright policies and self-archiving," 2009. http://www.sherpa.ac.uk/romeo/, (accessed November 02, 2010).

There are two possible answers to the first question (yes or no) and three possible answers to the second question (yes; no; yes, as long as others share alike). Combination of the answers gives six possible licenses: Attribution (CC BY), Attribution-ShareAlike (CC BY-SA), Attribution-NoDerivatives (CC BY-ND), Attribution-NonCommercial (CC BY-NC), Attribution-NonCommercial-ShareAlike (CC BY-NC-SA) and Attribution-NonCommercial-NoDerivatives (CC BY-NC-ND).[41]

Visibility and accessibility of OA repositories and their contents can increase by registering them in online directories. One of them is *OpenDOAR*, the project that started at the University of Nottingham, UK, in 2006. It provides repository list and let the users search for repositories or their contents. It also provides tools and support to both repository administrators and service providers in sharing best practice and improving the quality of the repository infrastructure.[42] The table shows OA repositories types worldwide for May 2009 and October 2010. According to the Table 3 and according to the data on growth of the OpenDOAR database,[43] it is obvious that the database is well accepted within scientific community.

A database very similar to *OpenDOAR* is *ROAR*, project started in 2005 at the *University of Southampton* by T. Brody. Data from January 2009 shows that there were 1243 repositories in the registry, and the number increased to 1900 by October 2010 (Table 3).[44]

Repository type	May 2009	October 2010
Institutional	1233	1418
Disciplinary	182	211
Aggregating	56	74
Governmental	28	40

Table 3: Repository types in the OpenDOAR in May 2009 and October 2010

[41] Creative Commons, http://creativecommons.org, (accessed June 28, 2010).
[42] DOAR: Directory of Open Access Repositories, www.opendoar.org, (accessed July 12, 2010).
[43] Directory of Open Access Repositories, "Growth of the Open DOAR database: worldwide," http://www.opendoar.org/onechart.php?cID=&ctID=&rtID=&clID=&lID=&potID=&rSoftWareName=&search=&groupby=r.rDateAdded&orderby=&charttype=growth&width=600&height=350&caption=Growth%20of%20the%20OpenDOAR%20Database%20-%20Worldwide, (accessed November 06, 2010).
[44] ROAR: Registry of Open Access Repositories, 2010. http://roar.eprints.org, (accessed November 06, 2010).

Institutions can also register their OA policy at *ROARMAP* (*Registry of Open Access Repository Material Archiving Policies*).[45] The policies are classified as institutional mandates, departmental mandates, funder mandates, thesis mandates and multi-institutional mandates.

Project *DRIVER* (*Digital Repository Infrastructure Vision for European Research*) is focused on European repositories and its networking activities have the task of "building a confederation of European digital repositories that will enable the share and re-use of scholarly information, through the involvement of representatives of academic institutions that host scientific digital repositories and representatives of national, regional or subject-based federations.[46] The number of repositories in the database was 70 at the end of 2007 and 250 until October of 2009.[47]

2.3 Golden route to OA – OA journals

According to S. Harnad and other authors (T. Brody, F. Vallieres, L. Carr, S. Hitchcock, C. Oppenheim, H. Stamerjohanns i E. R. Hilf) the ideal version of OA are OA journals.[48] That is why they are called the "golden route to OA".

The first OA journal, *Psycholoquy*, was launched by Stevan Harnad in 1989 and became peer-reviewed in 1990. The journal was sponsored (but not published) by the *American Psychological Association* and is important for implementing a new way of quality control – open peer commentaries – that are published along with the article they are referring to. If we want to analyze all the problems that OA journals faced at the beginning of their lifetime, we have to mention four major issues – funding, publishers' OA policies, intellectual property rights management and visibility of OA journals. OA journals are free of charge for users, but are not free to produce. Although costs are lower than the costs of conventionally published journals, they still exist. Several non-subscription based models have been developed since the launch of the first OA journals. Even before the *BOAI*, W. Y. Arms proposed two funding models for OA journals – priced add-ons and external support (e.g. by universities or

[45] ROARMAP, http://www.eprints.org/openaccess/policysignup/, (accessed November 06, 2010).
[46] DRIVER II: Digital Repository Infrastructure Vision for European Research, http://www.driver-repository.eu/PublicDocs/FACT_SHEET_I3_driver_ii.pdf, (accessed November 06, 2010).
[47] DRIVER: Networking European scientific repositories," http://www.driver-repository.eu/, (accessed November 06, 2010).
[48] Harnad, Stevan et al. "The access/impact problem and the green and gold roads to Open Access." *Serials Review* 30, no. 4 (2004), available at: http://eprints.ecs.soton.ac.uk/10209/1/impact.html, (accessed November 06, 2010).

scientific associations).[49] One model is copied from non-OA journals – "author pays" business model where the author (or his/her institution) pays for Open Access possibility (similar to "page charges" in conventional journals). For example, *BioMed Central* has a list on its website with the exact price for paid OA possibility in each of their journals. There are various discounts for the authors who are peer-reviewers as well as for the authors from developing countries. Authors whose institutions are members of *BioMed Central* do not pay for OA possibility.[50] The model is interesting to traditional subscription-based publishers who want to implement OA in their business models, thus publish hybrid journals. According to the *SHERPA/RoMEO* project, in May 2009 there were 67 publishers with the paid option for OA, the number increased to 87 in October 2010 and to 105 in January 2011. The publishers use different paid option models, and an example is *Springer Open Choice*.[51] It allows *Springer* authors to decide how their articles will be published in *Springer* journals. If authors choose Open Access option (Figure 4), they will not be required to transfer their copyright. The articles will be peer-reviewed just like all the other *Springer* articles and will be available on the *SpringerLink*. Those articles can be archived in OA repositories immediately (this is where green and golden routs to OA meet). Authors or their institutions pay for the *Open Choice* and subscription prices would be lower if the number of OA articles was higher in previous years.[52]

Another similar optional Open Access model is *Oxford Open*, by *Oxford University Press*. There is a list of 93 journals that have OA option and the prices depend on whether authors are based in an institution with or without a full price online subscription. There are also discounts for the authors from developing countries.[53]

[49] Arms, William Y. "Economic models for Open Access publishing," http://www.cs.cornell.edu/wya/papers/iMP-2000.html, (accessed November 06, 2010).
[50] BioMed Central, "How much is BioMed Central charging?," http://www.biomedcentral.com/info/authors/apcfaq#howmuch, (accessed November 06, 2010).
[51] Springer, "Springer Open Choice," http://www.springer.com/open+choice?SGWID=0-40359-0-0-0, (accessed November 06, 2010).
[52] Springer, "The Springer open choice flow diagram," http://www.springer.com/cda/content/document/cda_downloaddocument/Springer+Open+Choice+flow+diagram.pdf?SGWID=0-0-45-164919-0, (accessed November 06, 2010).
[53] Oxford University Press, "Oxford Open," http://www.oxfordjournals.org/oxfordopen/, (accessed November 06, 2010).

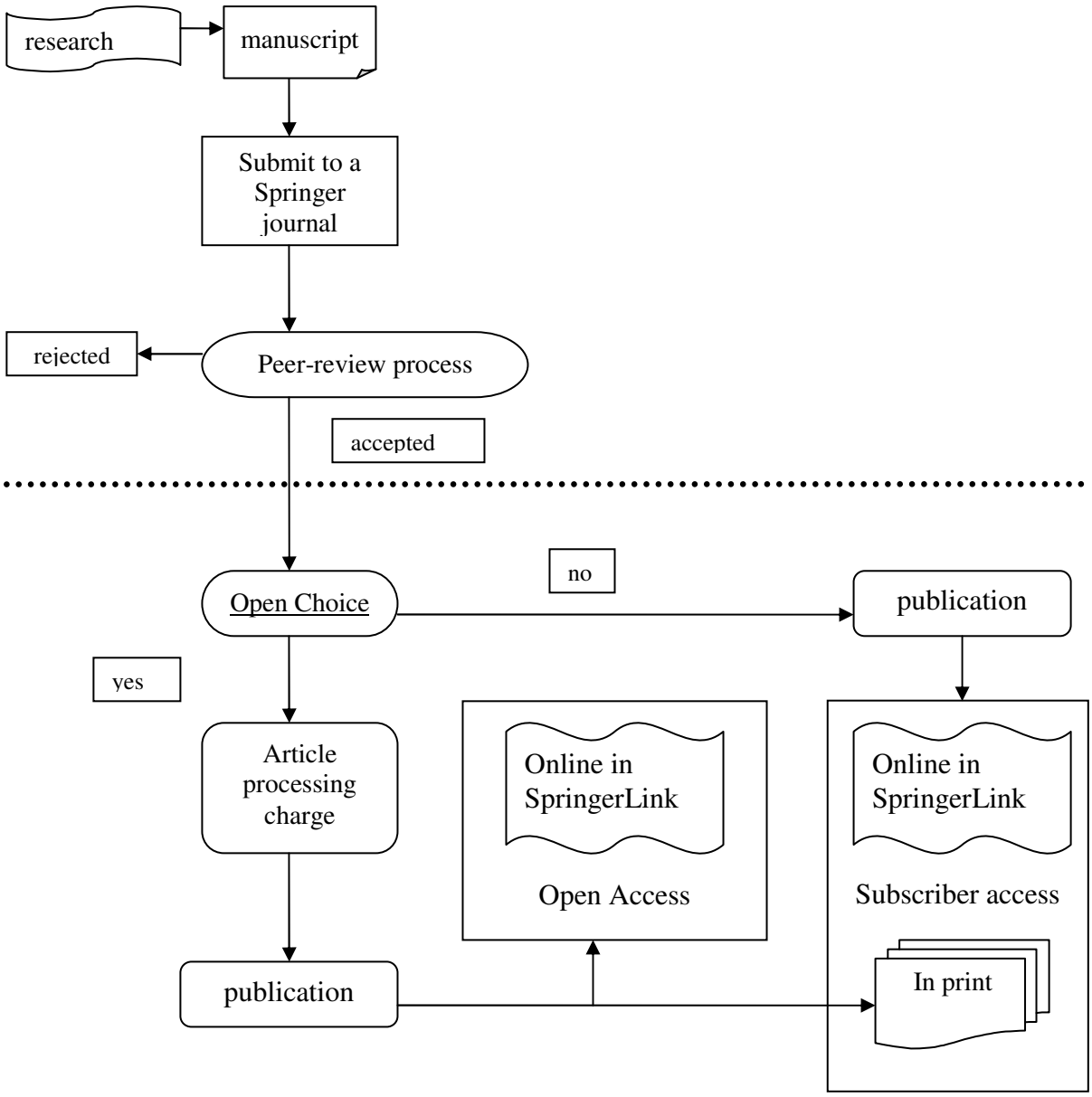

Figure 4: Springer Open Choice flowdiagram

By offering open choice models, publishers show their understanding of the OA movement importance, not giving up their profit. D. W. King's question in 2004 was – should commercial publishers be included in the model for Open Access through author payment.[54] Today, the answer is obvious – they are involved and author payment model became a common way of covering expenses of producing OA journals or articles. Beside models

[54] King, Donald W. "Should commercial publishers be included in the model for Open Access through author payment?" *D-Lib Magazine* 6, no. 10 (2004).

mentioned above, D. Solomon gives a significant role to volunteer effort in operating OA journals. Undergraduate and graduate students are a possible source of volunteer help.[55]

Ensuring high visibility is very important for OA journals. *Directory of Open Access Journals* (*DOAJ*), a database created and maintained by the *Lundt University*, aims to be comprehensive and to cover all OA journals that use a quality control system to guarantee the content. It also aims to increase the visibility and the use of OA journals thereby promoting their increased usage and impact. There were 4184 journals in the *DOAJ* in May 2009, with 1538 journals searchable on the article level. In October 2010 the numbers increased to 5509 journals, 2337 of them searchable on the article level.[56]

2.4 Citation impact of OA literature

There are three levels of discussion about the citation impact of OA journals and articles. The first (and the earliest) thematic level is the one that analyzes the citation advantage of OA articles and journals. Papers from the second level of discussion try to answer the question – is OA itself the only reason for the better impact of OA articles, or are there some other reasons? The growth of the number of articles dedicated to OA was the reason why the third group of papers, literature review articles, showed up – the results needed to be synthesized and reinterpreted.

Very important factors for authors are their articles' visibility and impact – they can improve the authors' future research helping them in their career advancement. Having that in mind, McVeigh stated in 2004 that if authors could see an improvement in the impact of their work due to OA, they would be willing to use OA. In the early 2000s OA proponents had to prove the impact and citation advantage of OA articles. Without positive results, scientists would have never totally accepted OA as a way of communicating in science. That is the reason why many studies intended to find out if OA publishing improves the impact of scientific papers.[57]

One of the most important studies, not because of the results, but because of the fact that it was the first study of OA citation advantage, was S. Lawrence's study conducted before the

[55] Solomon, David J. "Developing OA journals: a practical guide," http://www.developing-oa-journals.org/Guide_to_developing_oa_journals.pdf, (accessed November 17, 2010).
[56] DOAJ: Directory of Open Access Journals, http://www.doaj.org/, (accessed November 17, 2010).
[57] Turk, Nana. "Citation impact of Open Access journals." *New Library World* 109, no. 1/2 (2008): 65-74.

first OA initiatives. It clearly shows the connection between the number of citations and the article's OA status (author uses the term "online articles").[58] E.-J. Shin proved in 2003 that the impact factor of non-OA psychology journals, published in two periods, increased when they became available online.[59]

The base for future studies was made in the year 2004 by T. Brody and S. Harnad. They pointed out that the best way to test the OA impact advantage is not to compare the citation impact factor of OA and non-OA journals, but to compare the citation count of individual OA and non-OA articles published in the same journal. OA increases the number of potential article users by adding the users who would otherwise have been unable to access it because of the price barriers. According to the authors, access is not a sufficient precondition for citation, but it is a necessary one.[60] The statement opens many further discussions on the reasons for OA citation advantage.

G. J. Schwartz and R. C. Kennicutt noted that the articles self-archived as pre-prints are cited earlier than the articles published and/or archived as post-prints. Also, the articles from the first group are twice as cited as the articles from the second group. The reason is the fact that an average article from the first group is accessible 12 months earlier than conventionally published articles.[61]

Another important paper for the theory of OA citation advantage is published in 2004 by M. J. Kurtz et al. (G. Eichhorn, A. Accomazzi, C. Grant, M. Demleiter, E. Henneken, and S. S. Murray).[62] The authors examined why the OA articles are more heavily cited than non-OA articles. The paper started the second level of discussion that was mentioned above – what are the reasons for OA advantage. They specify three postulates and try to test them to see if they hold true for astronomy literature. The postulates are:

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[58] Lawrence, Steve. "Online or invisible?" *Nature* 411, no. 6837 (2001), p. 521, available at: http://citeseer.ist.psu.edu/online-nature01/, (accessed November 17, 2010).
[59] Shin, Eun-Ja. "Do impact factors change with a change of medium: a comparison of impact factors when publication is by paper and through parallel publishing." *Journal of information science* 6, no. 29 (2003): 527-533.
[60] Harnad, Stevan; Brody, Tim. "Comparing the impact of Open Access (OA) vs. non-OA articles in the same journals." *D-lib Magazine* 10, 6 (2004), available at: http://www.dlib.org/dlib/june04/harnad/06harnad.html, (accessed November 17, 2010).
[61] Schwartz, Greg J.; Kennicutt, Robert C. "Demographic and citation trends in Astrophysical Journal papers and preprints," 2004, http://www.publingresearch.net/Citations-SummaryPaper3_000.pdf, (accessed November 17, 2010).
[62] Kurtz, Michael J. et al. "The effect of use and access on citations," 2004, http://cfa-www.harvard.edu/~kurtz/kurtz-effect.pdf, (accessed November 17, 2010).

1. Open Access (OA) postulate - because of the access to the articles unrestricted by any payment mechanism, authors are able to read them more easily, and thus they cite them more frequently;

2. Early Access (EA) postulate - the article appears sooner, so it gains both primacy and additional time in press, and is thus cited more;

3. Self-selection Bias (SB) postulate - authors preferentially tend to promote (in this case by posting to the Internet and self-archiving) the most important, and thus most citable, articles (this postulate will later be also called Quality postulate, Quality bias or Quality differential).

H. F. Moed in 2005 tried to find a statistical relationship between downloads and citations at the individual documents level within a journal (*Tetrahedron Letters*). An analysis of 1,190 papers in the journal during a time interval of 2 years after publication date revealed that there is about one citation for every 100 downloads and the articles are barely cited in the first three months after publication.[63]

H. Besemer in 2006 also proves the positive correlation between OA and the number of citations. He thinks that all the researches of OA citation advantage should be longitudinal.[64] Such an analysis was made by G. Eysenbach in 2006 – he concluded that articles published immediately as OA articles on the journal site have higher impact than otherwise openly accessible articles. Even in a journal that is widely available in research libraries, OA articles are recognized and cited by peers earlier than non-OA articles published in the same journal. According to that, Eysenbach thinks that OA is likely to benefit science by accelerating dissemination and the uptake of research findings.[65]

In 2007 S. Harnad and C. Hajjem find five possible factors that increase Open Access advantage (OAA).[66] Their algorithm for OAA is: OAA=EA+QA+UA+(CA)+(QB). EA is Early Advantage (self-archiving pre-prints before publication increases citations), QA is Quality Advantage (self-archiving post-prints upon publication increases citation), UA is

[63] Moed, Henk F. "Statistical relationships between downloads and citations at the level of individual documents within a single journal." *Journal of the American Society for Information Science and Technology* 56, 10 (2005): 1088-1097.
[64] Besemer, Hugo. "Gathering evidence about the effectiveness of "Open Access" publishing policies in agriculture," 2006. http://agriscontent.wordpress.com, (accessed November 17, 2010).
[65] Eysenbach, Gunther. "Citation advantage of Open Access articles." *PloS Biology*. 2006. http://biology.plosjournals.org/archive/1545-7885/4/5/pdf/10.1371_journal.pbio.0040157-S.pdf, (accessed November 17, 2010).
[66] Harnad, Stevan; Hajjem, Chawki. "The Open Access citation advantage: quality advantage or quality bias?," 2007. http://eprints.ecs.soton.ac.uk/13328/1/moed.html, (accessed November 17, 2010).

Usage Advantage (self-archiving increases number of downloads), CA is Competitive Advantage (OA advantage compared to non-OA advantage, it disappears at full OA) and QB is Quality Bias (or self-selection bias – higher-quality articles are self-selectively self-archived more, QB also disappears at full OA). S. Harnad et al. tried to explain the connection between institutions' self-archiving mandates and research impact. The only institutions approaching 100% self-archiving are those that mandate depositing in the IR author's final draft immediately upon acceptance for publication. The number of OA mandates should increase because only 15% of articles are being spontaneously self-archived.[67]

This literature review shows constant interest in studying the relationship between OA and citation impact (bibliography of the studies is updated on the OpCit project website[68]). During the last decade, the OA advantage is proved, although there are some slight differences between scientific fields. That fact is an important pro-OA argument. It is important to continue studying OA advantage through more longitudinal cross-disciplinary research as to be sure that OA advantage is not a momentary phenomenon. All the results shown above indicate positive trend in OA acceptance.

[67]Harnad, Stevan et al. "Maximizing and measuring research impact through university and research-funder Open-Access self-archiving mandates," 2010. http://eprints.ecs.soton.ac.uk/16616/, (accessed November 17, 2010).
[68] Open Citation Project, "The effect of Open Access and downloads ('hits') on citation impact: a bibliography of studies," http://opcit.eprints.org/oacitation-biblio.html, (accessed November 17, 2010).

3. REMOVING ACCESS BARRIERS FOR DEVELOPING AND TRANSITION COUNTRIES

3.1 Defining peripheral scientific communities

It is important to understand the difference between scientifically peripheral and mainstream countries. There are two important factors in defining peripheral scientific communities. The first one is language and the second one is economy. Global scientific community communicates in English through high-quality scientific journals, and all the countries whose scientists do not communicate in English may be considered scientifically peripheral. Recent report on OA in Southern European countries (Spain, France, Greece, Italy, Portugal and Turkey) is a result of a meeting *Open Access to Science Information* held in Granada in May 2010. The analyzed countries, although some of them highly developed, are peripheral countries – they use languages that have a long tradition but are not the usual channel for scientific communication, they do not have a powerful publishing industry and/or they do not spend enough money on research and scientific data acquisition.[69]

We will here be interested in peripheral scientific communities in semi-developed, transition or emerging countries. A country's income level can be one of the indicators of its development status. According to the World Bank, the developing country's annual GNI (Gross National Income) per capita can range from US$825 or less (low income); US$826–US$3,255 (lower middle income) to US$3,256 (upper middle income).[70] The majority of African, Latin American and Asian countries are developing countries. Although developing

[69] *Open Access in Southern European Countries*, editors: Lluís Anglada, Ernest Abadal. Madrid: FECYT, 2010, available at: http://www.accesoabierto.net/sites/accesoabierto.net/files/OASouthEurope.pdf, (accessed November 17, 2010).

[70] Pappin Ranchman, Jennifer I.; Dawe, Richard, A. "Open Access publishing: a developing country view." *First Monday* 11, no. 6 (2006), available at: http://outreach.lib.uic.edu/www/issues/issue11_6/papin/index.html, (accessed November 17, 2010).

countries are often presented as a homogeneous group with similar problems, we have to have in mind that there are some differences including the levels of human development and ICT readiness. The so called "digital divide" is a great problem for all those countries and their scientists have one problem in common – limited finances to prepare and conduct research and to disseminate its results. And without research how can the science in those countries prosper?

Another group of scientifically peripheral countries whose scientists were affected by increasing journal subscription crisis is the one with transition economies. A transition economy is an economy which is changing from a centrally planned economy to a free market. According to the International Monetary Fund (IMF), the main ingredients of the transition process are liberalization, macroeconomic stabilization, privatization and legal and institutional reforms. The process has been applied in some Central European countries (Albania, Bulgaria, Croatia, Bosnia and Herzegovina…) and in some Asian countries (China, Laos, Vietnam, Russia…).[71]

Scientists in scientifically peripheral countries have two serious problems. The first one is the same as the problem that scientists in scientifically mainstream countries have – price barriers that block access to high quality scientific journals. We saw what has happened with those journals' accessibility when commercial publishers overtook their publishing. The fact that even developed countries (who can afford higher subscription prices) reacted, shows all the seriousness of the serial crisis. If scientists from developed countries suffered a lack of high-quality scientific information, what about the scientists in less developed countries? They had to feel the crisis earlier but were unable or unwilling to react. Developed countries had to take the initiative, and the OA movement is the right way to help. Another problem is scientifically peripheral countries' research results visibility in the global community. Scientists from those countries occasionally publish research results in international high-quality journals, but most frequently they publish them in local journals that do not reach the global scientific community (usually because of language barriers that minimise international subscriptions, readership and influence).[72] A contemporary scientific communication system enhances the differences between the journals from developed and semi-developed (or developing) countries.[73] Research results from peripheral scientific communities are invisible

[71] International Monetary Fund, "Transition economies: an IMF perspective on progress and prospects," http://www.imf.org/external/np/exr/ib/2000/110300.htm#I, (accessed November 17, 2010).
[72] Stojanovski, Jadranka; Petrak, Jelka; Macan, Bojan. "The Croatian national Open Access journal platform." *Learned Publishing* 22, no. 4 (2009): 263-273.
[73] Marušić, Ana; Marušić, Matko. "Small scientific journals from small countries: braking from a vicious circle of inadequacy." *Croatian Medical journal* 40, no. 4 (1999): 508-514.

to the wider scientific community – there is a danger for those research results to become a part of so called "lost science".

3.2 Access to scientific information in developing and transition countries

The world's big democracies promote free access to information for everyone, regardless of nationality, age, sex, religion, political views etc. They also promote each human's right to live and to have appropriate health care. The first field where developed countries noticed that developing countries needed their help was the health sector. In 2000 the World Health Organization (WHO) undertook a survey of scientists and their institutions in developing countries with low income. Asked to range the problems in their everyday work, scientists put restricted access to scientific journals at the first place. The survey showed that 56% of institutions had no subscriptions to international scientific journals.[74]

UNESCO notes that "the unimpeded flow of information is one of the prerequisites for the advancement of science and the building of the knowledge societies."[75] In 2007 the *Improving Access to Scientific Information Working Group* of the *UK National Commission for UNESCO's Natural Sciences Committee* undertook a survey of scientific learned societies in the UK to assess their participation in international journal access programs which provide free or low cost access to scholarly literature to developing country institutions and readers. Some of the journal access programs for developing countries that were highlighted by survey responses are *HINARI* (*Health Inter Network Access to Research Initiative*), *AGORA* (*Access to Global Online Research in Agriculture*), *OARE* (*Online Access to Research in the Environment*), *PERI* (*Programme for the Enhancement of Research Information*), eIFL (*Electronic Information for Libraries*) and the *Journal Donation Project*.

HINARI project was launched by *WHO* in 2002. Its aim is to provide free or very low cost online access to the major journals in biomedical and related social sciences to local, non-for-

[74] UNESCO, "Improving access to scientific information for developing countries: UK learned societies and journal access programmes," http://www.unesco.org.uk/UserFiles/File/SCI%20WG5/Final%20report%20May%202008(1).pdf, (accessed December 11, 2010).
[75] UNESCO, "Improving access to scientific information for developing countries: UK learned societies and journal access programmes," http://www.unesco.org.uk/UserFiles/File/SCI%20WG5/Final%20report%20May%202008(1).pdf, (accessed December 11, 2010).

profit institutions in developing countries.[76] There are two country lists based on GNI per capita. Institutions in countries with GNI per capita below US$1250 are eligible for free access and institutions in countries with GNI per capita between US$1250-$3500 pay a fee of US$1000 per year. Users can download and save limited numbers of articles or chapters from any journal issue or book, not to exceed 15% of its contents. Access may only be provided from computers owned by the institution.[77] Programs similar to *HINARI* are AGORA[78] and OARE.[79]

The *International Network for the Availability of Scientific Publications*' (*INASP*) *Program for the Enhancement of Research Information* (*PERii*) has been in phase 2 since 2008. Focusing on the needs of people in developing and emerging countries, *PERii* works with partners to support global research communication.[80] One of the six of *PERii*'s components is *PERii Open Access* with the aim to increase inclusion of developing countries research within the Open Access community.

Journal Donation Project (*JDP*) is situated at the *New School for Social Research*, New York.[81] Its mission is to assist in rebuilding major research and teaching libraries in countries that have fallen victim to political or economic deprivation. Since it began, the *JDP* has assisted libraries in 38 countries (some of them are Croatia, Armenia, Albania, Bosnia-Herzegovina, Czech Republic, Estonia, Russia, and Slovakia…). One of the possibilities for the libraries is to purchase journals through the *DJP* at deep discounts (over 50%).

Not-for-profit international organization *eIFL*, founded in 1999, works with libraries around the world to enable sustainable access to high-quality digital information for people in developing and transition countries as well as to develop and support various programs that increase access to knowledge.[82] One of the *eIFL*'s programs is *Access to Knowledge for Education, Learning and Research*. The program consists of four components. The aim of the

[76] World Health Organization, "HINARI: Research in health," http://www.who.int/hinari/about/en/, (accessed December 11, 2010).
[77] World Health Organization, HINARI: Eligibility," http://www.who.int/hinari/eligibility/en/, (accessed December 11, 2010).
[78] AGORA, "Who can participate," http://www.aginternetwork.org/en/about_agora/elegibility.html, (accessed December 11, 2010).
[79] OARE, "Online Access to Research in the Environment," http://www.oaresciences.org/en (accessed December 11, 2010).
[80] International Network for the Availability of Scientific Publications, "PERii: Program for the Enhancement of Research Information," http://www.inasp.info/file/5f65fc901786033888288140 2dc594e4/perii.html, (accessed December 11, 2010).
[81] The New School, "Journal Donation Project," http://www.newschool.edu/centers/jdp/contacts.aspx?s=8, (accessed December 11, 2010).
[82] eIFL, http://www.eifl.net/cps/sections/about (accessed December 11, 2010).

eIFL Licensing component is to negotiate with publishers trying to achieve discounted prices and fair terms of use in order to increase access to scientific literature that is essential for research and education. *eIFL Open Access* (*eIFL-OA*) component advocates for the adoption of OA policies and mandates by research funding agencies, universities and research organizations; it builds capacities to launch and sustain OA repositories to maximise access and to increase research impact. Within the *eIFL Intellectual Property* (*eIFL-IP*) component, *eIFL* emphasises that restrictive copyright laws create both legal and financial barriers for accessing scientific information. *eIFL Free and Open Source Software* (*eIFL-FOSS*) supports the development of free and open source software for libraries and provides necessary training enabling libraries to achieve significant cost savings. [83]

All the programs and projects described above are not OA programs, but are a step forward in making scientific information available to the scientists in developing and transition countries. The programs show that developed countries are aware of the price barriers and their effect on scientific communication in less developed countries. Removing those barriers is the only way to ensure equal benefit of scientific researches results for all. Some OA proponents criticise the described projects noting that they do not solve the access crisis and that they exclude some low- income countries.[84]

3.3 OA initiatives in developing and transition countries

Some of the OA initiatives for developing countries are initiated by the countries themselves, some of them by developed countries and sometimes the initiatives are result of cooperation between both groups of countries. An example of a collaborative initiative is *Bioline International*, managed by scientists and librarians from Canada and Brazil. It is a not-for-profit organization committed to providing OA to quality bioscience journals published in developing countries. It is not a publisher, but an aggregator that provides a free platform for distribution of peer-reviewed journals from developing countries, it helps reducing the global knowledge divide and finding "lost science". *Bioline International* improves the impact of developing world scientific publications allowing them to enter the mainstream research and

[83] eIFL, "2009 annual report.: knowledge without boundaries," http://www.eifl.net/cps/sections/about/annual-reports/annual-report-2009/downloadFile/attachedFile_f0/2009_Annual_Report_low-res.pdf?nocache=1276857054.79, (accessed December 11, 2010).
[84] Suber, Peter; Arunachalam, Subbiah," Open Access to science in the developing world," http://www.earlham.edu/~peters/writing/wsis2.htm, (accessed December 11, 2010).

knowledge activities. *Bioline International's* OA promotion is usually done through case studies, studies of how OA affects authors and studies of library use. The aggregator is not opened only to low-income countries, but also to those who have middle per-capita income.[85]

BioMed Central, an OA publisher, also promotes OA for the developing world on its web site as well as by organising conferences.[86] One of them is conference *Open Access Africa*, held in Kenya on 10th and 11th of November 2010. The aim of the conference was to bring together scientists, librarians, university administrators and funders to discuss the issues surrounding access to scientific research and the role of OA journals.[87] *BioMed Central* also supports the global campaign *HIFA2015* (*Healthcare Information for All by 2015*) whose aim is to ensure every person worldwide the access to an informed healthcare provider by 2015.[88]

One of the earliest examples of OA projects initiated by several developing countries themselves is *SciELO* (*Scientific Electronic Library Online*).[89] It is a model for cooperative electronic publishing of scientific journals on the Internet. Especially conceived to meet the scientific communication needs of developing countries, particularly Latin America and the Caribbean countries, it provides an efficient way to assure universal visibility and accessibility to their scientific literature, contributing to overcome the phenomenon known as "lost science". In addition, the *SciELO* model comprises of integrated procedures for the measurement of usage and impact of scientific journals. A pilot project (1997-1998) involved 10 Brazilian journals from different subject areas and aimed at the development and evaluation of an adequate methodology for electronic publishing on the Internet. In 2002 the project was supported by the Brazilian *Ministry of Science and Technology*. The model comprises three components. The first one is the *SciELO Methodology* which enables e-publication of complete editions of scientific journals, organisation of searchable bibliographical and full text databases, preservation of electronic archives and production of statistical indicators of the scientific literature usage and impact. The methodology also includes journal evaluation criteria based on international scientific communication standards. *SciELO* full texts are enriched with hypertext links with national and international databases. The second component is the application of the *SciELO Methodology* to operate web sites of collections of electronic journals. The *SciELO Model* envisages the operation of national sites

[85] Bioline International, http://www.bioline.org.br, (accessed December 11, 2010).
[86] BioMed Central, "Open Access and the developing world," http://www.biomedcentral.com/developingcountries/improvingaccess, (accessed December 11, 2010).
[87] BioMed Central, "Open Access Africa," http://www.biomedcentral.com/developingcountries/openaccessafrica, (accessed December 11, 2010).
[88] HIFA2015: people are dying for lack of knowledge, http://www.hifa2015.org, (accessed December 11, 2010).
[89] SciELO, http://www.scielo.org/php/index.php, (accessed December 11, 2010).

as well as thematic sites. *SciELO Brazil*, *SciELO Chile* and *SciELO Cuba* are operating applications regularly. *SciELO Public*, a regional thematic library covering Public Health scientific journals from Latin America and Spain, was launched in 1999. The Model's third component is the actual development of partnerships among national and international scientific communication subjects - authors, editors, institutions, funding agencies, universities, libraries etc. In October 2010 there were 10 collections in *SciELO* (8 national and 2 thematic collections) with another 9 in development (7 national and 2 thematic). There were 661 journals in *SciELO* at the time, 18115 issues with 271617 articles.

Although not entirely committed to OA promotion, a similar project is *African Journals OnLine* (*AJOPL*). It is an online service that aims to provide access (not necessarily OA) to African-published research, and increase worldwide knowledge of indigenous scholarship. In October 2010 there were 399 journals, 5452 issues, 58700 abstracts and 47110 full text articles hosted by AJOL.[90] Similar smaller projects are *Vietnam Journals OnLine*, *Nepal Journals OnLine* and *Bangladesh Journals OnLine*. The very successful Croatian national Open Access journal platform *Hrčak* (meaning *hamster*) has to be mentioned here. *Hrčak* provided access to 222 journals, 4121 issues and 54163 full text articles in October 2010.[91] The portal will be described and analysed later (see chapter 4.2).

Beside projects that support and promote OA, developing and transition countries organize (sometimes with a help of developed countries) conferences and other meetings to promote OA. The *Latin American and Caribbean Center on Health Sciences Information*, *Pan American Health Organization* and *World Health Organization* organised in September 2005 the international seminar *Open Access for developing countries* in Salvador, Brazil.[92] The seminar resulted in the *Salvador Declaration on Open Access*. Participants agreed that research was essential for social and economic development; that scientific communication was a crucial part of research and science development; that science advanced more effectively when there was unrestricted access to information and that OA enabled education. OA must facilitate developing countries' active participation in the worldwide exchange of scientific information, including free access to the heritage of scientific knowledge, effective participation in the process of generation and dissemination of knowledge, and strengthening the coverage of topics of direct relevance to developing countries. Participants concluded that developing countries already had pioneering initiatives that promoted OA and therefore they

[90] AJOL: African journals online, http://ajol.info, (accessed December 11, 2010).
[91] Hrčak: portal of the scientific journals of Croatia, http://hrcak.srce.hr/?lang=en, (accessed December 11, 2010).
[92] ICML 9, "International Seminar: Open Access in developing countries," http://www.icml9.org/meetings/openaccess/program.php?lang=en, (accessed December 11, 2010).

should play an important role in shaping OA worldwide. Governments should strengthen the local OA journals and repositories; they should promote the integration of developing countries scientific information in the worldwide body of knowledge. Also, governments should consider the cost of publication as part of the cost of research. Participants of the seminar called on all stakeholders in the international community to work together to ensure that scientific information was openly accessible and freely available to all, forever. [93]

In May 2006 the *Coady International Institute* from Canada convened an online discussion on OA. This created a space for people to share their views on what OA can mean. Participants were invited to think about challenging issues related to the potential, the relevance, and the barriers to OA, and to identify what it would really mean for development workers. More than 140 participants from 35 countries took part in the forum. The group was diverse, including librarians and other information workers, adult educators, IT specialists, development workers, academics, youth and retired persons. Several papers were prepared to stimulate the discussion. The papers were written by information specialists from Canada, Nigeria, Mongolia, Vietnam, Nepal and East Africa. Over 150 messages were exchanged during the forum's two weeks, and a number of participants proposed an ongoing dialogue after the formal discussion period ended. Participants agreed that where necessary information infrastructure exists, OA was an important part of communicating both globally and locally. Content in OA should be accessible easily; i. e. formats should be free and open.[94]

In Bangalore, India, in November 2006, a workshop on electronic publishing and OA was convened in order to agree a model national OA policy for developing countries. The workshop was organised by the Indian Institute of Science, Indian Academy of Science, and the M. S. Swaminathan Research Foundation with the financial support of Open Society Institute.[95] The result of the workshop was a document that expresses participants' opinions on what governments should do to encourage OA. They should require electronic copies of any research paper that has been accepted for publication in a peer-reviewed journal, and is supported in whole or in part by Government funding, to be deposited in an institutional OA repository immediately upon acceptance for publication. Governments should encourage

[93] ICML 9, "Salvador declaration on Open Access: the developing world perspective," http://www.icml9.org/meetings/openaccess/public/documents/declaration.htm, (accessed December 11, 2010).
[94] Iseli-Otto, Sabina. "Open Access and information for development: summary of online discussion messages," 2006. http://coady.stfx.ca/work/openaccess/index. htm, (accessed December 11, 2010).
[95] Kirsop, Barbara. "Open and shut?: creating a national Open Access policy for developing countries," 2006. http://poynder.blogspot.com/2006/11/creating-national-open-access-policy.html, (accessed December 11, 2010).

government grant holders to provide OA to their deposited papers immediately upon deposit and to publish in a suitable OA journal where one exists. Benefits of OA to governments and to researchers are outlined in the document. A country's research will be more accessible to global researchers, hence better known and more widely used and cited. Research done in the country will be open to the general public with Internet access and that will be beneficial both commercially and culturally. Also, citation data on the research will be available for analysis to help shape researchers', institutions' and nations' strategies and policies.

In Havana, in September 2008, the *InterAcademy Panel on International Issues* (IAP) organised the *International Workshop for Open Access to Scientific Literature and other Digital Scientific Information Resources in Central America and the Caribbean*.[96] The tasks of this workshop were to identify and discuss the policy, legal, institutional, economic, management, technical and infrastructure factors, relevant to provide effective Open Access and use of digital scientific data and information; to examine existing models for preserving and accessing digital scientific information and their potential benefits or shortcomings; to examine specific experiences; to identify and discuss possible follow-up activities for improving OA as well as to provide a networking opportunity for future collaborative activities.

OA promotion does not take place only in developing, but also in semi-developed, transition and emerging countries. They are somewhere in the middle – they are not low-income countries, their governments do invest in science trying to ensure all the resources necessary for science development, but they cannot invest as much as the governments in developed countries. Those countries are excluded from of all the initiatives and programs for easier or free access to scientific information for low-income countries (as they are not classified as low-income). In the following chapters, Croatia will be an example of such a country. Its situation will be described and Open Access in Croatia will be investigated.

[96] Electronic Publishing Trust, "OA workshop in Cuba," http://epublishingtrust.blogspot.com/2008/08/oa-workshop-in-cuba.html, (accessed December 11, 2010).

4. OPEN ACCESS IN CROATIA

4.1 Croatia – a scientifically peripheral country

Croatia (official name the Republic of Croatia) is situated on the cross-roads between Central Europe and the Mediterranean, along the eastern coast of the Adriatic Sea and its hinterland.[97] It is situated in central and south-eastern Europe, bordering Italy (across the Adriatic Sea), Slovenia, Hungary, Bosnia and Herzegovina, Serbia and Montenegro.

Croatia is classified as developing and emerging economy by the International Monetary Fund[98] and as high-income economy by the World Bank (Croatian GNI per capita for 2009 was US$19170).[99] According to the 2001 census, Croatia has population of 4 437 460, or 78.5 inhabitants per kilometre. 90% of them are Croats, 4.5% Serbs and 5.5% other minorities (Italian, Hungarian, Czech, Slovak, German and others). The official language is Croatian and Latin script, government type is parliamentary democracy.[100]

Before analysing the OA movement in Croatia, three specificities of Croatia as a peripheral scientific community have to be explained – accessibility (and visibility) problem, language of scientific communication and scientific publisher types.

As was mentioned earlier, Croatian scientific and academic libraries perceived the serial crisis before the same institutions in the developed countries. They had to cancel some subscriptions making the needed information inaccessible to their users. There are three levels

[97] Government of the Republic of Croatia, "Identity card," http://www.vlada.hr/en/about_croatia/information/identity_card, (accessed December 11, 2010).
[98] International Monetary Fund, "World Economic Outlook Database," http://www.imf.org/external/pubs/ft/weo/2010/02/weodata/index.aspx, (accessed December 11, 2010).
[99] The World Bank, "Croatia," http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/ECAEXT/CROATIAEXTN/0,,menuPK:301250~pagePK:141159~piPK:141110~theSitePK:301245,00.html, (accessed December 11, 2010).
[100] Central Intelligence Agency, "The world factbook," https://www.cia.gov/library/publications/the-world-factbook/geos/hr.html, (accessed December 11, 2010).

of accessibility problem for Croatian scientists – Croatian scientists' access to Croatian research results; foreign scientists' access to Croatian research results and Croatian scientists' access to foreign research results. On the first level there are no accessibility problems if the results are published in Croatian scientific journals but the problem persists when the results are published in foreign commercial journals with high subscription prices. On the second level, the biggest visibility problem for the non-Croatian-speaking community is when the results are published in local journals in Croatian language. And the third level, the visibility of foreign research results in Croatia, is the same as in the whole world – access to high-quality scientific journals is sometimes unaffordable to Croatian libraries and their users.

Another important characteristic of Croatia is its language. The unofficial language of global scientific communication is English, but the official language in Croatia is Croatian. It is not a problem for Croatian scientists to read articles written in English, and the majority of its scientists can write in English, but the problem is on the other side – the global scientific community does not understand scientific articles written in Croatian. Those articles have small visibility, usage and impact outside Croatia.[101] The same problem is with any scientific community using "small" language.[102] But, as it is well known, scientists need to improve their articles visibility and impact if they want to prosper. That is the reason why more and more Croatian scientists begin to write in English, either in foreign or in local scientific journals. More and more Croatian scientific journals accept articles written in English (sometimes they do not accept articles written in Croatian at all) and all the Croatian journals publish abstracts in English (sometimes even in a third language). Thanks to that, Croatian scientific journals raise their visibility and impact. Where is the problem then? Croatian scientists just have to write in English and their visibility will be much higher. But what about those scientific fields closely oriented to the Croatian language, culture or history? What about the development of Croatian language? Language is a living organism; it can develop only by being used and by accepting new terminology and developing syntax. If Croatian scientists decide to write in English only, their research results will not be understandable to the entire Croatian public (and scientific research in Croatia is publicly funded!). So, resolving the problem of lower visibility could cause new problems. We have to be very careful and try to enlarge visibility and at the same time protect the interests of national science.

[101] Bekavac, Anamarija; Buneta, Zoran. "Language barrier in a scientifically peripheral country: a case report from Croatia." *Croatian Medical Journal* 34, no. 4 (1993): 272-275.
[102] Garfield, Eugene. "The languages of science revisited: English (only) spoken here?" *Current Contents* 31(1990): 3-18.

The third specific of Croatia as a peripheral scientific community is the nature of scientific publishing. Croatian scientific journal publishers are mainly not-for-profit organisations (universities, faculties, departments, associations…). The Croatian *Ministry of Science, Education and Sports* (*MSES*) gives grants only to not-for-profit scientific publishers (that is, of course, only one of the *MSES*'s funding criteria, others will be explained later). So, if the worlds' commercial publishers were the main reason for the serial crisis, and if Croatian scientific publishers are not-for-profit publishers, there would not have been problems with access to Croatian journals. And that is true – Croatian scientists do not have many problems accessing Croatian scientific journals. A great number of the journals are in OA, mainly through the *Hrčak* portal, and others do not have costly subscriptions – they are affordable even to individuals, and even the institutional prices are really not high (in 2008 the highest subscription was about €100 per year, and some individual subscriptions were as low as €5 per year).

Is OA important for peripheral scientific communities? Will their research results be more visible in OA? Is OA necessary if we know that publishers are not-for-profit organisations and subscriptions are not too high? We can assume that all the answers are positive. Croatia tries to keep abreast of scientific communication trends in the whole world. Its government, publishers, scientists, universities and libraries are engaged in OA promotion knowing that it will help increase the impact of Croatian research results as well as increasing the visibility of foreign research results to Croatian scientists.

4.2 OA promotion in Croatia

The importance of OA was early recognised by Croatian scientists, libraries and publishers. Project *Croatian scientific journals textual database* was initiated in 2002 (immediately after the OA movement was defined in the *BOAI*) at the *Croatian National and University Library* (the project manager was M. Jokić). The project provided OA to 2002 and 2003 issues of 17 Croatian scientific journals, but was soon stopped. Despite its short life, the project is important because it shows Croatian librarians' early awareness of the importance of OA. The awareness is also proved by the fact that *Berlin Declaration* was translated into Croatian soon after it was released in 2003.

One of the most important OA promoters in Croatia is the *Croatian Information and Documentation Society* (*Hrvatsko informacijsko i dokumentacijsko društvo*, *HID*) founded in

1993. *HID* OA working group (initiated in 2004 by V. Silobrčić) planned to publish basic information about OA, to explain definitions and spread news about OA in local scientific journals as well as on the *HID* website, to encourage individuals and institutions to sign *BOAI* and *Berlin Declaration* and to accept technical standards for achieving OA.[103]

As a part of the *HID*'s OA initiative, *Hrčak*, portal of Croatian scientific journals was launched. The idea originated in 2003 and was supported by the *Croatian Library Association*, *Croatian Information Technology Society* and *Zagreb Archive Association*. The project proposal was written in cooperation with *Zagreb University Computer Centre* (*SRCE*) and was financially supported by the Croatian *Ministry of Science, Education and Sports* (*MSES*).[104] The project was focused on improving the online accessibility of local scientific journals by helping journal editors to create online versions of their journals. The project's main goals are:

- to gather all Croatian scientific journals and journals' metadata records;
- to become a central repository for full-text journal articles with free online accessibility;
- to provide data about Croatian scientific journals to other national and international databases and repositories.

Hrčak was publicly launched in February 2006 and it provides a simple and free interface for creating electronic online versions of printed journals. It offers (since 2007) *Open Journals System* (*OJS*), open source software for creating and maintaining an electronic journal as well as for automated peer-review process. *Hrčak* also provides technical support, maintenance and data protection. The portal is *OAI-PMH* compliant and ensures long-term archiving.[105] *Hrčak* is oriented to various groups of users - publishers, authors, scientific and academic institutions, general public and, last but not least, Web robots. Thanks to *Hrčak*, publishers have a free, simple and fast tool for creating online versions of their journals, i. e. for small effort and no cost they can become OA publishers. Publishers are responsible for the regular uploading of full text articles and for inputting metadata at journal, issue and article level. Authors can see their articles' download counters; their articles have better visibility and impact. Research and academic institutions get the chance for better dissemination of their

[103] Hrvatsko informacijsko i dokumentacijsko društvo (Croatian Information and Documentation Society), "OPZI: otvoreni pristup znanstvenim informacijama," http://www.hidd.hr/projects/opzi/opzi.php, (accessed December 11, 2010).
[104] Toth. Tibor. "Centralni portal znanstvenih časopisa Hrvatske: Hrčak (Central portal of Croatian scientific journals: Hrčak)." *Kemija u industriji* 55, no. 3 (2006): 143-145.
[105] Stojanovski, Jadranka; Petrak, Jelka; Macan, Bojan. "The Croatian national Open Access journal platform." *Learned publishing* 22, no. 3 (2009): 263-273.

research results. Readers (who can be scientists or the wider general public) can easily access the results of publicly funded research. Web robot software programs can disseminate information about the articles to the global scientific community. Metadata from *Hrčak* are harvested by free services but also by commercial databases (e. g. *Elsevier* and *Thomson Reuters*).

In October 2010 we can say that *Hrčak* practically accomplished its goals. The best proof is the increasing number of journals. A study shows that in 2002, four years before *Hrčak* was launched, there were 21 scientific journals with online versions of their printed issues.[106] Figure 5 shows the number of the journals in *Hrčak* since 2006 until 2010.

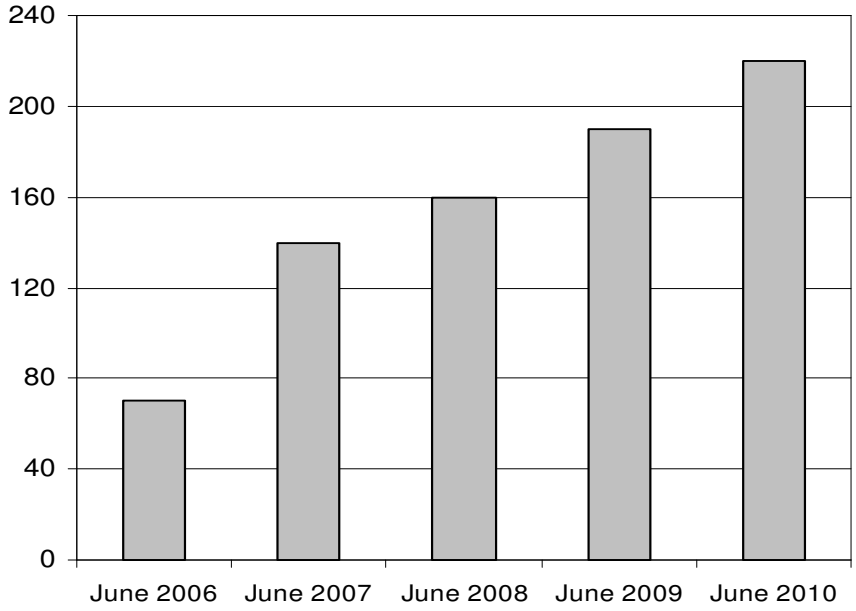

Figure 5: Number of journals in Hrčak between 2006 and 2010 (according to Stojanovski, J.; Petrak, J.; Macan, B. "The Croatian national Open Access journal platform." Learned publishing 22, no. 3 (2009), p 41 and to Hrčak: Portal of scientific journals of Croatia, 2010. http://hrcak.srce.hr/?lang=en)

Hrčak has its *Code of ethics* that specially refers to editors and editorial boards of Croatian scientific journals. The Code proves that *Hrčak* supports and promotes OA – new issues have to be published on the portal at the same time or prior to printed versions. If editorial boards decide not to do so, they have to give the precise deadline when full texts will be available. If the texts are not available by the date, the issues are marked as unpublished.

[106] Konjević, Sofija. "Hrvatski znanstveni časopisi na internetu (Croatian scientific journals on the Internet)." *Vjesnik bibliotekara Hrvatske* 46, no. 3/4 (2003): 111-118.

When cooperating with international information services, *Hrčak* will give priority to the journals that publish in OA (free online full text articles, without delay).[107]

Hrčak became a part of the *Croatian Scientific Portal*, a project that started in 2006 with a goal of providing all the information about Croatian scientists, their papers and research projects and about Croatian scientific journals. The portal aims to provide better interconnection between scientists, to promote and popularise science in the country and abroad. Besides *Hrčak*, another two important services are part of the *Croatian Scientific Portal*. The *Croatian scientific bibliography* (*CROSBI*) provides data about all the published papers and books written by Croatian scientists since 1996. It also gives the possibility of attaching full-text articles to bibliographic records – it is not a national OA repository, but offers OA to some articles. Authors are advised to consult the *SHERPA/RoMEO* website to find out if their publisher allows self-archiving of either pre-print or post-print.[108]

In the *MSES'*s document on science and technology policy it is specified that the results of all publicly funded research should be accessible to the general public through open publications or databases.[109] The attitude has its base in a numerous international documents, e. g. *European Commissio*n's *Study on the economic and technical evolution of the scientific publication markets in Europe*, released in 2006.[110]

Since the beginning of the 21st century many conferences in Croatia, as well as some Croatian scientific journals, have had OA as one of their topics. The *4th Annual conference of Croatian academic and scientific libraries* in 2003 had a special guest – Peter Suber, one of the world famous OA proponents.[111] In the same year, another conference, *Archives-Libraries-Museums*, had a part of its program dedicated to the "serial crisis" and electronic archives. [112]

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[107] Hrčak, "Etički kodeks urednika na portalu Hrčak (Code of ethics for editors on the Hrčak portal)," http://hrcak.srce.hr/admin/eticki_kodeks.pdf, (accessed December 11, 2010).
[108] Croatian Scientific Portal, "Croatian scientific program: projects and initiatives," 2009. http://www.znanstvenici.hr/index_en.php?p=o-nama_en (accessed December 11, 2010).
[109] Ministry of Science, Education and Sports, "Znanstvena i tehnologijska politika Republike Hrvatske (Science and technology policy of the Republic of Croatia)," public.mzos.hr/fgs.axd?id=, (accessed December 11, 2010).
[110] European Commission, "Study on the economic and technical evolution of the scientific publication markets in Europe: final report,," http://ec.europa.eu/research/science-society/pdf/scientific-publication-study_en.pdf, (accessed December 11, 2010).
[111] SZI, http://www.szi.hr/seminar.htm, (accessed December 11, 2010).
[112] Melinščak Zlodi, Iva. "Elektronički arhivi: revolucija u pristupu znanstvenim informacijama (Electronic archives: revolution in access to scientific information)." In *6. seminar Arhivi, knjižnice, muzeji: mogućnosti suradnje u okruženju globalne informacijske infrastrukture: zbornik radova*. Zagreb: Hrvatsko knjižničarsko društvo, 2003: 108-120.

Croatian Academic and Research Network (*CARNet*) started (in 2004) organizing lectures about free access to scientific information.[113] An article on the "serial crisis" was published in 2004 in *Croatian Librarians Herald* (*Vjesnik bibliotekara Hrvatske*).[114] In the same journal in 2007 V. Silobrčić gave an overview of the history of OA in Croatia and in the world. [115] An article in 2008 describes one of a few OA repositories in Croatia (IR of the *Faculty of Mechanical Engineering and Naval Architecture*).[116] Some articles about OA are published in the journals that cover various scientific fields (chemistry, medicine, biology and others). That is the best way to promote OA among those scientists who are not information specialists.

Some doctoral theses at Croatian universities also dealt with the problem of scientific communication and OA, e. g. *Influence of Networked Information Resources on Development of Scientific Communication in the Field of Social sciences in Croatia* by R. Vrana in 2003[117] and *Open Access to Scientific Information in Croatian Scientific Journals and Digital Repositories* by I. Hebrang Grgić in 2009.[118]

Electronic communication through electronic networks improves and accelerates information flow, but some restrictions (such as financial barriers) still exist. Peripheral scientific communities, such as Croatian, are in a specific position – they have problems with access to the worlds' scientific output and, on the other hand, they use "small" language, financial and organizational problems cause lower visibility and impact of their own research results on the global scientific community.

In Croatia, the importance of OA is recognised by the Government, scientists, their institutions, their libraries, associations and publishers. Open Access in Croatia (OA repositories and OA journals) is a topic of our study that will be presented in the next chapter.

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[113]CARNet, "CARNet novosti (CARNet News)," http://www.carnet.hr/novosti/novosti?news_id=411 (accessed December 11, 2010).

[114] Hebrang Grgić, Ivana. "Kriza izdavaštva znanstvenih časopisa (Serial crisis)." *Vjesnik bibliotekara Hrvatske* 47, no. 1/2 (2004): 87-94.

[115] Silobrčić, Vlatko. "Slobodan pristup ocijenjenim znanstvenim informacijama: moguća budućnost informiranja znanstvenika (Open access to peer reviewed scientific information: future of scientific communication)." *Vjesnik bibliotekara Hrvatske* 50, no. 1/2 (2007): 51-61.

[116] Krajna, Tamara; Markulin, Helena; Levanić, Andrija. "Repozitorij ustanove Fakulteta strojarstva i brodogradnje (Institutional repository of the Faculty of Mechanical Engineering and Naval Architecture). *Vjesnik bibliotekara Hrvatske* 51, 1/4 (2008): 36-46.

[117] Vrana, Radovan. "Influence of networked information resources on development of scientific communication in the field of social sciences in Croatia." PhD thesis, Faculty of Humanities and Social Sciences, University of Zagreb, 2003.

[118] Hebrang Grgić, Ivana. "Open Access to scientific information in Croatian scientific journals and digital repositories." PhD thesis, Faculty of Humanities and Social Sciences, University of Zagreb, 2009.

5. THE STUDY OF OA IN CROATIA

The study of OA in Croatia will have two parts – the study of OA journals and the study of OA repositories. The first part will be much more detailed because there are more than 200 scientific journals in Croatia (not all of them OA journals), but only few OA repositories. The first part of the study will investigate Croatian scientific journals editorials' OA policies as well as quantity of Croatian scientific journals in national and international databases. The second part of the study will present the main characteristics of Croatian OA institution repositories (IRs) and will also show Croatian scientific institutions' (and their libraries') awareness of the OA IRs' importance.

The whole study should show in which phase OA in Croatia is at the moment (2010) and what are future Croatian perspectives regarding OA. The main hypothesis is that all the subjects of scientific communication in Croatia (scientists, libraries, institutions, publishers) accept OA to Croatian scientific information but there is still much work that has to be done before achieving OA to all the results of publicly funded research in Croatia. The study will also try to show how OA affects Croatian scientific journals' visibility and quality.

5.1 Croatian Open Access journals

5.1.1 Aim and methodology

The data on editorial policy regarding electronic online publishing was gathered. Nine groups of data were analysed, some of them describing journals' general characteristics and the others describing publishers' OA policies:

1. existence of electronic edition ISSN (eISSN);

2. number of volumes, issues and articles of each journal available on the *Hrčak* portal (portal of Croatian scientific journals);

3. number of volumes and issues of each journal available on their publishers' web sites;

4. language of papers published in Croatian OA journals;

5. publisher types;

6. publishers' OA and/or copyright policy;

7. number of journals in the *Directory of Open Access Journals* (*DOAJ*);

8. number of journals in the *Web of Science* database (*WoS*);

9. number of journals in the *Journal Citation Reports* database (*JCR*);

Electronic edition ISSN (eISSN) assignment can show if the editors and editorial boards are aware of the fact that electronic edition is a new edition that has to have its own ISSN. ISSN for electronic edition cannot be assigned to the publication that does not fulfil specific criteria that ensure quality of the journals' editorial policy (e. g. irregular publishing).

The *Hrčak* portal content was analysed to detect its importance in OA promotion in Croatia. It will be interesting to find out whether publishers have their own web sites with full-text articles, whether they are maintained parallel with the *Hrčak* portal or the editors gave up updating their websites at the time the *Hrčak* portal was launched. The journals' presence in the *WoS*, the *DOAJ* and the *JCR* databases can indicate visibility and impact of the journals in global scientific community. Only not-for-profit publishers can get *Ministry of Science, Education and Sports'* financial support.

The language of the articles and abstracts was analysed and correlated to the journals' visibility and impact. We will find out if the OA (or any similar) policies are published in Croatian OA journals.

The results will help us make conclusions about the acceptance of OA in Croatia as well as about its specific characteristics. The results will also show how the *Hrčak* portal helped implementing OA in Croatian scientific journals editorial policies.

For web site content analysis the following web sites were consulted: www.hrcak.hr, www.doaj.org and publishers' web sites. Content was analysed either on the journal level (e. g. number of volumes and issues in OA) or on the article level (e. g. article language), depending on the scope of different parts of the study.

Web sites' content was analysed between June and October 2010. At the same time *Web of Science* was browsed.

5.1.2 The sample

All the journals in the sample fulfil the following criteria:

- they had *MSES*'s financial support for the year 2009 (the list of the supported journals was the starting point for the survey);

- all the journals conduct peer-review process and categorise the articles;

- at least one issue of all journals for the year 2009 were freely available online (either on the publishers' websites or on the *Hrčak* portal) by the end of June 2010.

The first criterion is important because of the *MSES*'s policy on financial support to scientific publishers.[119] The journals should have cultural, national and local importance for scientific community. They should also be edited in accordance with the *Guidelines for editing scientific journals*.[120] The articles should pass double blind peer-review; journals should be indexed in at least one relevant international bibliographic database (list of relevant databases is published regularly by a committee of respectable scientists from all fields). Publishers should be not-for-profit organisations; the *MSES* should be specified as a funding agency. The *MSES* will give priority to the journals that publish their issues on a regular basis and to the journals with web sites (not necessarily with freely available full text articles, but at least with basic information about the journal). When deciding about financial support, the *MSES* will also consider the quantity of categorised articles in each journal, the quality of peer-review, journals' visibility and impact. According to the short review of the *MSES*'s directions, only high-quality journals can secure the financial support. In the year 2009, 211 journals were supported.

The second criterion, according to which journals have to be peer-reviewed and categorised, is important because the *MSES* supports some popular journals that do not

[119] Ministry of Science, Education and Sports, "Izvod iz Pravila o novčanom podupiranju znanstvene izdavačke djelatnosti: knjiga i časopisa (Extract from Scientific publishing funding policy: books and journals)," 2007. http://public.mzos.hr/fgs.axd?id=13402, (accessed December 11, 2010).
[120] Ministry of Science, Education and Sports, "Upute za uređivanje i oblikovanje časopisa (Guidelines for editing scientific journals)," http://public.mzos.hr/Default.aspx?art=5466 (accessed December 11, 2010).

conduct peer-review (although the number of those journals is small). For our study, those journals were excluded from the *MSES*'s list.

The third criterion – all the journals in the sample have to have freely available online, at least one issue of the journal for the year 2009 – is important because it guarantees open accessibility of the journal. We chose to tolerate some minor problems (financial and/or organisational) that could cause delays in publishing in OA, but we did not want to tolerate delays longer than six months after the end of the previous year (the data for the year 2009 are observed at the end of June 2010). Accordingly, the journals that have, for example, in Open Access articles published in 2008, but not those published in 2009 were excluded from the sample.

Exclusion of all the journals that do not match our sample criteria resulted in a new list of 133 journals. That is the total number of Croatian OA journals in the year 2009 that become openly accessible by the end of June 2010.

5.1.3 Hypothesis

At the beginning of the study it was presumed that:

- a minority of the journals have eISSN – publishers are generally not aware that electronic publication is a new publication (content is the same but format and media is different);
- all the publishers are not-for-profit organisations – that is one of the *MSES*'s funding preconditions – and the study will show the types of the organisations as well as if there are some commercial co-publishers of Croatian scientific journals;
- a significant quantity of the journals publish articles in English (and the majority publish abstracts in English) – English is the unofficial language of the global scientific community; the editorial boards recognise the fact in trying to increase the journals' impact;
- the majority of the journals use the *Hrčak* portal – editors recognise the portal as the easiest way for making their journals freely available online;
- a minority of the journals use only the publishers' websites (not the *Hrčak* portal) to publish in OA – they either do not recognise the importance of the *Hrčak* portal, or they do not want to change their and their users' habits;

- a significant quantity of the journals are present in international databases (*WoS, DOAJ* and *JCR*) – high-quality peer-review process and publishing in English increase the number of Croatian journals in those databases;

- all the editorials support OA, but only a minority decide to publish their OA policy – as all the journals from the sample publish in OA, they obviously support it, but not all of them find it important to publish OA policy (the journals that use OJS automatically publish a note about supporting OA).

The main hypothesis is that all the participants of scientific communication in Croatia accept OA to Croatian scientific information but they still have to do a lot on achieving and promoting OA. In conclusion the general hypothesis and all the presumptions mentioned above will be commented on and some recommendations on further OA promotion will be proposed.

5.1.4 Results

5.1.4.1 ISSN and eISSN

All the journals have printed edition ISSN. As shown in Figure 6, 34 journals (25.6%) also have an ISSN for electronic edition (eISSN). The fact that 52 journals (39%) publish printed edition ISSN in their electronic edition shows editors and publishers' lack of awareness that electronic edition is a new edition that requires a new ISSN. It is also possible that some publishers applied for eISSN, but could not get one because their publication does not meet the serial publication definition. Serial publication has to be published at scheduled times and the issues have to be numbered. Electronic serial publication that applies for an eISSN has to have a title and an imprint with all the relevant data (editorial board, publishing schedule…). Here we can see a need for educating Croatian scientific journals' publishers and/or editors. They should know exactly what ISSN is and when and why to apply for it.

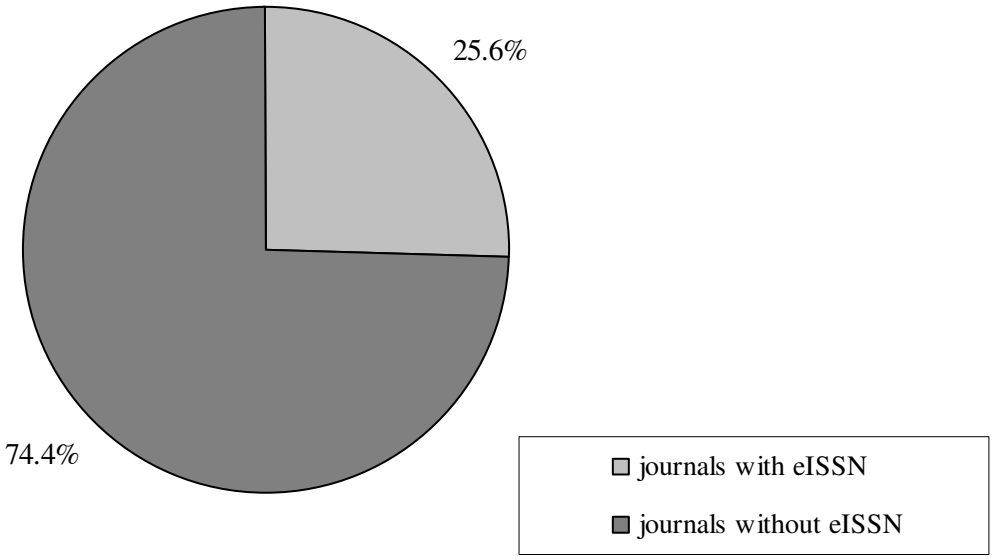


Figure 6: ISSN for electronic edition of Croatian OA journals

5.1.4.2 Number of volumes and issues on the Hrčak portal and on the publishers' web sites

The launch of the *Hrčak* portal in 2006 was a turning point for Croatian scientific publishing. Nevertheless, there had been free online scientific journals in Croatia before the portal was launched. Some of them exist today, regularly updating their own web sites. There are four basic groups of Croatian OA journals regarding web locations for access to their content.

In the first group are the journals that exist electronically, not using *Hrčak* portal at all. This group is the smallest; it has 4 journals (3%). Those journals probably do not need the portal because they have their own publishing models that editors and users are used to. There is nothing wrong about such an editorial policy; those journals are real OA journals. An example of such a journal is *Acta Dermatovenerologica Croatica*, a journal that had published electronically, by June 2010, 8 volumes in OA (with 30 issues). The journal's archive is searchable by issue, author's name, article title, abstract, index terms and full text.[121] The small number of journals such as *Acta Dermatovenerologica Croatica* can be interpreted as a proof that the *Hrčak* portal quality is recognised by other journals' editors and publishers.

[121] ADC: Acta Dermatovenerologica Croatica, http://adc.mef.hr/archive.php, (accessed July 12, 2010).

In the second group are the journals that have, since the launch of the *Hrčak* portal, continued to maintain simultaneously their own (publisher's) web site and the journals' web pages on the *Hrčak* portal. The number of those journals was 39 (29.3%) in June 2010. We suppose that the number will decrease in the future because the double effort has to be done to maintain both web sites. Some of the journals from the second group put the *Hrčak* link on their own web sites, so their old web addresses continue to exist redirecting the users to the *Hrčak* portal.

An example is *Croatica Chemica Acta*, a journal that has on the publisher's website 13 volumes (50 issues) with full text articles (since 1998).[122] The last 6 volumes are on the *Hrčak* portal (since 2005).[123] Only the 2005 volume has full text articles both on the *Hrčak* portal and on the publisher's website. If the users open publisher's websites and browse for an issue published in 2006 or later, they are redirected to the *Hrčak* portal. That is an example of a good practice – the publisher has recognized the *Hrčak* portal as an easier way for maintaining online content, but did not forget the readers who had used online edition on the publisher's website before the *Hrčak* portal was launched. Those readers do not need to know the new web location; they can still use the publisher's website and will be redirected to the *Hrčak* portal. It is predictable that the practice will continue in the future. Figure 7 shows location of the *Croatica Chemica Acta* full text articles since 1998.

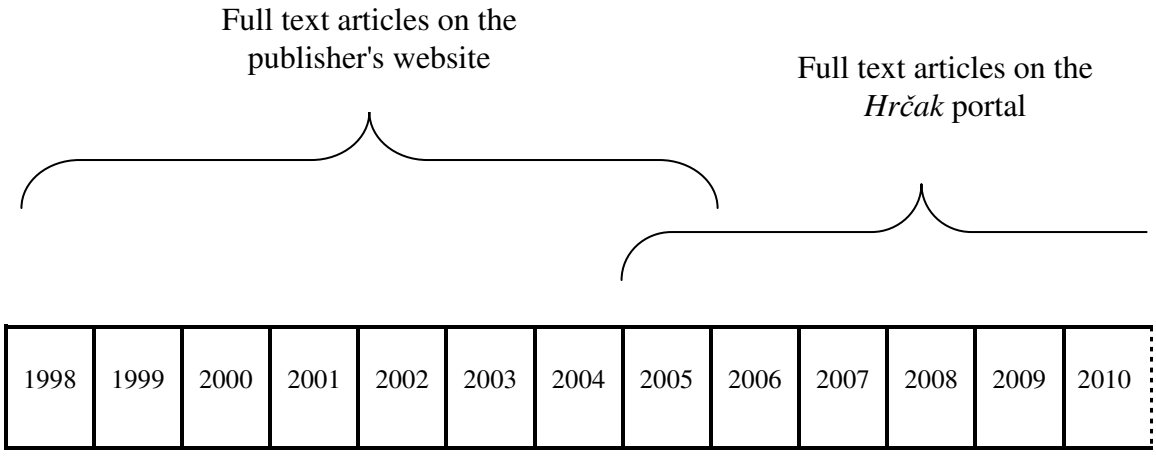


Figure 7: Location of the Croatica Chemica Acta full text articles since 1998

[122] Croatica Chemica Acta, http://www.vnovak.hr/ccacaa, (accessed July 12, 2010).
[123] Croatica Chemica Acta, http://hrcak.srce.hr/cca, (accessed July 12, 2010).

The third group of journals consists of journals that had existed online before *Hrčak* and, by the launch of *Hrčak*, they over passed to the portal and stopped updating their own web sites (that did not always have full-text articles available online). There were 7 (5.3%) such journals in June 2010. An example is *Periodicum Biologorum*, journal that had, on the publisher's website, journal content for the year 2007. The publisher has regularly updated the *Hrčak* website of the journal since 2008 (3 volumes, 11 issues).[124]

In the fourth group are the journals that had not had the online version before the *Hrčak* portal was launched. They used the portal to make their content freely available online. Those journals (i. e. their editors and publishers) completely benefited from the *Hrčak* portal. By June 2010 there were 83 (62.4%) journals that became OA thanks to the portal. The number is high and we expect it to increase in the future. A good example is journal *Bogoslovska smotra* that used the *Hrčak* portal to archive 80 volumes or 260 issues (since 1910) with full text articles.[125]

If we put together all the journals that have their content openly accessible at the *Hrčak* portal only (the third and the fourth group), there were 90 (67.7%) such journals in June 2010. Figure 8 shows the percentage of journals that are on the *Hrčak* portal, those that have the publishers' web sites only, and those that have both the *Hrčak* and the publishers' web sites.

Total number of OA journals on the *Hrčak* portal is 129 (97%). The number of volumes in June 2010 was 1079; the number of issues 2824 and the number of OA articles was 38265.

[124] Periodicum Biologorum, http://hrcak.srce.hr/pb, (accessed July 12, 2010).
[125] Bogoslovska smotra: (Ephemerides Theologicae Zagrabienses), http://hrcak.srce.hr/bogoslovska-smotra, (accessed July 12, 2010).

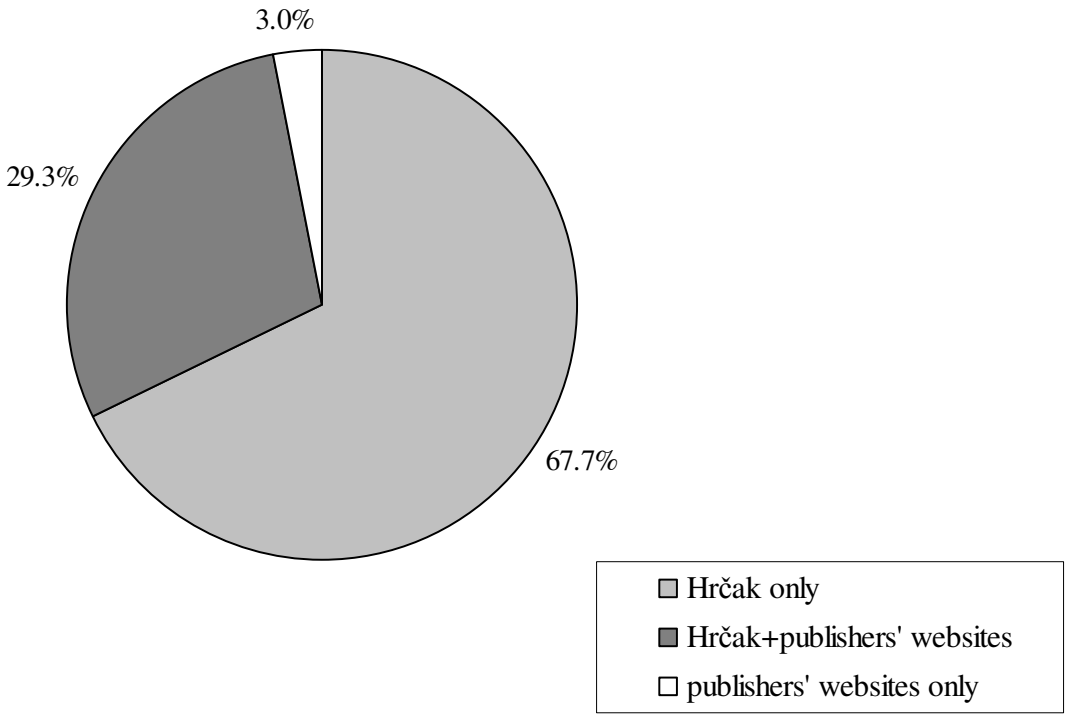


Figure 8: Percentage of the journals with the content on the Hrčak and/or the publishers' websites

The total number of OA journals with the publishers' web sites was 43 (32.3%) and they had 372 volumes and 1008 issues in OA (Table 4). The decrease of the number can be anticipated, but some future longitudinal studies have to be realised to prove the presumption. The results show that the *Hrčak* portal is recognised by editors and publishers of Croatian scientific journals as a good, maybe even the best, way of making journals freely available online. It offers a simple interface, technical support; it is free of charge, OAI-PMH compliant and offers long-term archiving. Future researches will probably show the similar tendency – more and more Croatian journals will become a part of the *Hrčak* portal and fewer journals will have the publishers' web sites.

	the *Hrčak* portal	publishers' websites
OA journals	129	43
OA volumes	1079	372
OA issues	2824	1008

Table 4: Number of journals, volumes and issues on the Hrčak portal compared to the number of journals, volumes and issues on publishers' websites in June 2010

5.1.4.3 Publication language of Croatian OA journals

Publication language is not important for the OA itself, but is very important when talking about the impact of the articles. One of OA's goals is increasing visibility, and it cannot be increased if the language is not understood by people who might be interested in reading the papers. In Croatia there are four journal categories concerning language:

1. Croatian only (40 journals or 30.1%);
2. English only (29 journals or 21.8%);
3. English or Croatian – journals that accept papers either in English or in Croatian (55 journals or 41.3%);
4. English and Croatian – journals that publish all the papers in both languages (9 journals or 6.8%).

An example of a journal from category 1 is *Archeologica Adriatica*. The publisher and editors decided to publish articles in Croatian with abstracts in English and "will do their best to publish the articles in both languages in the future".[126] Here we can see that, although the publication language is Croatian, the publisher is aware of the advantages of publishing in English. *Acta Botanica Croatica* is an example of a journal that has an international editorial board and since 1998 it has published all the contributions in English only.[127] The biggest group of the journals is the one that accepts articles in either of the two languages (and sometimes in a third language). An example is journal *Geodetski list*. All the articles, regardless of language of their full text, have abstracts in both English and Croatian.[128] The smallest group is the one with the journals that publish all the papers in both English and Croatian. If the editors want their journals to have greater impact and to develop Croatian terminology, they have to publish all the papers in both languages. That requires additional work and expense, so there are only 9 journals (6.8%) with such a practice (category 4). An example is journal *Nafta* that published all the 2009 volume articles in both languages.[129]

[126] Archeologia Adriatica, http://hrcak.srce.hr/adriatica?lang=en, (accessed July 12, 2010).
[127] Acta Botanica Croatica, http://hrcak.srce.hr/acta-botanica-croatica?lang=en, (accessed July 12, 2010).
[128] Geodetski list, http://hrcak.srce.hr/geodetski-list?lang=en, (accessed July 12, 2010).
[129] Nafta, http://hrcak.srce.hr/nafta?lang=en, (accessed July 12, 2010).

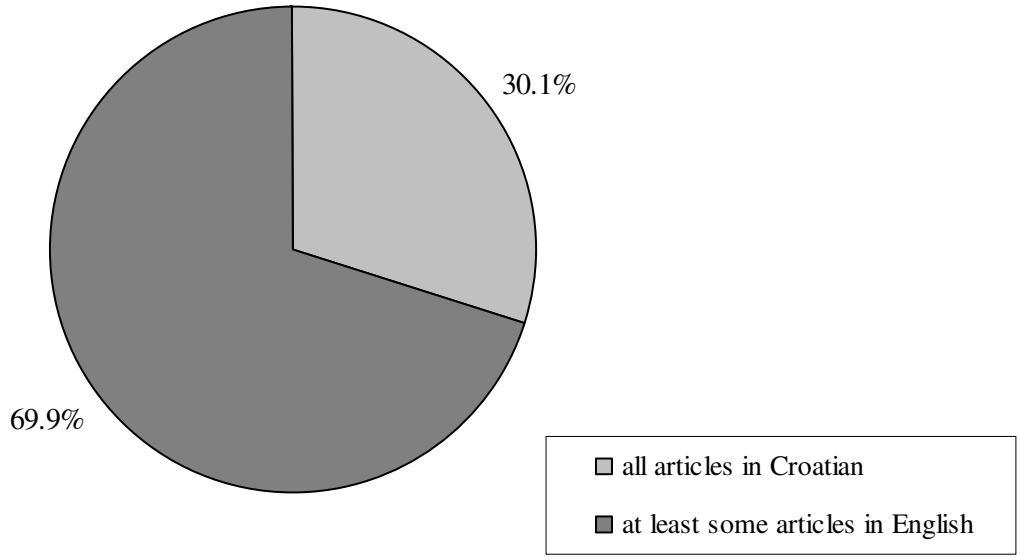


Figure 9: Language of the articles in Croatian scientific journals

Figure 9 shows the percentage of journals that publish at least some papers in English (categories 2, 3 and 4 – 93 journals or 69.9%) compared to the percentage of journals that publish the papers in Croatian only (category 1 - 40 journals or 30.1%).

Journal language also depends on the scientific field, so the journals from category 1 (Croatian language only) are mostly journals from social sciences and humanities.

5.1.4.4 Croatian OA publishers

The most important characteristic of journal publishing in Croatia are not-for-profit publishers. Scientific output promotion is at the heart of their interest, rather than profit. At that point, communication in peripheral communities such as Croatian is similar to the early beginnings of scientific communication in the 17th century. Croatian publishers do not want to make profit by selling either individual or institutional subscriptions. They, of course, do have subscribers, but the prices are not too high – lots of Croatian libraries or individuals continue to subscribe to printed editions even if the journals are in OA.

All the scientific research in Croatia is publicly funded (by the *Ministry of Science, Education and Sports*) and the results should be visible to all the Croatian citizens. The *Ministry* encourages OA publishing by putting OA journals on its priority list when deciding

on funding. All of the publishers from our sample are not-for-profit institutions or organisations, although three journals have commercial co-publishers.

There are three groups of not-for-profit publishers of Croatian OA journals (Figure 10):

1. scientific or professional associations (53 or 39.8%);
2. universities or faculties (46 or 34.6%) and
3. scientific institutes (31 or 23.3%).

An example of a journal that is published by a professional association is *Vjesnik bibliotekara Hrvatske* (*Croatian Librarians Herald*). The publisher is *Croatian Library Association*; articles are published in Croatian with English abstracts. The journal is published quarterly and is indexed in *Library and Information Science Abstracts (LISA), Information Science Abstracts (ISA)* and *PASCAL: Sciences de l' Information, Documentation*. Online issues are published immediately on the publisher's web site (8 volumes are available)[130], and on the *Hrčak* portal there is only a 2007 volume (and the link to the publisher's web site).[131]

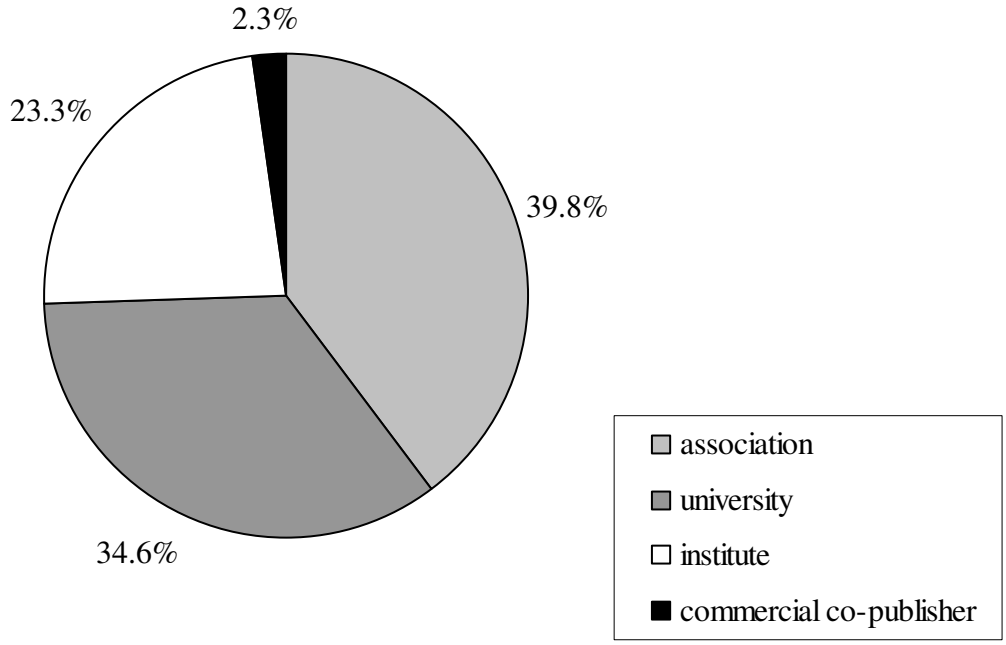


Figure 10: OA publisher types in Croatia

[130] Vjesnik bibliotekara Hrvatske, http://www.hkdrustvo.hr/vbh, (accessed July 12, 2010).
[131] Vjesnik bibliotekara Hrvatske, http://hrcak.srce.hr/vbh?lang=en, (accessed July 12, 2010).

Journal *Kinesiology* is an example of a journal published by a faculty. The publisher is *Faculty of Kinesiology* at the *University of Zagreb*. The journal is published twice a year, since 2000 articles have been published in English only, with extended abstracts in Croatian. The journal is indexed in several international databases: *American Psychological Abstracts*, *SportDISCUS*, *SIIC*, *EBSCO - Current Awareness*, *Index Copernicus* and from the year 2008 the journal has been included for coverage in the *Thomson Reuters*' indexes and services. Full texts are available at the *Hrčak* portal (7 volumes).[132]

Sociologija i prostor (*Sociology and Space*) is a journal published by the *Institute for Social Research* three times a year; articles can be submitted in English or in Croatian. The journal is indexed in *Sociological Abstract*, *Social Science Citation Index*, *Social Scisearch*, *Journal Citation Reports/Social Science Edition* and other databases. Seven volumes are available on the *Hrčak* portal.[133]

Three journals (2.3%) have a commercial co-publisher. An example is *Polemos*, a journal published twice a year by the *Croatian Sociological Association* and commercial publisher *Jesenski & Turk Publishing House*. The journal is indexed in *Sociological Abstracts* and *Political Science Abstracts*. Articles are published in Croatian with abstracts in English. Eleven volumes are available on the *Hrčak* portal.[134] Annual subscription is not too costly – US$25 – so we can conclude that the commercial co-publisher does not plan to earn a great amount of money through the subscriptions.

5.1.4.5 OA policies

Although all of the publishers from our sample are pro-OA, 52 of them (or 39%) consider it important to publish their publishing and copyright policy, and only 21 of them (15.8%) use the term "Open Access" either in English or in Croatian (Figure 11). *Croatica Chemica Acta,* for example, makes the "full text of all articles available from 1998 onwards free of charge". In the journal *Agriculturae Conspectus Scientificus* "full access is free". An example of a journal that uses the term Open Access is the *Croatian Medical Journal*, "an international peer-reviewed Open Access journal…"[135]

[132] Kinesiology, http://hrcak.srce.hr/kineziologija?lang=en, (accessed July 12, 2010).
[133] Sociology and Space, http://hrcak.srce.hr/sociologija-i-prostor?lang=en, (accessed July 12, 2010).
[134] Polemos, http://hrcak.srce.hr/polemos?lang=en, (accessed July 12, 2010).
[135] Croatian Medical Journal, http://cmj.hr/?show=40588, (accessed July 12, 2010).

Journals that use Open Journal System (OJS), open source software for editing electronic issues, always publish OA policy. OA policy is published among other policies (e. g. peer-review policy) and the phrase is always the same (as offered by the OJS): "This journal provides immediate Open Access to its content on the principle that making research freely available to the public supports a greater global exchange of knowledge".[136]

None of the publishers are registered on the SHERPA/RoMEO list of the publishers' OA policies. As all the journals are OA journals, it is supposed that they would allow self-archiving.

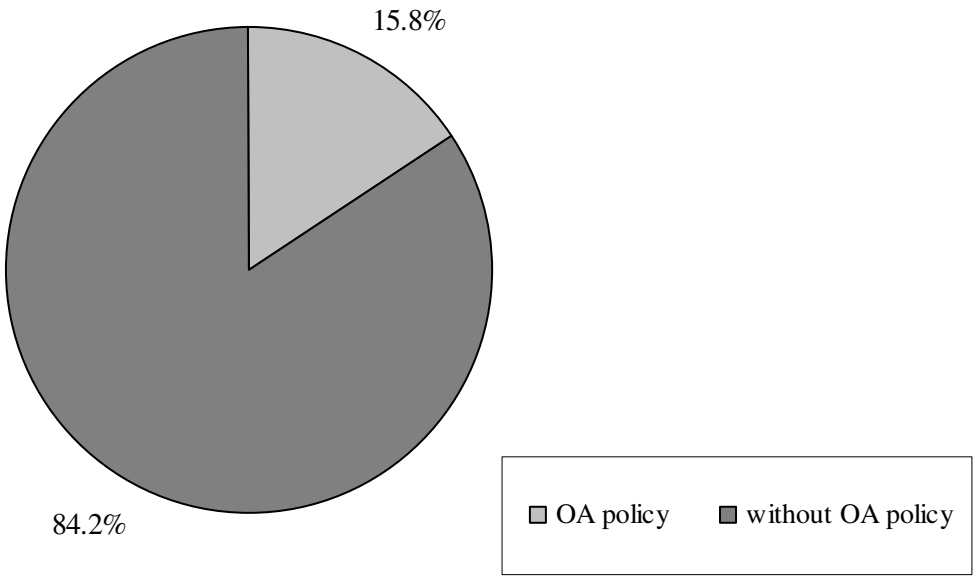


Figure 11: Percentage of journals with and without OA policy

5.1.4.6 Croatian OA journals in the DOAJ

The *Directory of Open Access Journals* is a database of free, full text, quality controlled scientific journals, covering all subjects and languages. By January 2011 there were 6000 journals in the directory, 2558 of them searchable at article level. There were 500285 articles included in the DOAJ at the time. Journals were from 110 countries, and Croatia came in 23rd

[136] Journal of Information and Organizational Sciences, http://www.jios.foi.hr/index.php/jios/about/editorialPolicies#openAccessPolicy,(accessed July 12, 2010).

place with 71 journals in the directory. Figure 12 shows the growth of the number of Croatian journals in the *DOAJ* from the year 2002 until December of 2010. A great progress is seen in the year 2007 when 30 new journals were added, and in the following year when 15 new journals were added. That is the time when the *Hrčak* portal team started promoting the *DOAJ* by suggesting a number of journals to the *DOAJ* team.[137]

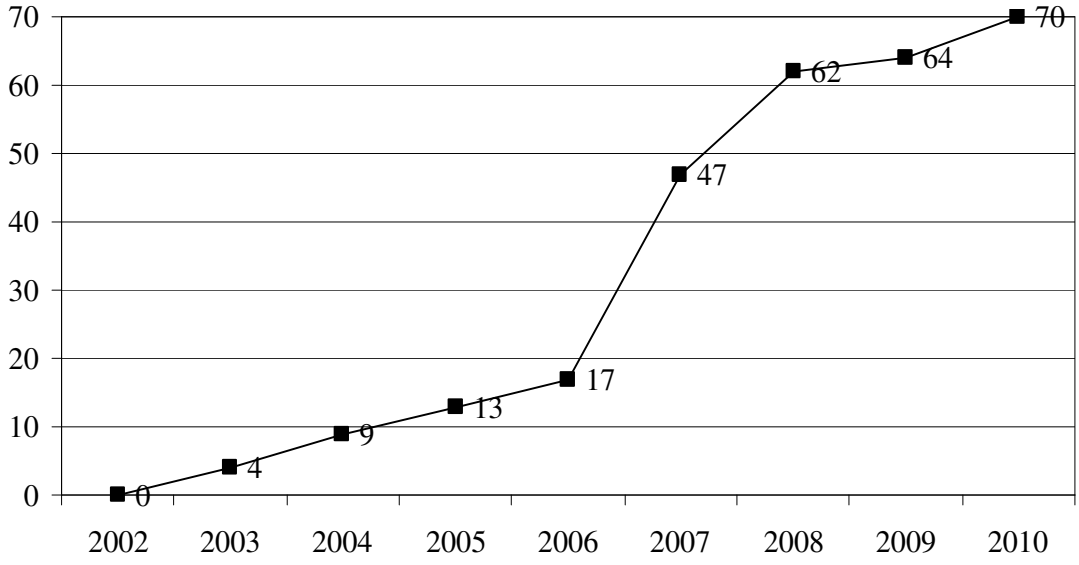


Figure 12: Increase of the number of Croatian journals in the DOAJ, 2002-2010.

Figure 13 shows total number of journals in the *DOAJ* at the end of 2010 for some European scientifically peripheral countries. When analysing the chart, we have to have in mind the size of the countries – Croatia is one of the smallest (4.5 million inhabitants, comparing to Poland - 38 million, Czech Republic - 10.5 million, Bulgaria - 7.5 million, Slovakia - 5.5 million, Bosnia & Herzegovina – 4 million and Slovenia – 2 million).

Fifty seven journals from our sample are in the *DOAJ* (or 42.9%). Eighteen of them have the *DOAJ* content, i. e. they deposit metadata on an article level (31.6% of all the sample journals in the *DOAJ*). It is also interesting that 21 of the 57 journals (or 36.8%) in the *DOAJ* have links to the full-text articles published on publisher's website, and 36 journals (63.2%) have links to the *Hrčak* portal. That is further proof of the importance of the *Hrčak* team's involvement in promotion of the *DOAJ*.

[137] Directory of Open Access Journals, "DOAJ by country," http://www.doaj.org/doaj?func=byCountry, (accessed November 06, 2010).

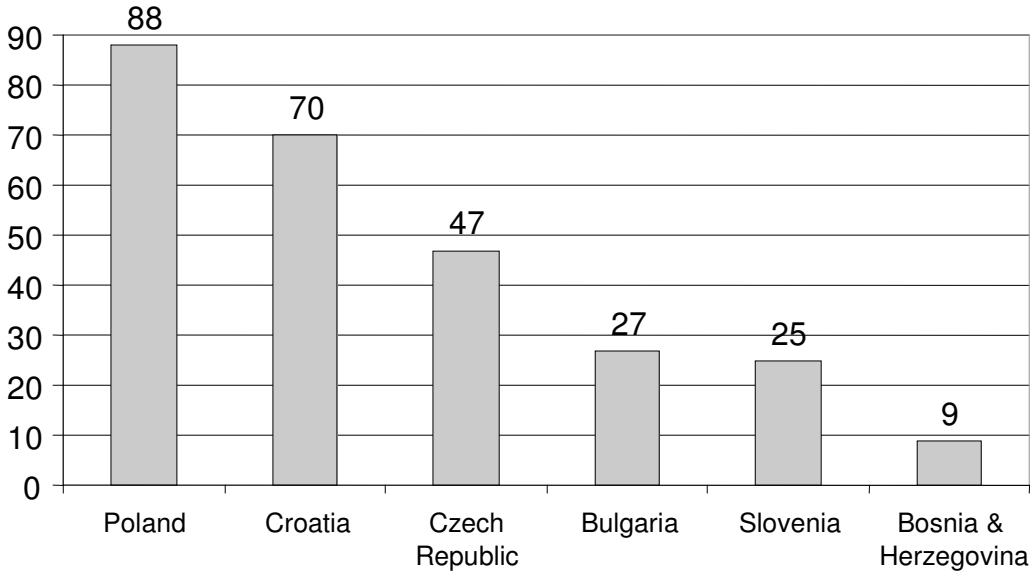


Figure 13: Total number of journals in the DOAJ at the end of 2010 for some European countries

5.1.4.7 Croatian OA journals in the Web of Science

Web of Science is a service of the *Thompson Reuter's Web of Knowledge*. It provides researchers, administrators, faculty, and students with quick, powerful access to the world's leading citation databases. Authoritative, multidisciplinary content covers over 10,000 of the highest impact journals worldwide, including Open Access journals and over 110,000 conference proceedings. When deciding on funding, the *MSES* consider indexing in the *WoS* as an important element. In June 2010, 42 (31.6%) of the journals from the sample were in the *WoS* (Figure 14).

There is a strong correlation between indexing in the *WoS* and the language of the publications. In the *WoS* are more journals that publish at least some articles in English (37, or 88% of all Croatian OA journals in the *WoS*). A conclusion can be made that the presence in the *WoS* strongly depends on the language of the articles – journals that publish at least some articles in English are more visible.

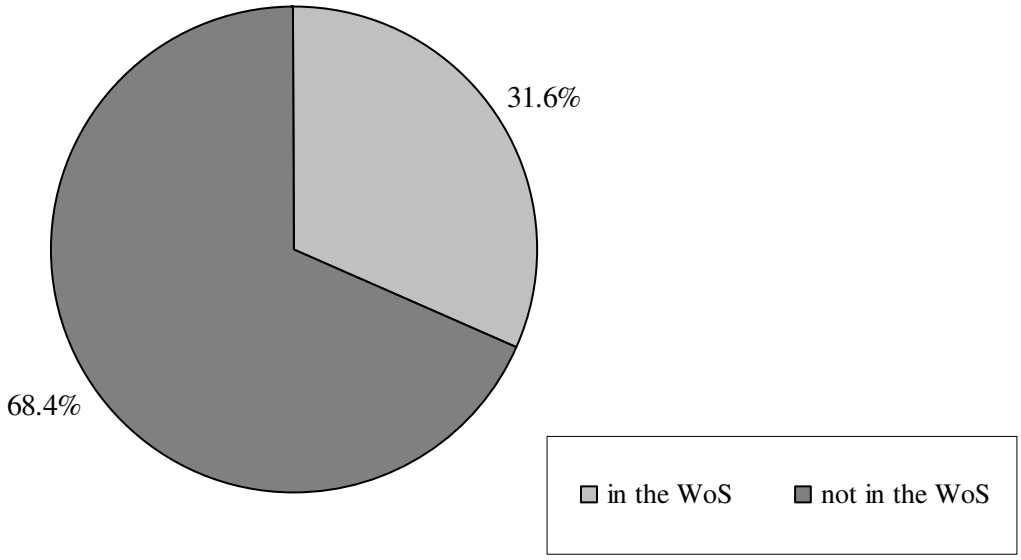


Figure 14: Croatian journals and the WoS database

5.1.4.8 Croatian OA journals in the JCR database

Another *Thomson Reuters'* service is *Journal Citation Reports* that offers a systematic, objective means to critically evaluate the world's leading journals, with quantifiable, statistical information based on citation data. By compiling articles' cited references, *JCR Web* helps to measure research influence and impact at the journal and category levels, and shows the relationship between citing and cited journals. It covers (October 2010) more than 8 000 of the world's most highly cited, peer-reviewed journals. Journals are from 3300 publishers in approximately 227 disciplines, from 66 countries. The *JCR* has two editions - the *Sciences Edition* (over 6500 journals) and the *Social Sciences Edition* (over 1900).[138] Before being indexed in the *JCR*, journals have to be at least 3 years indexed in the *WoS*, for its impact factor can be counted. Impact factors are published at the end of June for previous year.

In the year 2009 a part of the *Thomson Reuters* policy was increasing the number of journals from scientifically peripheral countries, as well as the journals in "small" languages. That policy was a great benefit for Croatian journals. In the year 2008 there were 14 Croatian journals in the JCR (11 in the *Sciences Edition* and 3 in the *Social Sciences Edition*). In 2009 the number was 35 (24 in the *Sciences Edition*, 12 in the *Social Sciences Edition*, one journal

[138] Journal Citation Report, http://thomsonreuters.com/products_services/science/science_products/a-z/journal_citation_reports, (accessed July 12, 2010).

is in both editions). In our sample there were 27 journals that are in the *JCR* for 2009 (18 in the *Sciences Edition*, 10 in the *Social Sciences Edition*, one journal is in both editions). Table 5 compares the number of Croatian journals in both JCR editions for the years 2008 and 2009 as well as the number of the OA journals in the 2009 editions of JCR.

Year / *JCR edition*	Total no. in 2008	Total no. in 2009	No. of OA journals in JCR in 2009
Sciences Edition	11	24	18
Social Sciences Edition	3	12	10
Total	**14**	**26**	**18**

Table 5: Croatian journals in JCR for 2008 and 2009

5.1.4.9 Conclusion – Croatian OA journals

Out of 211 journals that were financially supported by the *MSES* in 2009, 133 were OA journals (i. e. scientific journals that had, by June 2010, freely online available full text articles for at least one 2009 issue). Nine elements were analysed (eISSN, number of volumes and issues on the *Hrčak* portal and on the publishers' websites, language, publisher types and publishers' OA policy, number of the journals in the *DOAJ*, the *WoS* and the *JCR*).

As was presumed, the results show that the majority of Croatian OA journals do not have an ISSN for electronic edition. The publishers are either not aware of the fact that electronic publication is a new publication or they do not publish electronic versions regularly. The presumption that all the publishers are not-for-profit organisations is proved right, although three publishers have commercial co-publishers. The important fact is that those commercial publishers' primary interest is not making money out of the subscriptions (subscriptions are not too costly).

It is proven that the majority of the journals do publish articles in English, and all of the journals publish at least abstracts in English. Editors and publishers are aware that the English language is the unofficial language of global scientific communication and is important for the journals' visibility and impact.

The analysis showed that the majority of the journals are on the *Hrčak* portal and the portal plays an important role in OA promotion. Only 4 journals from the sample do not

deposit their full text articles on the portal. Thanks to the portal, at least 36 journals are included in the *DOAJ*. The fact that the journals are openly accessible is not the only fact that is important for their inclusion in the *WoS* and *JCR*, but many studies proved that OA improves visibility and impact. We can be sure that the *Hrčak* portal, by promoting and implementing OA, improved visibility and impact of Croatian OA journals. It would be interesting to repeat the study of Croatian OA journals in the future as to prove that Croatian publishers and editors are becoming more and more aware of the OA importance.

Table 6 summarises the results concerning the number of the journals on the *Hrčak* portal, on the publishers' websites, in the *DOAJ*, in the *WoS* and in the *JCR*. The number is compared to the total number of journals at each location.

Location	No. of Croatian OA journals	Total no. of journals at the location
Hrčak	129	222
Publishers' websites	43	-
DOAJ	57	5600
WoS	45	10000
JCR	27	8000

Table 6: Number of Croatian OA journals compared to the total number of journals at the Hrčak portal, publishers' websites, DOAJ, WoS and JCR

The number of journals with both *Hrčak* and publishers' websites is rather high. In the future, the number of publishers that decide to maintain both locations will probably decrease. The total number of journals at the *Hrčak* portal cannot increase a lot because in Croatia there are not much more than 200 scientific journals. Their number can vary each year but it will not increase rapidly. But the space for improvement is in the difference between the total number of journals on the portal and the number of journals that meet the OA definitions (222 minus 129 equals 93 journals). Those journals should improve their electronic versions; publishers and editors should do their best to make the journals freely accessible online. *Hrčak* portal gives the appropriate tool and technical support.

The *DOAJ* has become a reliable OA journal database. It is recommendable to Croatian journals' publishers and editors to submit their journals to the database, maybe even metadata on the article level. The *Hrčak* portal is involved enough in promotion of the database.

Because of the *Thomson Reuters* policy of including journals from the scientific "periphery" in their services and databases, it is predictable that the number of Croatian journals in the *WoS* and in the *JCR* will increase. Nonetheless, the journals themselves have to retain or improve their quality.

5.2 OA repositories in Croatia

5.2.1 Searching for Croatian OA repositories

In the second part of the study, Croatian OA repositories will be analysed. By content analysis of scientific institutions' web sites and repositories' web sites several elements could be identified: total number of OA repositories, repository types, software, OAI PMH compliance, types of documents, total number of the deposited documents, formats, legal issues, staff issues, way of archiving (self-archiving or other) and archiving policies. Data about the repositories will be compared and conclusions on their functionality will be drawn.

To identify the total number of Croatian OA repositories, three databases were consulted – the *MSES'*s list of Croatian scientific institutions,[139] the *Directory of Open Access Repositories* (*DOAR*)[140] and the *Repository of Open Access Repositories* (*ROAR*)[141].

There were 98 institutions on the *MSES'*s list and their web content analysis resulted in detecting three repositories that allow access to at least some of the full-text documents to the general public (although there are some attempts and testing models, such as the repository of the *Department of Information Sciences, Faculty of Philosophy, University of Osijek*, that do not allow access but intend to become OA IRs in the future). The three repositories are the *Digital Archive of the Faculty of Humanities and Social Sciences* at the *University of Zagreb*, the *Repository of the Faculty* of *Mechanical engineering and Naval Architecture, University of Zagreb* (*FAMENA PhD Collection*) and the *University of Zagreb Medical School Repository*.

[139] Ministry of Science, Education and Sports, "Ustanove iz sustava znanosti (Scientific institutions)," http://pregledi.mzos.hr/Ustanove_Z.aspx, (accessed July 12, 2010).
[140] DOAR: Directory of Open Access Repositories, www.opendoar.org, (accessed July 12, 2010).
[141] ROAR: Registry of Open Access Repositories, 2010. http://roar.eprints.org, (accessed November 06, 2010).

According to the *DOAR*, there were five OA repositories in Croatia in October 2010 – the three mentioned above, the *FOI* (*Faculty of Organization and Informatics*) *digital library* and the *Hrčak* portal. According the *ROAR*, there were, in October 2010, three repositories – all of them mentioned earlier – the *University of Zagreb Medical School Repository*, the *Digital Archive of the Faculty of Humanities and Social Sciences at the University of Zagreb* and the *Hrčak* portal.

If we put together all the mentioned repositories, the total number is five. But only one of them meets the full definition of an OA repository. The *FOI* digital library has an intention to become OA IR, but is in a test phase and had, in October 2010, only 5 items, all of them administrative documents of the institution.[142] The *Hrčak* portal is not really an OA repository but the platform for access to Croatian OA journals. The *Digital Archive of the Faculty of Humanities and Social Sciences* at the *University of Zagreb* has an intention to be an OA repository, it operates on the EPrints software and is OAI PMH compliant but it still does not allow OA to all of its content (to access some full-texts registration is required). The repository archives mainly diploma thesis, although it has an intention to archive other material types. The *Repository of the Faculty of Mechanical engineering and Naval Architecture*, *University of Zagreb* does not allow OA to all of the deposited items; it is not OAI-PMH compliant and does not use open source software although it also has an intention to become an OA repository. It archives only master thesis and PhD thesis, but have the intention to archive other material types in the future (such as journal articles, books etc.). The only Croatian repository that meets the full definition of OA repository, and the only one that archive journal articles is the *University of Zagreb Medical School Repository*. The repository will be described as an example of good practice.

5.2.2 University of Zagreb Medical School Repository

The launch of the repository was initiated in 2005 by the library.[143] It is a database of research results written by employees and students of the School. The full texts are freely available and the repository is OAI PMH compliant. Open source software Eprints, version 2.3.13.1 (September 2005) was chosen and adapted to meet the institution's and the users' needs. The self-archiving option is blocked and all the archiving is made by librarians. All the

[142] FOI dlib, http://dlib.foi.hr/handle/10439/1, (accessed July 12, 2010).
[143] University of Zagreb Medical School, "Repozitorij Medicinskog fakulteta, (Medical School Reposirory)," http://medlib.mef.hr, (accessed July 12, 2010).

directions, searching and browsing are in English, only basic information are in both English and Croatian. Here we can see the intention of increasing visibility of the repository to the global scientific community.

Središnja medicinska knjižnica

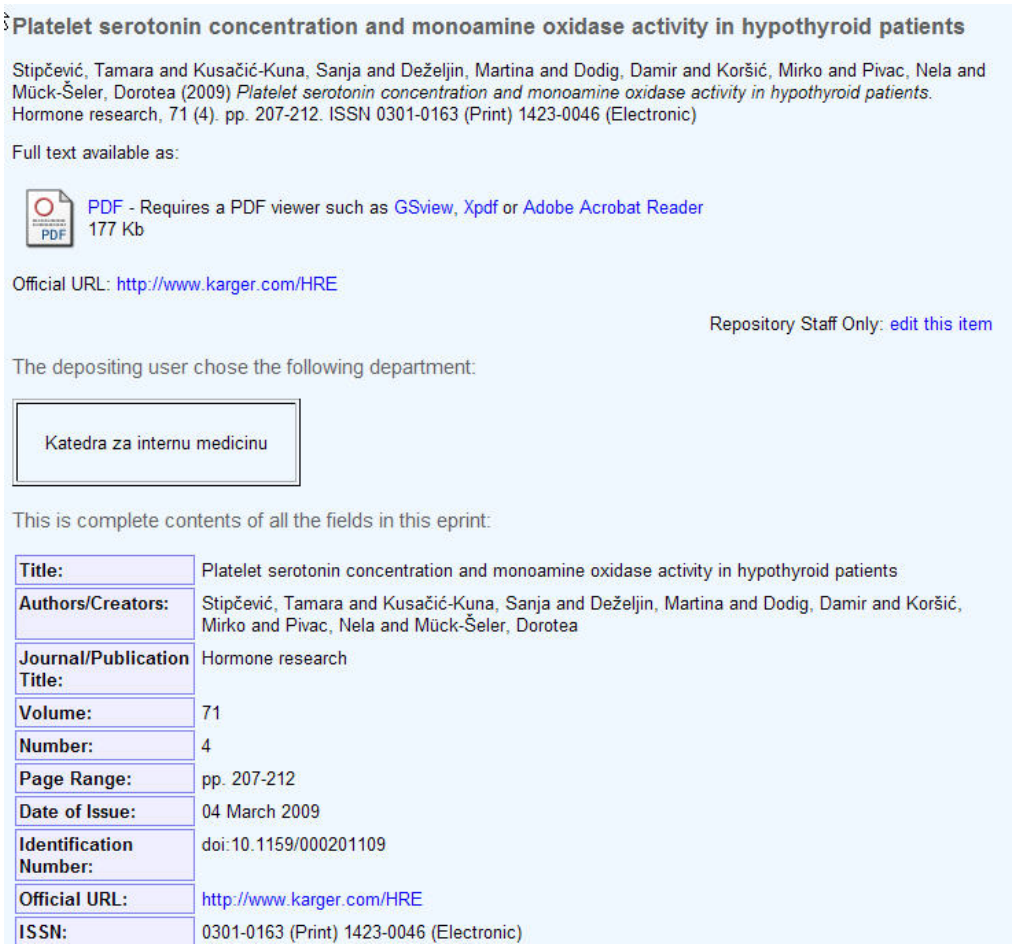
Stipčević, T., Kusačić-Kuna, S., Deželjin, M., Dodig, D., Koršić, M., Pivac, N., Mück-Šeler, D. (2009) *Platelet serotonin concentration and monoamine oxidase activity in hypothyroid patients.* Hormone research, 71 (4). pp. 207-212.

Figure 15: An example of the first page of an archived document in the University of Zagreb Medical School repository

Types of archived material are journal articles (595 items in October 2010), thesis (153), book sections (6), conference or workshop items (2), books (1), patents, monographs and other. The main problem in archiving the major two groups of items (journal articles and theses) is copyright. When a librarian wants to deposit a journal article written by a *Medical School* member, he has to consult the SHERPA/RoMEO website to find the publisher's self-archiving policy. If the policy is not available at the web site, he has to contact the publisher and get written archiving permission. *Medical School* logo is added to the author's version of the article and the PDF format is archived. An example of the first page of an archived document is in the Figure 15.

Archiving PhD thesis in the repository is not mandatory. Before archiving PhD theses, a librarian has to have the author's permission. The author can choose among the following three options:

1. the thesis cannot be archived;
2. the thesis can be archived immediately;
3. the thesis can be archived, but with a one-year embargo period.



Platelet serotonin concentration and monoamine oxidase activity in hypothyroid patients

Stipčević, Tamara and Kusačić-Kuna, Sanja and Deželjin, Martina and Dodig, Damir and Koršić, Mirko and Pivac, Nela and Mück-Šeler, Dorotea (2009) *Platelet serotonin concentration and monoamine oxidase activity in hypothyroid patients.* Hormone research, 71 (4). pp. 207-212. ISSN 0301-0163 (Print) 1423-0046 (Electronic)

Full text available as:

PDF - Requires a PDF viewer such as GSview, Xpdf or Adobe Acrobat Reader
177 Kb

Official URL: http://www.karger.com/HRE

Repository Staff Only: edit this item

The depositing user chose the following department:

Katedra za internu medicinu

This is complete contents of all the fields in this eprint:

Title:	Platelet serotonin concentration and monoamine oxidase activity in hypothyroid patients
Authors/Creators:	Stipčević, Tamara and Kusačić-Kuna, Sanja and Deželjin, Martina and Dodig, Damir and Koršić, Mirko and Pivac, Nela and Mück-Šeler, Dorotea
Journal/Publication Title:	Hormone research
Volume:	71
Number:	4
Page Range:	pp. 207-212
Date of Issue:	04 March 2009
Identification Number:	doi:10.1159/000201109
Official URL:	http://www.karger.com/HRE
ISSN:	0301-0163 (Print) 1423-0046 (Electronic)

Figure 16: An archived paper record in the University of Zagreb Medical School repository

The repository can be browsed by NLM (*National Library of Medicine*) classification, by mentor, by author and by item type. The repository can be searched by title, author(s), creators, full-text, date, MeSH (Medical Subject Headings), institution, English abstract, Croatian abstract, journal title, department, editors, subjects and status. Figure 16 shows a record in the repository.

The *University of Zagreb Medical School repository*, thanks to the librarians' effort, is an Open Access repository. The full texts of all the deposited items are available; it is OAI PMH compliant, and indexed in the *DOAR* and the *ROAR* databases. OA promotion is on a high level, *Medical School* members are educated about the purpose of the repository as well as about all the advantages of archiving in the repository.

5.2.3 Future of OA repositories in Croatia

A library is the first loop in scientific communication chain that can recognise all the problems that evolved from the "serial crisis". One of the most important roles of all libraries is to meet the users' needs, trying to ensure access to all the needed information. One way to achieve the goal is by launching OA repositories. Majority of OA repositories in the world are institutional repositories, launched on the librarians' initiative.

A 2010 study of Croatian academic libraries showed that Croatian librarians are aware of the importance of launching institutional OA repositories.[144] Almost all respondents (98.2%) found it necessary to establish a digital repository in their institution and 33.9% think that a repository should be established within a year. The librarians are also aware of the importance of OA – more than 90% think that repositories should be OA repositories – accessible to everyone and OAI PMH compliant.

Although Croatian librarians are aware of the importance of OA repositories, the number of the repositories is too small and something has to be done on both institutional and national level. On the national level a working group should release guidelines for setting up a repository. The document should help librarians in deciding how to organise a repository, which software to use, which policies to apply etc. The document could be a standard that would encourage the launch of institutional OA repositories in Croatia. There is a possibility of launching a national repository, but that decision should be based on a detailed study of libraries', institutions' and users' needs. Another solution could be based on the existing projects, such as *Croatian Scientific Bibliography* (*CROSBI*)[145], but in that case, some major modifications should be done.

5.3 Conclusion – Open Access in Croatia

The study of OA in Croatia shows that Croatian librarians, scientists and publishers recognise OA as a new form of formal scientific communication. Their efforts resulted in

[144] Hebrang Grgić, Ivana; Barbarić, Ana. "The Future of Open Access in Croatia: a survey of academic and research libraries." *Library Review* 60, no. 2 (2011): 155-160.
[145] CROSBI: Croatian Scientific Bibliography, http://bib.irb.hr/index.html?lang=ENhttp://bib.irb.hr/index.html?lang=EN, (accessed July 12, 2010).

publishing OA journals and in launching OA repositories, but OA journals are a more common way of achieving OA in Croatia.

Scientific journals publishing in Croatia are publicly funded and some guidelines and rules for editing the journals are regulated – the correct way of editing is a precondition for funding. The state encourages all the results of publicly funded research to be publicly available. Therefore, one of the criteria when deciding on grant applications is journals' free availability on the Internet. As the study showed, editorial policies prove a high level of OA advantage awareness. Although Croatia is a small, peripheral scientific community, Open Access, along with all the other segments of editorial policies (such as quality control and language of publications), raises Croatian scientific journals' visibility and impact, both in Croatia and in the global scientific community. Not-for-profit publishers facilitate OA publishing – they are not afraid of losing subscriptions and they are usually willing to allow immediate, free of charge access to full-text articles published in their journals.

The *Hrčak* portal is a great help for editors and publishers in achieving OA because it offers a simple way of electronic publishing on a simple interface. Its OAI PMH compliance assures interoperability with other information services and providers. The number of Croatian OA journals has a tendency to increase in the future and some longitudinal research should try to prove the trend. Croatian scientific research results published in Croatian scientific journals do not have tremendous accessibility and visibility problems. Some minor problems could be resolved by promoting and encouraging Open Access to those journals that are not yet in OA.

The "green route to OA" is less developed in Croatia. The government does encourage Open Access, but there are no rules or guidelines for setting up repositories. The launch of the repositories mostly depends on the librarians' enthusiasm. They have to find the time to start the projects, they have to decide on all the important issues, organise working groups, promotion committees, and in some libraries there are only one or two librarians. It is not easy for them to find the time to do all that and it is not easy for them to make the right decisions. The biggest problems are choosing appropriate software and dealing with copyright issues. Until the launch of the repositories is regulated on a national level, librarians themselves will have to solve all the problems. The study showed that OA has its future in Croatia. The government should get more involved in promoting and encouraging OA. Publishers and librarians should continue their work in publishing OA journals and setting up OA repositories.

The study of Croatian scientists was not included in this research. The results from the 2009 survey show that 54.7% of authors believe that at least one journal they publish in is an OA journal. Their reasons for publishing in OA journals are support of free access to scientific information (55%) and higher impact of their articles (36.9%). Sixty eight per cent of the Croatian authors are not sure what self-archiving is.[146] A similar survey should be repeated in the future to find out about Croatian scientists views and experiences. The study of Croatian OA journals and repositories should also be repeated in future to show possible changes in OA trends in Croatia. The studies of OA in Croatia could be the starting point for building national OA strategy. The following recommendations are a part of this conclusion and could probably help with advancing OA in Croatia.

5.4 Recommendations for the further development of OA in Croatia

In conclusion of the study of OA in Croatia, we will try to recommend what should be done in the future to promote and achieve OA. Three important subjects of scientific communication in Croatia will be included – the *Ministry of Science, Education and Sports* as the funding agency; publishers and/or editors of Croatian scientific journals (that could make an effort to produce more OA journals) and special and academic libraries (that can initiate OA repositories).

The *Ministry of Science, Education and Sports* should:

- continue to financially support scientific journals according to the *Guidelines for financial support to scientific journals*;
- give priority to the journals that make all of their content openly accessible immediately after (or before) the printed edition is published;
- give priority to the journals that are on the *Hrčak* portal and in the *DOAJ*;

[146] Hebrang Grgić, Ivana. "Open Access in Croatia: a study of authors' perceptions." In *The future of information sciences: INFuture2009: Digital resources and knowledge sharing*. Zagreb: Department of Information Sciences, Faculty of Humanities and Social Sciences, University of Zagreb, 2009: 169-176.

- in all of its documents related to Open Access use the term “Open Access” (i. e. Croatian translation of the term);
- get involved in organisation of national and international meetings with the topic of Open Access;
- encourage studies and surveys about OA;
- encourage launch of OA repositories by organising working group(s) that would develop institutional and/or national policies and guidelines;
- encourage scientists to deposit their theses in institutional repositories;
- encourage scientific institutions to educate their employees about OA;
- encourage cooperation between publishers, editors, libraries and institutions;

Editors and publishers of Croatian scientific journals should:

- publish high quality peer-reviewed articles in their journals;
- publish their journals on the *Hrčak* portal;
- accept OA as a new way of scientific communication;
- publish all the issues regularly;
- make their content freely available without an embargo period;
- update their websites regularly;
- try to publish electronic versions prior to the printed ones;
- suggest their journals to databases such as *DOAJ*;
- keep informed about global scientific communication trends;
- keep informed about OA development on national and international level;
- adopt and publish OA policy;
- apply for the ISSN for the electronic version of their journals;
- try to benefit from all the advantages of electronic publishing (i. e. links, audio and video links, high resolution or 3D photographs…)

- try to publish articles in both English and Croatian for better visibility and for developing Croatian terminology in the field;
- exchange the experiences about OA publishing;
- organise thematic conferences and meetings on OA;
- promote OA among their authors and readers.

Special and academic libraries should:

- launch institutional OA repositories;
- improve existing repositories;
- carefully choose the most appropriate software for their repositories (Open source software);
- make their repository OAI-PMH compliant;
- take care about copyright;
- control and assist in self-archiving;
- propose self-archiving policy for their institution;
- ensure long-time archiving;
- keep informed about global scientific communication trends;
- keep informed about OA development on national and international level;
- keep informed about editorial policies of high quality international journals;
- educate their users;
- exchange experiences connected with OA;
- strategically promote OA repository in the institution and out of the institution.

CONCLUSION

Open Access is a new way of communicating in science. During the last two decades it has evolved into a global movement and has become more and more accepted by all the subjects of scientific communication. Scientists, publishers and libraries try to use OA as a new tool for accessing, acquiring and disseminating high quality scientific information. The basic concept of OA is compatible with the scientists' needs for fast and unrestricted access to high quality peer reviewed information, a basic precondition for further development of science, society and the whole of mankind.

However, there are some differences between the global scientific community and some smaller, peripheral scientific communities. We tried to prove that, regardless of all the differences, the basic OA model is applicable in scientifically peripheral countries. Croatia was an example of such a country. We cannot say that OA awareness in Croatia is on a high level although some Croatian scientists, librarians, publishers and organisations did recognise the importance of the movement very early; almost immediately after the first OA initiative was launched. Both ways of achieving OA are being practiced in Croatia, but the green route to OA is far less developed than the golden route. We can find numerous reasons for that. First of all, publishers of Croatian scientific journals are not-for-profit organisations. The editors want their journals to be OA for better visibility and for fulfilling one of the *MSES*'s basic funding preconditions. The Government encourages open accessibility to the results of publicly funded research. Croatian OA publishers have, thanks to the *Hrčak* portal, a high quality platform for publishing their journals. The number of Croatian OA journals is relatively high, concerning the total number of scientific journals as well as concerning the size of the country.

Another way of achieving OA is less developed in Croatia. Although scientists and librarians mostly support the idea of OA repositories, there are still numerous organisational problems that have to be solved. Traditional initiators of launching repositories are libraries, but it is impossible for librarians to do all the work without the support on both institutional and national level. We also have to mention that it is easier to convert an existing traditional

scientific journal to an OA journal than to launch a completely new service such as an OA repository.

When discussing OA awareness in Croatia, its granularity has to be mentioned. The survey described in previous chapters proved that publishers and editors are to a large extent aware of the OA advantage – almost two thirds of Croatian scientific journals are OA journals. Libraries are also aware of all the possibilities and advantages of OA repositories. The scientists are those who have to be educated and encouraged (by their libraries, editors, publishers…) to increase publishing in OA. Although Croatian scientific institutions and the Government are aware of OA's importance, they should do some new steps in promoting it, such as organising a national working group for launching OA repositories.

Open Access is not the only future of scientific communication. We cannot hope that everything written in science will be openly accessible on the Internet in our near future. But OA is a good way of solving access problems and of making high quality scientific information more visible to global scientific community.

LITERATURE

1. Acta Botanica Croatica, http://hrcak.srce.hr/acta-botanica-croatica?lang=en, (accessed July 12, 2010).
2. ADC: Acta Dermatovenerologica Croatica, http://adc.mef.hr/archive.php, (accessed July 12, 2010).
3. AGORA, "Who can participate," http://www.aginternetwork.org/en/about_agora/elegibility.html, (accessed December 11, 2010).
4. AJOL: African journals online, http://ajol.info, (accessed December 11, 2010).
5. Archeologia Adriatica, http://hrcak.srce.hr/adriatica?lang=en, (accessed July 12, 2010).
6. Arms, William Y. "Economic models for open access publishing," http://www.cs.cornell.edu/wya/papers/iMP-2000.html, (accessed November 06, 2010).
7. Arxive.org, http://www.arxive.org, (accessed October 04, 2010).
8. Association of Research Libraries, "The case for institutional repositories: a SPARC position paper," 2002. http://www.arl.org/sparc/bm~doc/ir_final_release_102.pdf, (accessed November 02, 2010).
9. Bekavac, Anamarija; Buneta, Zoran. "Language barrier in a scientifically peripheral country: a case report from Croatia." *Croatian Medical Journal* 34, no. 4 (1993): 272-275.
10. Berlin declaration on Open Access to knowledge in the sciences and humanities, http://oa.mpg.de/openaccess-berlin/berlindeclaration.html, (accessed November 02, 2010).
11. Bernal, John D. "Provisional scheme for central distribution of scientific publications." In *Royal Society Scientific Information Conference*. London: The Royal Society, 1948: 253-258.

12. Besemer, Hugo. “Gathering evidence about the effectiveness of "open access" publishing policies in agriculture,” 2006. http://agriscontent.wordpress.com/2006/08/23/gathering-evidence-about-the-effectiveness-of-%E2%80%9Copen-access%E2%80%9D-publishing-policies-in-agriculture/, (accessed November 17, 2010).
13. Bethesda statement on Open Access publishing, http://www.earlham.edu/~peters/fos/bethesda.htm, (accessed November 02, 2010).
14. Bioline International, http://www.bioline.org.br, (accessed December 11, 2010).
15. BioMed Central, “How much is BioMed Central charging?,” http://www.biomedcentral.com/info/authors/apcfaq#howmuch, (accessed November 06, 2010).
16. BioMed Central, “Open Access Africa,” http://www.biomedcentral.com/developingcountries/openaccessafrica, (accessed December 11, 2010).
17. BioMed Central, “Open access and the developing world,” http://www.biomedcentral.com/developingcountries/improvingaccess, (accessed December 11, 2010).
18. Bogoslovska smotra: (Ephemerides Theologicae Zagrabienses), http://hrcak.srce.hr/bogoslovska-smotra, (accessed July 12, 2010).
19. Budapest Open Access Initiative, http://www.soros.org/openaccess/read.shtml, (accessed November 02, 2010).
20. Bush, Vannevar. “As we may think.” *The Atlantic Monthly*, July 1945, available at: http://www.theatlantic.com/unbound/flashbks/computer/bushf.htm, (accessed October 29, 2010).
21. CARNet, “CARNet novosti (CARNet News),” http://www.carnet.hr/novosti/novosti?news_id=411 (accessed December 11, 2010).
22. Central Intelligence Agency, “The world factbook,” https://www.cia.gov/library/publications/the-world-factbook/geos/hr.html, (accessed December 11, 2010).
23. Creative Commons, http://creativecommons.org, (accessed June 28, 2010).
24. Croatian Medical Journal, http://cmj.hr/?show=40588, (accessed July 12, 2010).
25. Croatian Scientific Portal, “Croatian scientific program: projects and initiatives,” 2009. http://www.znanstvenici.hr/index_en.php?p=o-nama_en (accessed December 11, 2010).
26. Croatica Chemica Acta, http://hrcak.srce.hr/cca, (accessed July 12, 2010).

27. Croatica Chemica Acta, http://www.vnovak.hr/ccacaa, (accessed July 12, 2010).
28. CROSBI: Croatian Scientific Bibliography, http://bib.irb.hr/index.html?lang=ENhttp://bib.irb.hr/index.html?lang=EN, (accessed July 12, 2010).
29. Directory of Open Access Journals, "DOAJ by country," http://www.doaj.org/doaj?func=byCountry, (accessed November 06, 2010).
30. Directory of Open Access Repositories, "Growth of the Open DOAR database: worldwide," http://www.opendoar.org/onechart.php?cID=&ctID=&rtID=&clID=&lID=&potID=&rSoftWareName=&search=&groupby=r.rDateAdded&orderby=&charttype=growth&width=600&height=350&caption=Growth%20of%20the%20OpenDOAR%20Database%20-%20Worldwide, (accessed November 06, 2010).
31. DOAJ: Directory of Open Access Journals, http://www.doaj.org/, (accessed November 17, 2010).
32. DOAR: Directory of Open Access Repositories, www.opendoar.org, (accessed July 12, 2010).
33. DRIVER: Networking European scientific repositories," http://www.driver-repository.eu/, (accessed November 06, 2010).
34. DRIVER II: Digital Repository Infrastructure Vision for European Research, http://www.driver-repository.eu/PublicDocs/FACT_SHEET_I3_driver_ii.pdf, (accessed November 06, 2010).
35. eIFL, "2009 annual report: knowledge without boundaries," http://www.eifl.net/cps/sections/about/annual-reports/annual-report-2009/downloadFile/attachedFile_f0/2009_Annual_Report_low-res.pdf?nocache=1276857054.79, (accessed December 11, 2010).
36. eIFL, http://www.eifl.net/cps/sections/about (accessed December 11, 2010).
37. Eisenberg, Daniel. "The electronic journal." *Journal of scholarly publishing* 20, no. 1 (1988): 49-58.
38. Electronic Publishing Trust, "OA workshop in Cuba," http://epublishingtrust.blogspot.com/2008/08/oa-workshop-in-cuba.html, (accessed December 11, 2010).
39. European Commission, "Study on the economic and technical evolution of the scientific publication markets in Europe: final report," http://ec.europa.eu/research/science-society/pdf/scientific-publication-study_en.pdf, (accessed December 11, 2010).

40. Eysenbach, Gunther. “Citation advantage of open access articles.” *PloS Biology*. 2006. http://biology.plosjournals.org/archive/1545-7885/4/5/pdf/10.1371_journal.pbio.0040157-S.pdf, (accessed November 17, 2010).
41. Ferris, Sharmila P. “Writing electronically: the effects of computers on traditional writing.” *Journal of electronic publishing* 8, no. 1 (2002), available at: http://quod.lib.umich.edu/cgi/t/text/text-idx?c=jep;view=text;rgn=main;idno=3336451.0008.104, (accessed October 29, 2010).
42. FOI dlib, http://dlib.foi.hr/handle/10439/1, (accessed July 12, 2010).
43. Gardner, William. “The electronic archive: scientific publishing for the 1990s.” *Psychological Science* 1, no. 6 (2006): 333–341.
44. Garfield, Eugene. “The languages of science revisited: English (only) spoken here?” *Current Contents* 31(1990): 3-18.
45. Geodetski list, http://hrcak.srce.hr/geodetski-list?lang=en, (accessed July 12, 2010).
46. Government of the Republic of Croatia, “Identity card,” http://www.vlada.hr/en/about_croatia/information/identity_card, (accessed December 11, 2010).
47. Harnad, Stevan et al. “Maximizing and measuring research impact through university and research-funder Open-Access self-archiving mandates,” 2010. http://eprints.ecs.soton.ac.uk/16616/, (accessed November 17, 2010).
48. Harnad, Stevan et al. “The access/impact problem and the green and gold roads to Open Access.” *Serials Review* 30, no. 4 (2004), available at: http://eprints.ecs.soton.ac.uk/10209/1/impact.html, (accessed November 06, 2010).
49. Harnad, Stevan. “Post-Gutenberg galaxy: the fourth revolution in the means of production of knowledge.” P*ublic-Access Computer Systems Review* 2, no. 1 (1991): 39-53, also available at: http://www.ecs.soton.ac.uk/~harnad/papers/harnad/harnad91.postgutenberg.html, (accessed October 28, 2010).
50. Harnad, Stevan. “Scholarly skywriting and the prepublication continuum of scientific inquiry,” http://www.ecs.soton.ac.uk/~harnad/Papers/Harnad/harnad90.skywriting.html, (accessed October 29, 2010).
51. Harnad, Stevan; Brody, Tim. “Comparing the impact of Open Access (OA) vs. non-OA articles in the same journals.” *D-lib Magazine* 10, 6 (2004), available at: http://www.dlib.org/dlib/june04/harnad/06harnad.html, (accessed November 17, 2010).

52. Harnad, Stevan; Hajjem, Chawki. “The Open Access citation advantage: quality advantage or quality bias?,” 2007. http://eprints.ecs.soton.ac.uk/13328/1/moed.html, (accessed November 17, 2010).
53. Harnad. Stevan. “What is Open Access,” http://www.eprints.org/openaccess, (accessed November 02, 2010).
54. Hebrang Grgić, Ivana; Barbarić, Ana. “The future of Open Access in Croatia: a survey of academic and research libraries.” *Library Review* 60, no. 2 (2011): 155-160.
55. Hebrang Grgić, Ivana. “17. stoljeće : prekretnica u razvoju modern znanosti (17th century: a turning point in the development of modern science).“ *Vjesnik bibliotekara Hrvatske* 50, no. 1/2 (2007): 89-95.
56. Hebrang Grgić, Ivana. “Kriza izdavastva znanstvenih casopisa (Serial crisis).” *Vjesnik bibliotekara Hrvatske* 47, no. 1/2 (2004): 87-94.
57. Hebrang Grgić, Ivana. “Open Access in Croatia: a study of authors' perceptions.” In *The future of information sciences: INFuture2009: Digital resources and knowledge sharing*. Zagreb: Department of Information Sciences, Faculty of Humanities and Social Sciences, University of Zagreb, 2009: 169-176.
58. Hebrang Grgić, Ivana. “Open Access to scientific information in Croatian scientific journals and digital repositories.” PhD thesis, Faculty of Humanities and Social Sciences, University of Zagreb, 2009.
59. HIFA2015: people are dying for lack of knowledge, http://www.hifa2015.org, (accessed December 11, 2010).
60. Holmes, Neville. “Free access is not Open Access,” http://www.binarylaw.co.uk/index.php/2007/10/11/free-access-is-not-open-access/, (accessed November 02, 2010).
61. Horvat, Aleksandra. *Knjižnični katalog i autorstvo* (*Library catalogue and authorship*). Rijeka: Naklada Benja, 1995.
62. Houghton, Bernard. *Scientific periodicals: their historical development, characteristics and control*. London: Clive Bingley, 1975, p. 47.
63. Hrčak: portal of the scientific journals of Croatia, http://hrcak.srce.hr/?lang=en, (accessed December 11, 2010).
64. Hrčak, “Etički kodeks urednika na portalu Hrčak (Code of ethics for editors on the Hrčak portal),” http://hrcak.srce.hr/admin/eticki_kodeks.pdf, (accessed December 11, 2010).
65. Hrvatsko informacijsko i dokumentacijsko društvo (Croatian Information and Documentation Society), “OPZI: otvoreni pristup znanstvenim informacijama (Open

Access to scientific information),” http://www.hidd.hr/projects/opzi/opzi.php, (accessed December 11, 2010).

66. ICML 9, “International Seminar: Open Access in developing countries,” http://www.icml9.org/meetings/openaccess/program.php?lang=en, (accessed December 11, 2010).
67. ICML 9, “Salvador declaration on Open Access: the developing world perspective,” http://www.icml9.org/meetings/openaccess/public/documents/declaration.htm, (accessed December 11, 2010).
68. International Monetary Fund, “Transition economies: an IMF perspective on progress and prospects,” http://www.imf.org/external/np/exr/ib/2000/110300.htm#I, (accessed November 17, 2010).
69. International Monetary Fund, “World economic outlook database,” http://www.imf.org/external/pubs/ft/weo/2010/02/weodata/index.aspx, (accessed December 11, 2010).
70. International Network for the Availability of Scientific Publications, “PERii: Program for the Enhancement of Research Information,” http://www.inasp.info/file/5f65fc9017860338882881402dc594e4/perii.html, (accessed December 11, 2010).
71. Internet world stats, “Internet usage statistics: the Internet big picture: world Internet users and population stats,” http://www.internetworldstats.com/stats.htm, (accessed October 29, 2010).
72. Iseli-Otto, Sabina. “Open Access and information for development: summary of online discussion messages,” 2006. http://coady.stfx.ca/work/openaccess/index. htm, (accessed December 11, 2010).
73. Joint Information Systems Committee, “The digital repositories infoKit,” 2009. http://www.jiscinfonet.ac.uk/infokits/repositories/index_html, (accessed November 02, 2010).
74. Journal Citation Report, http://thomsonreuters.com/products_services/science/science_products/a-z/journal_citation_reports, (accessed July 12, 2010).
75. Journal of Information and Organizational Sciences, http://www.jios.foi.hr/index.php/jios/about/edi torialPolicies#openAccessPolicy,(accessed July 12, 2010).
76. Kinesiology, http://hrcak.srce.hr/kineziologija?lang=en, (accessed July 12, 2010).

77. King, Donald W. “Should commercial publishers be included in the model for Open Access through author payment?” *D-Lib Magazine* 6, no. 10 (2004).
78. King, Tenopir. “Trends in scientific scholarly journal publishing in the United States.“ *Journal of Scholarly Publishing,* 28, no. 3 (1997): 135-170.
79. Kirsop, Barbara. “Open and shut?: creating a national Open Access policy for developing countries,” 2006. http://poynder.blogspot.com/2006/11/creating-national-open-access-policy.html, (accessed December 11, 2010).
80. Konjević, Sofija. “Hrvatski znanstveni časopisi na internetu (Croatian scientific journals on the Internet).” *Vjesnik bibliotekara Hrvatske* 46, no. 3/4 (2003): 111-118.
81. Krajna, Tamara; Markulin, Helena; Levanić, Andrija. “Repozitorij ustanove Fakulteta strojarstva i brodogradnje (Institutional repository of the Faculty of Mechanical Engineering and Naval Architecture). *Vjesnik bibliotekara Hrvatske* 51, 1/4 (2008): 36-46.
82. Kronick, David A. *A history of scientific & technical periodicals: the origins and development of the scientific and technical press 1665 – 1790*. Metuchen, N. J.: The Scarecrow Press, 1976.
83. Kuchma, Iryna. “How to start: setting up repositories.” In *Open Access to the achievements of Slovenian scientists: Proceedings of the 4th joint conference of the Special Libraries Section and the Academic Libraries Section of the Slovenian Library Association*. Ljubljana: Zveza bibliotekarskih društev Slovenije, 2010: 147-151.
84. Kurtz, Michael J. et al. “The effect of use and access on citations,” 2004, http://cfa-www.harvard.edu/~kurtz/kurtz-effect.pdf, (accessed November 17, 2010).
85. Lawrence, Steve. “Online or invisible?” *Nature* 411, no. 6837 (2001), p. 521, available at: http://citeseer.ist.psu.edu/online-nature01/, (accessed November 17, 2010).
86. Lycos retriever, “Galileo Galilei,” http://www.lycos.com/info/galileo-galilei--johannes-kepler.html, (accessed October 04, 2010).
87. Marušić, Ana; Marušić, Matko. “Small scientific journals from small countries: braking from a vicious circle of inadequacy.” *Croatian Medical journal* 40, no. 4 (1999): 508-514.
88. McCallum, David L. “Proposed principles for electronic scholarly publishing projects: (25/02/97),” http://www.schoolnet.ca/vp-pv/cesn/e/princips.htm, (accessed October 28, 2010).
89. Melinščak Zlodi, Iva. “Elektronički arhivi: revolucija u pristupu znanstvenim informacijama (Electronic archives: revolution in access to scientific information).” In

6. seminar Arhivi, knjiznice, muzeji: mogućnosti suradnje u okruzenju globalne informacijske infrastrukture: zbornik radova. Zagreb: Hrvatsko knjižničarsko društvo, 2003: 108-120.

90. Ministry of Science, Education and Sports, "Izvod iz Pravila o novčanom podupiranju znanstvene izdavačke djelatnosti: knjiga i časopisa (Extract from Scientific publishing funding policy: books and journals)," 2007. http://public.mzos.hr/fgs.axd?id=13402, (accessed December 11, 2010).
91. Ministry of Science, Education and Sports, "Upute za uređivanje i oblikovanje časopisa. (Guidelines for editing scientific journals)," http://public.mzos.hr/Default.aspx?art=5466 (accessed December 11, 2010).
92. Ministry of Science, Education and Sports, "Ustanove iz sustava znanosti (Scientific institutions)," http://pregledi.mzos.hr/Ustanove_Z.aspx, (accessed July 12, 2010).
93. Ministry of Science, Education and Sports, "Znanstvena i tehnologijska politika Republike Hrvatske (Science and technology policy of the Republic of Croatia)," public.mzos.hr/fgs.axd?id=, (accessed December 11, 2010)..
94. Moed, Henk F. "Statistical relationships between downloads and citations at the level of individual documents within a single journal." *Journal of the American Society for Information Science and Technology* 56, 10 (2005): 1088-1097.
95. Morrison, Heather. "Open Access for librarians in developing countries," http://eprints.rclis.org/6597/1/OADeveloping.pdf, (accessed November 02, 2010).
96. Nadasdy, Zoltan. "Truly all-electronic journal: let democracy replace peer review," http://www.press.umich.edu/jep/03-01/EJCBS.html, (accessed October 29, 2010).
97. Nafta, http://hrcak.srce.hr/nafta?lang=en, (accessed July 12, 2010).
98. OARE, "Online Access to Research in the Environment," http://www.oaresciences.org/en (accessed December 11, 2010).
99. *Open Access in Southern European countries*, editors: Lluís Anglada, Ernest Abadal. Madrid: FECYT, 2010, available at: http://www.accesoabierto.net/sites/accesoabierto.net/files/OASouthEurope.pdf, (accessed November 17, 2010).
100. Open Archives Initiative, "Open Archive Initiative Protocol for Metadata Harvesting," http://www.openarchives.org/pmh/, (accessed November 02, 2010).
101. Open Citation Project, "The effect of Open Access and downloads ('hits') on citation impact: a bibliography of studies," http://opcit.eprints.org/oacitation-biblio.html, (accessed November 17, 2010).

102. Open Society Foundations, “Open Society Institute: a guide to institutional repository software,” http://www.soros.org/openaccess/software/OSI_Guide_to_Institutional_Repository_Software_v3.htm, (accessed November 02, 2010).
103. Oppenheim, Charles. “Progress in documentation: developments in digital journals.“ *Journal of Documentation* 57, no. 2 (2001): 260-283.
104. Oxford University Press, “Oxford Open,” http://www.oxfordjournals.org/oxfordopen/, (accessed November 06, 2010).
105. Pappalardo, Kyleie; Fitzgerald, Anne and Fitzgerald, Brian. “A guide to developing Open Access through your digital repository,” 2007. http://eprints.qut.edu.au/archive/00009671/01/9671.pdf, (accessed November 02, 2010).
106. Pappin Ranchman, Jennifer I.; Dawe, Richard, A. “Open Access publishing: a developing country view.” *First Monday* 11, no. 6 (2006), available at: http://outreach.lib.uic.edu/www/issues/issue11_6/papin/index.html, (accessed November 17, 2010).
107. Periodicum Biologorum, http://hrcak.srce.hr/pb, (accessed July 12, 2010).
108. Polemos, http://hrcak.srce.hr/polemos?lang=en, (accessed July 12, 2010).
109. ROAR: Registry of Open Access Repositories, 2010. http://roar.eprints.org, (accessed November 06, 2010).
110. ROARMAP, http://www.eprints.org/openaccess/policysignup/, (accessed November 06, 2010).
111. *Scholarly journals at the crossroads: a subversive proposal for electronic publishing,* edited by Ann Shumelda Okerson and James J. O'Donnell, 1995, www.arl.org/scomm/subversive/toc.html, (accessed November 02, 2010).
112. Schwartz, Greg J.; Kennicutt, Robert C. “Demographic and citation trends in Astrophysical Journal papers and preprints,” 2004, http://www.publingresearch.net/Citations-SummaryPaper3_000.pdf, (accessed November 17, 2010).
113. SciELO, http://www.scielo.org/php/index.php, (accessed December 11, 2010).
114. Securing a Hybrid Environment for Research Preservation and Access, “Publisher copyright policies and self-archiving,” 2009. http://www.sherpa.ac.uk/romeo/, (accessed November 02, 2010).
115. Šercar, Tvrtko. *Komunikacijska filozofija znanstvenih časopisa (Communication philosophy of scientific journals)*. Zagreb: Globus, 1988, p. 48.

116. Shin, Eun-Ja. “Do impact factors change with a change of medium: a comparison of impact factors when publication is by paper and through parallel publishing.” *Journal of information science* 6, no. 29 (2003): 527-533.
117. Silobrčić, Vlatko. “Slobodan pristup ocijenjenim znanstvenim informacijama: moguća budućnost informiranja znanstvenika (Open Access to peer reviewed scientific information: future of scientific communication).” *Vjesnik bibliotekara Hrvatske* 50, no. 1/2 (2007): 51-61.
118. Sociology and Space, http://hrcak.srce.hr/sociologija-i-prostor?lang=en, (accessed July 12, 2010).
119. Solomon, David J. “Developing OA journals: a practical guide,” http://www.developing-oa-journals.org/Guide_to_developing_oa_journals.pdf, (accessed November 17, 2010).
120. Springer, “Springer Open Choice,” http://www.springer.com/open+choice?SGWID=0-40359-0-0-0, (accessed November 06, 2010).
121. Springer, “The Springer open choice flow diagram,” http://www.springer.com/cda/content/document/cda_downloaddocument/Springer+Open+Choice+flow+diagram.pdf?SGWID=0-0-45-164919-0, (accessed November 06, 2010).
122. Stellenbosch University, “University of Pretoria digital institutional research repository business plan example only,” http://ir.sun.ac.za/wiki/files/business_plan.doc, (accessed October 29 2010).
123. Stojanovski, Jadranka; Petrak, Jelka; Macan, Bojan. “The Croatian national Open Access journal platform.” *Learned Publishing* 22, no. 4 (2009): 263-273.
124. Suber, Peter. “Lists related to the Open Access movement,” http://www.earlham.edu/~peters/fos/lists.htm, (accessed November 02, 2010).
125. Suber, Peter; Arunachalam, Subbiah,“ Open Access to science in the developing world,“ http://www.earlham.edu/~peters/writing/wsis2.htm, (accessed December 11, 2010).
126. Super, Peter. “Open Access overview,” http://www.earlham.edu/~peters/fos/overview.htm, (accessed November 02, 2010).
127. SZI, http://www.szi.hr/seminar.htm, (accessed December 11, 2010).
128. The New School, “Journal Donation Project,” http://www.newschool.edu/centers/jdp/contacts.aspx?s=8, (accessed December 11, 2010).

129. The World Bank, “Croatia,” http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/ECAEXT/CROATIAEXTN/0,,menuPK:301250~pagePK:141159~piPK:141110~theSitePK:301245,00.html, (accessed December 11, 2010).
130. Till, Jim. “The "Guild publishing" model,” http://www.ecs.soton.ac.uk/~harnad/Hypermail/Amsci/1889.html, (accessed October 28, 2010).
131. Toth. Tibor. “Centralni portal znanstvenih časopisa Hrvatske: Hrčak (Central portal of Croatian scientific journals: Hrčak).” *Kemija u industriji* 55, no. 3 (2006): 143-145.
132. Treloar, Andrew. “Electronic scholarly publishing and the world wide web.” *Journal of scholarly publication* 27, no. 3 (1996): 135-150.
133. Turk, Nana. “Citation impact of Open Access journals.” *New Library World* 109, no. 1/2 (2008): 65-74.
134. UNESCO, “Improving access to scientific information for developing countries: UK learned societies and journal access programmes,” http://www.unesco.org.uk/UserFiles/File/SCI%20WG5/Final%20report%20May%202008(1).pdf, (accessed December 11, 2010).
135. University of Zagreb Medical School, “Repozitorij Medicinskog fakulteta, (Medical School Reposirory),” http://medlib.mef.hr, (accessed July 12, 2010).
136. Vjesnik bibliotekara Hrvatske, http://hrcak.srce.hr/vbh?lang=en, (accessed July 12, 2010).
137. Vjesnik bibliotekara Hrvatske, http://www.hkdrustvo.hr/vbh, (accessed July 12, 2010).
138. Vrana, Radovan. “Influence of networked information resources on development of scientific communication in the field of social sciences in Croatia.” PhD thesis, Faculty of Humanities and Social Sciences, University of Zagreb, 2003.
139. Williams, Henry Smith. *The story of modern science.* New York; London: Funk and Wagnalls Co., 1923.
140. World Health Organization, “HINARI: Research in health,” http://www.who.int/hinari/about/en/, (accessed December 11, 2010).
141. World Health Organization, HINARI: eligibility,” http://www.who.int/hinari/eligibility/en/, (accessed December 11, 2010).

Apendix 1 - Figures

Apendix 2 – Tables

Apendix 3 – list of journals

1. ACS Agriculturae Conspectus Scientificus
2. Acta Adriatica
3. Acta Botanica Croatica
4. Acta Clinica Croatica
5. Acta dermatovenerologica Croatica
6. Acta medico-historica Adriatica
7. Acta pharmaceutica
8. Acta Stomatologica Croatica
9. Adrias
10. Agronomski glasnik
11. Anali Zavoda za povijesne znanosti, HAZU Dubrovnik
12. Anali Zavoda za znanstveni i umjetnički rad HAZU Osijek
13. Archaeologica Adriatica
14. Arhiv za higijenu rada i toksikologiju
15. Arhivski vjesnik
16. Arti musices
17. Automatika
18. Biochemia Medica
19. Bogoslovska smotra
20. Brodogradnja
21. Chemical and Biochemical Engineering Quarterly
22. CIT - Journal of Computing and Informatology Tehnology
23. Collegium Antropologicum
24. Croatian Journal of Forest Engineering
25. Croatian Medical Journal
26. Croatica Chemica Acta
27. Croatica Christiana Periodica

28. Croatica et Slavica Iadertina
29. Časopis za suvremenu povijest
30. Društvena istraživanja
31. Drvna industrija
32. Ekonomska i ekohistorija
33. Ekonomska istraživanja
34. Ekonomska misao i praksa
35. Ekonomski pregled
36. Ekscentar
37. Energija
38. Engineering Review
39. Entomologia Croatica
40. Etnološka tribina
41. Filologija
42. Filozofska istraživanja
43. Financijska teorija i praksa
44. Fizika A
45. Fizika B
46. Fluminiensia
47. Food Technology and Biotechnology
48. Geoadria
49. Geodetski list
50. Geofizika
51. Geologia Croatica
52. Glasnik matematički
53. Goriva i maziva
54. Građevinar
55. Hrvatska revija za rehabilitacijska istraživanja
56. Hrvatski geografski glasnik
57. Hrvatski ljetopis za kazneno pravo i praksu
58. Infektološki glasnik
59. Informatologia
60. Interdisciplinary Description of Complex Systems
61. Jezikoslovlje
62. Journal of central European Agriculture

63. Journal of Information and Organizational Sciences
64. Kartografija i geoinformacije
65. Kemija u industriji
66. Kinesiology
67. KOG
68. Kriminologija i socijalna integracija
69. Krmiva
70. LAHOR: Časopis za hrvatski kao materinski, drugi i strani jezik
71. Ljetopis socijalnog rada
72. Magistra Jadertina
73. Management: Journal of Contemporary Management Issues
74. Mathematical Communications
75. Medica Jadertina
76. Medicina
77. Medijska istraživanja
78. Metalurgija
79. Metodički ogledi
80. Metodika
81. Migracijske i etničke teme
82. Mljekarstvo
83. Nafta
84. Narodna umjetnost
85. Naše more
86. Natura Croatica
87. Nova prisutnost
88. Obnovljeni život
89. Odgojne znanosti
90. Paediatria Croatica
91. Periodicum Biologorum
92. Polemos
93. Polimeri
94. Politička misao
95. Poljoprivreda
96. Pomologia Croatica

97. Pomorstvo (Journal of Maritime Studies)
98. Poredbeno pomorsko pravo
99. Povijesni prilozi
100. Prilozi Instituta za arheologiju
101. Prilozi za istraživanje hrvatske filozofske baštine
102. Prolegomena
103. Prostor
104. Psihologijske teme
105. Psychiatria Danubina
106. Radovi Zavoda za povijesne znanosti HAZU Zadar
107. Radovi zavoda za znanstveni rad u Varaždinu
108. Rasprave Instituta za hrvatski jezik i jezikoslovlje
109. Review of Croatian History
110. Revija za socijalnu politiku
111. Revija za sociologiju
112. Ribarstvo
113. Rudarsko-geološko-naftni zbornik
114. Sigurnost
115. Sjemenarstvo
116. Slovo
117. Socijalna ekologija
118. Sociologija i prostor
119. Stočarstvo
120. Strojarstvo
121. Studia etnologica croatica
122. Suvremena lingvistika
123. Synthesis Philosophica
124. Šumarski list
125. Tehnički vjesnik
126. Veterinarski arhiv
127. Vjesnik bibliotekara Hrvatske
128. Vjesnik za arheologiju i historiju dalmatinsku
129. Zbornik Odsjeka za povijesne znanosti - Zavoda za povijesne i društvene znanosti HAZU

130. Zbornik Pravnog fakulteta u Zagrebu
131. Zbornik radova Ekonomskog fakulteta u Rijeci
132. Zbornik radova Pravnog fakulteta Split
133. Život i škola