

In search of new models of scientific communication in electronic environment: case of scientists in the field of social sciences in Croatia

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Abstract

Science is a basic social activity that helps the development of society. It is also a dynamical system, which components are in constant interaction enabling transfer of scientific information to all of the system's components and to the outside world. For that reason scientists need adaptable and flexible tools which will enable dissemination of quality scientific material to them, their colleagues and to general public. Scientific community in Croatia has accepted information technology as a key tool for the dissemination of information emerging from scientific activities of the Croatian scientists.

There are many open questions regarding behavior and activities of the Croatian scientists now working in an environment strongly influenced by ever growing number of printed and electronic information resources used for teaching at universities and scientific research. To discover the status of current developments in area of scientific communication in Croatia (in the field of social sciences), a research study was considered necessary having in mind issues such as availability of information supporting the advancement of scientific communication, changing attitudes of the Croatian scientists in the field of social sciences using networked information resources and, finally, change of context in scientists' working environment which is influencing their decision to publish in electronic publications.

To understand the current state of the development of scientific communication among the scientists in the field of social sciences in Croatia, a nationwide research was initiated. The research was carried out in early 2003 in form of a survey at 5 Croatian universities (in Zagreb, Rijeka, Split, Zadar and Osijek). It included research and teaching staff at 16 faculties in the field of social sciences.

The results of the research showed frequent and direct communication between scientists exchanging ideas, research data, opinions, draft papers etc. At the same time, the results demonstrate that the structure of the still active paradigm of scientific communication in the field of social sciences based on printed information resources (and electronic aids for information retrieval for various types of databases) does not differ significantly from the communication paradigm other scientists from the same field of science use in the rest of the world. It is also very significant that the results confirmed the interest of the Croatian scientists for the use of electronic information resources which are available to them and which have become integral part of their daily working routine.

As a conclusion, we can say that the results of the survey describe the current state of the development of scientific communication as being in position of creating pre-conditions for larger dissemination of electronically created information which will eventually take shape of increased quantity of scientific papers published electronically, which will be available on the Internet and in future the Croatian digital libraries and which will eventually lead to a scientific communication paradigm shift..

Introduction

Science is a basic social activity and also a dynamical system, which components are in constant interaction enabling transfer of scientific information to all of its components and outside world and thus enabling development of society. To achieve this goal, science needs quality and flexible tools which will facilitate scientific communication in an environment that is constantly changing under the influence of information and communication technology. To develop such tools, information science scientists and IT and professionals should study user behavior in electronic working environment, as well as user needs and preferences for quality information resources (printed and electronic books, journals, proceedings, research data etc.).

Literature about scientific communication and changes introduced by information and communication technology is numerous and rich. To illustrate the context and some of the general problems which global system of scientific communication is going through, a few thoughts of several scientists who wrote on this topic will be presented. In his article on scientific communication in the last century, Vickery pointed out that new media are constantly appearing, and this is especially true for electronic media, and their appearance may have important and long-term influence for scientific communication because each new medium changes volume and speed of communication.¹ Another author, Bernal, gave more accurate picture of the system of scientific communication based of printed sources of information, which he considered to be ineffective and that the work of scientists often went to waste, also pointing out that only fragments of information that are result of scientists' work are ever actualized and/or actually applied and published because of the lack of coordination among scientists themselves and because of the actual possibility of loss of information in a muddle of illegible scientific literature.² To improve scientific communication in general, we need solutions to current problems of inefficacy in dissemination of scientific information.

Moreover, some fields of science such as social sciences are considered to have different means of cooperation between scientists. For instance, it is considered that scientific work in social sciences and humanities is slower than in natural sciences, and that scientists are working and communicating more dispersedly while scientists in technical and natural sciences work more often in groups and communicate more quickly. Since there are very few research studies which would cast some light on current state of communication in social sciences in Croatia, it seems crucial to explore modes of communication among the scientists in Croatia in details and see whether they need improvements and if improvements are needed, in what segment of scientist's work they should be made.

Improvements can be made in many segments of communication. As far as the information and communication infrastructure is involved, we can say that the existing information infrastructure in the Croatian academic community makes possible for the Croatian universities to be connected to the Internet. In addition to the information and communication infrastructure, we can speak about services which enable scientists to interact with and use various types of information resources for research and teaching at the Croatian universities. This part is less investigated, particularly in the field of social sciences and this was one of the main incentives for the launch of the research which is the main topic of this paper.

Generally speaking, there are many areas which can be chosen for detailed investigation. Some authors dedicated their articles to comment or single out such areas, which are also very valuable when considering new research studies in Croatia.

¹ Vickery, B. (1999) "A century of scientific and technical information", *Journal of documentation*, Vol. 55 No. 5, p. 517.

² Bernal, J.D. (1944) "The social function of science" London : George Routledge and sons. p. 99

In his article on scholarly use of Internet-based electronic resources, Zhang indicated several areas of scientific communication that still need further research. He put more stress on the following areas:³

- Research using the citation analysis approach to examine the impact of Internet-based electronic resources,
- Research to explore details of scholars' use of Internet-related resources and factors affecting their use,
- Citation behavior regarding e-sources,
- Scholars' evaluation of e-sources,
- Scholars' perspectives on using e-sources.

While Zhang is describing well known areas among which citation analysis is one of the most famous methods of measurement of scientific productivity and relations among scientists when recognizing the results of peer efforts, some of enumerated areas are extremely important for understanding of development of a new paradigm of scientific communication based on electronic publications and electronic communication worldwide and in Croatia. Areas that were of interest to research in Croatia and to this paper are:

- Details of scholar's use of Internet-related resources and factors affecting their use,
- Scholars' evaluation of electronic resources and
- Scholars' evaluation on using electronic resources.

These and other data about the current state of use of IT supported electronic information resources are needed for the development of new forms of information resources intended for scholarly use. As the number of electronic information resources is growing, the need for their better organization is constantly growing as well, thus suggesting more rapid development of digital libraries in Croatia which will facilitate use of scientific electronic resources. To develop digital libraries effectively we should understand how users seek and employ digital materials (insight into user behavior, capabilities and preferences).⁴

In Croatia, little is known about information needs, habits and preferences of scientists in social sciences (and humanities as well) which are often neglected in this type of research. To avoid presumptions and unverified hypotheses about ways scientists interact and communicate this research was initiated.

Research among scientists in the field of social sciences in Croatia

The research was carried out at the beginning of 2003 at 5 Croatian universities (in Zagreb, Rijeka, Split, Zadar and Osijek) and 16 faculties only in the field of social sciences in Croatia and it included research and teaching staff. The sample for the research was drawn from the Statistical Yearbook for the year 2002 of the Republic of Croatia published by the Central Bureau of Statistics and from the data about the number of research and teaching staff available at the particular university.

The research was carried out in a form of a survey. The aim of the survey was to collect data about the state of use of information technology for the purpose of scientific communication among scientists in the field of social sciences. More specifically, the survey contained 35 questions, divided into three parts:

1. Scientific communication and new technologies,
2. Information resources for research and teaching and

³ Zhang, Y. (2001), "Scholarly use of Internet-based electronic resources", Journal of the American society for information science and technology, Vol. 52 No. 8, p. 628.

⁴ Marcum, D. (2003) "Requirements for the future digital library", The journal of academic librarianship, Vol. 29 No. 5, pp. 276-279.

3. Publishing of scientists' papers.

The total of 666 surveys were distributed, and 236 out of the total of 245 returned survey were valid (35,43%). The result is considered good when we take into account geographically scattered sample, different availability of information resources to scientists, different use rate of IT, different information needs and habits, possibility to reach possible respondents etc.

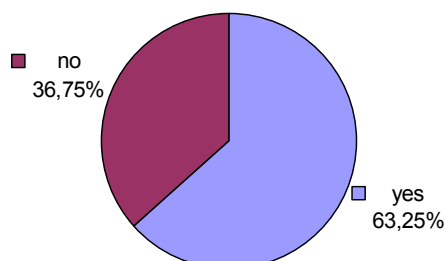
The results

This conference paper will present only a part of the results which are considered most interesting in relation to the topic.

The first part of the survey was dedicated to scientific communication in general and use of new technologies (more specifically), and it sought answers to question about the scientists' use of information and communication technology. The focus of this part of the survey was on actual use of the Internet. As expected, 97,42% of the respondents use the Internet for communication with other colleagues, and 93,62% of all the respondents have e-mail address at their working place, which is an important precondition for actual communication.

In the next step, it was essential to find out whether the scientists use e-mail for direct exchange of their already published papers with other colleagues.

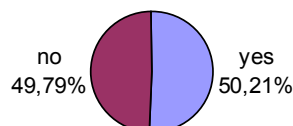
Sending already published papers to colleagues in Croatia and abroad by e-mail



63,25% of the respondents indicated in their answers that they use e-mail for the exchange of already published papers with their colleagues. The answers to this question are important because they indicate the existence of direct communication between scientists for the purpose of distribution of results of previously conducted research. This form of communication represents an alternative channel for distribution of scientific papers in addition to all other existing distribution channels such as printed journals, books, conference proceedings etc. available in libraries, online electronic databases and elsewhere.

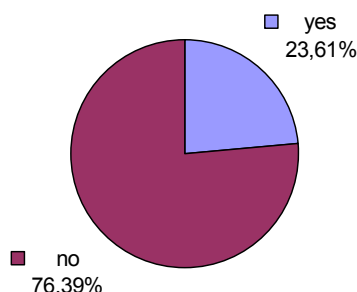
Another interesting question to the Croatian scientists was sending of draft papers (in pre-publication period) to their colleagues by e-mail.

Sending draft papers to colleagues in Croatia and abroad by e-mail



Over half of the respondents (50,21%) send their draft papers to their colleagues in Croatia and abroad by e-mail. These results are very encouraging, because they indicate active communication between scientists and exchange of research data, early research results opinions and ideas before papers are published. This aspect of scientific communication is almost the hardest to investigate since there are no exact and reliable data about this type of communication. In addition, these results indicate need for the creation of a pre-print server for social sciences at which scientists would be able to display their draft papers and get comments from the colleagues.

Did electronic communication with your colleagues took you extra time?



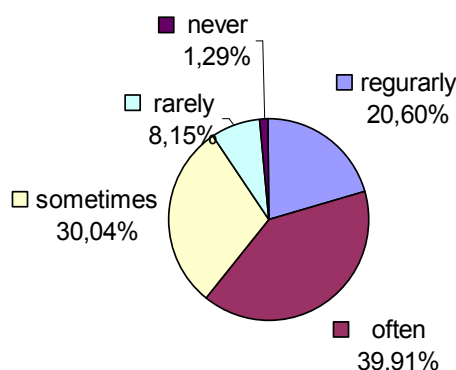
Communication in electronic environment can be time consuming. Today, e-mail is considered a basic service on the Internet and a lot of communication is going through that communication channel. As volume of e-mail correspondence is increasing, communicating in this way can become very time consuming for the researchers. Luckily, 76,39% of the respondents don't feel that communication by e-mail is taking them extra time.

Furthermore, the scientists were asked if information and communication technology has improved communication with colleagues. The respondents gave the following answers:

Yes	92,80%
No	2,12%
Can't estimate	5,08%

We can conclude that the great majority of the respondents felt improvement in communication with their fellow scientists when using information and communication technology. This important finding can lead us to further investigation of the details which led scientists to express the feeling of improvement while communicating with other scientists and can make other new forms of communication that will emerge in near future more easily accepted once we know that use of information and communication technology for communication purpose has become an everyday routine among the Croatian scientists.

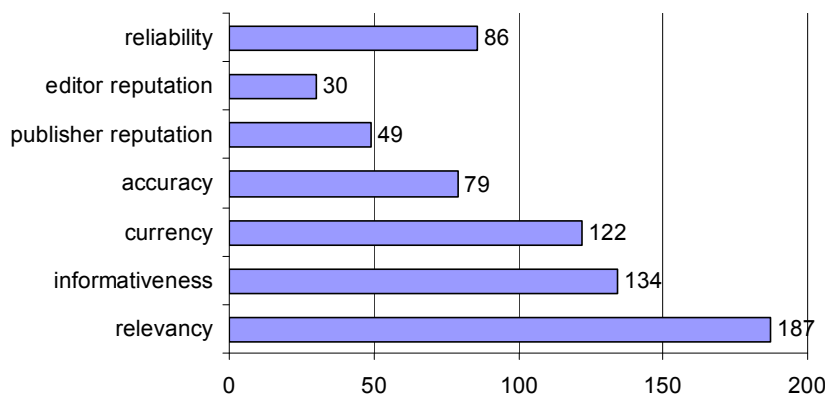
Reading electronic professional and scientific journals from your own field of science



The second part of the survey was dedicated to the investigation of use of information resources for research and teaching and it covered both printed and electronic information resources. For this paper, we will select only those results which are oriented towards the use of electronic resources. The findings indicate that the respondents recognize electronic information resources as very important for research and teaching. 20,60% of the respondents read electronic journals regularly, 39,91% do it often and 30,04% sometimes.

Another question related to the reading of electronic journals is criteria for their selection of electronic journals for reading. Generally speaking, number of electronic journals is constantly increasing, yet little is known about criteria which help scientists in deciding which electronic journal to select for reading. In this question scientists were offered seven choices compiled from different sources in the phase of literature review which preceded the actual research.

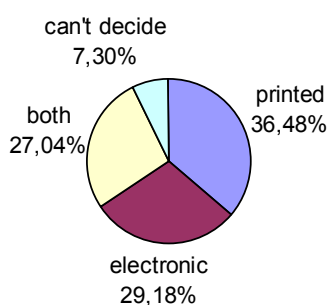
Selection criteria for electronic journals for reading



The findings indicate relevancy to be the most important criterion for 187 respondents, followed by informativeness, currency of information, reliability of the information that can be found in electronic journals and accuracy of information (this criterion is in the fifth position, which is rather curious). Publisher's reputation and editor's reputation were least important to the respondents. It is quite interesting to see such prevalence of relevancy over reliability and accuracy, since the available literature suggests that reliability (and permanence) of electronically published information are the most problematic issues when discussing the future of electronic publications and their acceptability for the advancement in scientific community. This issue of criteria for the selection of electronic journals for reading should be further investigated.

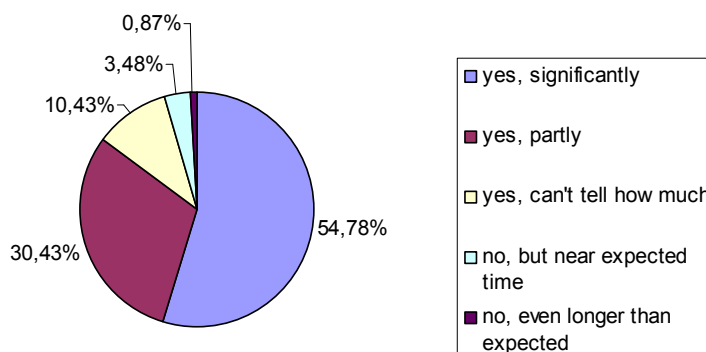
Despite increased popularity of electronic journals, printed journals remain the most popular source of information. Scientists were asked about the preferred type of journal for reading, if both types were available to them.

What type of journals would you prefer (if both available)?



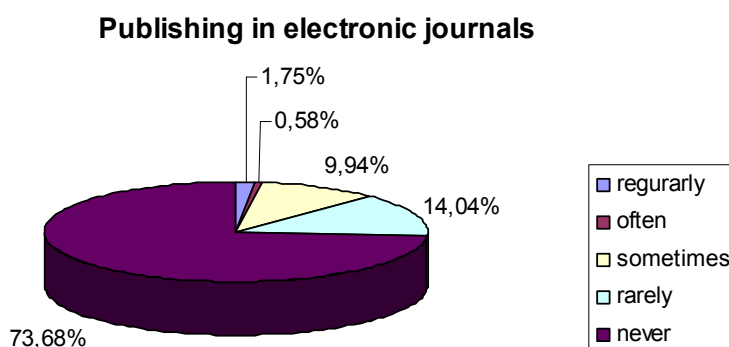
The chart shows clearly that printed journals are still preferred more than electronic journals, while 27,04% of the respondents prefer use of both types of journals. The respondents could write down reasons for choosing either type of journals. Reasons for choosing printed journals are following: reading habit, reading on any location, reliability (unchangeable), ability to underline, cheaper, appropriate for citing, computer unrelated. Reasons for choosing electronic journals are following: practical use, larger quantity of quality journals, ability to search, availability, cheaper than printed journals, easy storage (in computer), less storage space.

Use of electronic resources / time saving



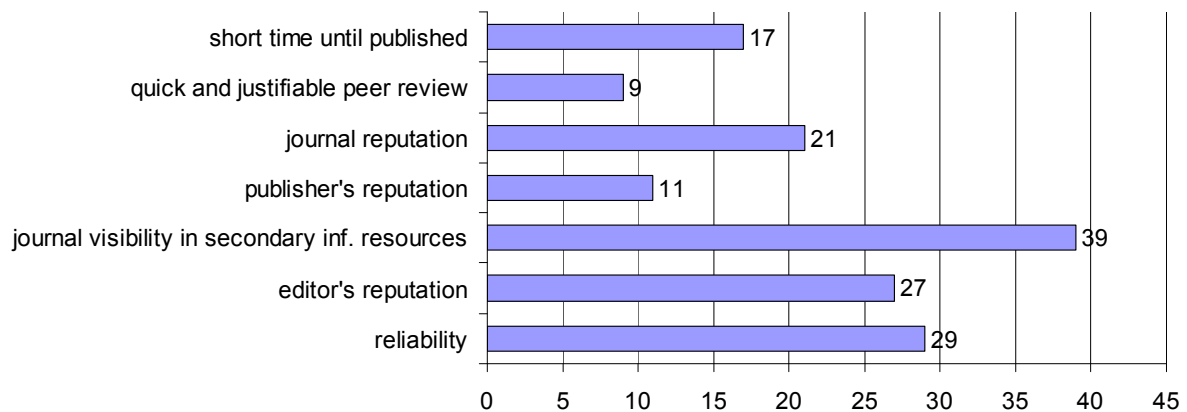
Next question was directed towards collecting of data about possibility of time saving by using electronic information resources for preparation of scientific paper or research. Over half of the respondents (54,78%) answered that they saved time significantly using electronic information resources, while another 30,43% saved time partly, and 10,43% saved time but couldn't estimate how much. Only 3,48% of the respondents didn't save time, but were near expected time, and 0,87% needed some extra time. The overall results are positive, indicating that the respondents were successful in use of electronic information resources and that their success contributed to achieving shorter time in the process of preparation of scientific papers and research.

The third part of the survey was dedicated to the publishing of scientific works. Among other issues, the scientists were asked whether they publish their papers in electronic journals. Although electronic information resources in general are used more and more frequently among the scientists in the field of social sciences in Croatia, few respondents answered that they publish in electronic journals at all. The respondents were offered to choose how frequently they publish their papers in electronic journals. The best positive results were achieved in category "rarely", where 14,04% of the respondents indicated they publish their papers in electronic journals "rarely", 9,94% do it "sometimes", 0,58% "often" and 1,75% of the respondents do it "regularly". It is expected that more scientists will publish their papers in electronic journals in the near future as they will be accepted more readily in the process of scientists' advancement.



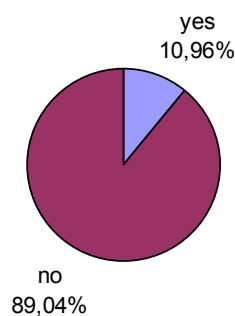
Until then, it is quite interesting to learn more about the criteria which help scientists to decide to which electronic journal they will send their draft papers. The findings below show that the most important criterion for scientists to send their draft papers to electronic journal is actual journal visibility in secondary information resources. Other important criteria are: reliability of electronic journal, editor's reputation, and journal reputation, short time of publication, publisher's reputation and quick and justifiable peer review.

Criteria for sending draft papers to electronic journals



Based on the positive attitudes of the scientists towards use of electronic information resources for research and teaching, one would expect that they will use the World Wide Web as an opportunity to make their work more publicly available. Unfortunately, only 10,69% of the respondents publish their work on their personal Web pages. There can be a number of reasons why scientists don't publish their work more on their personal pages, but, these reasons are still in the domain of speculations until investigated more thoroughly. Judging from the literature review made for this research, we can only guess why the scientists are still reluctant to choose this medium for the publication of their papers. One possibility is that this type of publications is still not properly validated for the advancement of scientists worldwide when compared to papers published in printed journals and books. This conclusion can be partly confirmed by the results of another question whether electronic information resources can replace printed resources in next 5 years. 61,30% of the respondents answered negatively, 19,13% positively and 19,57% of the respondents couldn't estimate if it will happen.

Publishing papers on personal Web site?



It is also expected that this ratio will change as scientists will be offered mechanisms which will guarantee them that their journal articles, book chapters etc. will be equally accepted as if they were published in printed publication. Until then, we can expect that scientists who already developed their career will have personal Web pages containing journals articles, book chapters, or even complete books in electronic forms, research data and reports in electronic form.

Conclusion

The excerpts presented in this paper illustrate only a part of the complete picture about the state of use of information technology for the purpose of scientific communication among scientists in the field of social sciences in Croatia. The results of the survey divided in three parts showed rich activity in each of the investigated segments. They showed frequent and direct communication among the respondents suitable for the exchange of ideas, research data, opinions draft and published papers etc. The large number of scientists uses information and communication technology for communication with their colleagues which will make future Internet based services possible. For this research, it was necessary to find out whether or not the surveyed scientists are part of the global scientific community in the sense that they communicate with other scientists in similar way as other scientists for this and other fields of science in the world. The second part of the survey showed that the respondents are using both printed and electronic information resources for research and teaching. Very little is known about the use of electronic information resources, so, this research will certainly help to cast some light on details of this activity, and to explain how scientists from this field of science interact in electronic environment. At the present moment, the respondents are using printed and electronic information resources (journal articles and books) of recent date, but they also use older publications, which probably represent fundamental works in this field of science. This fact is also worth mentioning, because scientists in the field of social sciences are often considered reluctant to use newer publications. The third part of the survey showed that the respondents are still oriented towards the printed sources of information when deciding where to publish results of their research. They prefer printed journals and proceedings, and less book chapters or even books, while many of them hardly publish in electronic journals. While this may seem as an expression of a negative attitude towards the electronic publications, the truth is that such papers are still not taken into account for the advancement of scientists at universities. This makes scientists uncomfortable when deciding about sending draft papers to electronic journals and more massive publications of scientific and professional papers is needed for wider acceptance of electronic publications. Unfortunately, most of the respondents don't publish their papers on personal Web sites, which is not totally uncommon, but it just tells us that personal Web pages are still not perceived as important for publishing as "classic" journals and books.

Despite the fact that the global information infrastructure is widely available in academic community in many countries around the world, scientists in general as well as their colleagues in Croatia have enormous responsibility of carrying the burden of the development of society on their shoulders by doing research and also by making the results of those research widely available by use of information and communication technology in their countries. While this may sound as a well known phrase, world of scientific communication is rapidly changing its mode of operation relying more heavily on self produced electronic publications and newly developed tools which will help other scientists and people outside the realm of science to benefit from the results of scientific endeavor. The concrete results can be seen in increased number of scientific publications circulating on the Internet freely and openly while retaining the same level of quality as when published in well known journals from different scientific fields.

The increased number of published scientific papers is a prerequisite for true paradigm shift, when scientific electronic publications will become the main form of publishing of scientific papers which will be equally accepted as quality information resources as printed publications are accepted today. The results from this research show that scientists in the field of social sciences in Croatia are still reluctant to publish their scientific works in electronic journals. We can only guess about the reasons for such trend, however, it is clear that electronic journals and books have to prove themselves as stable, accessible to potential authors, of high quality, and accessible to potential users for reading without little or no restrictions at all. There are several ways to achieve this goal. One is certainly publishing papers on personal Web pages or Web pages of an academic institution, while other is joining initiatives such as Open Archive Initiative.

In Croatia, today we have almost all the necessary preconditions for massive scientific publishing in electronic form (high speed local networks in academic institutions, all academic institutions in Croatia are connected to the Internet, PCs at scientist's desks, ability to use information technology

and to communicate directly with other scientists, servers that can hold electronic scientific publications etc.). It has become important for scientists to decide to publish at least part of their works on the Internet to give incentives to other colleagues to do the same.

This research is planned to be one in series of researches dedicated to explorations into habits and preferences of the Croatian scientists. More research should be initiated to explore details of interaction of scientists in electronic working environment, and to help them to use information and communication technology more intensely.

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