Digital libraries: a catalyst to the changing process of accessing and use of information in academic community

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Abstract:

The aim of this paper is to introduce digital libraries as a new form of information resource supporting faster creation, collection, processing, organization and use of high quality information and knowledge and serving as a means of communication in the academic community. The foundation of this type of communication is information technology which helped the advancement in development of libraries presenting us a new category of libraries: digital libraries. During the last decade most of the existing digital libraries have been developed as a part of different scientific projects having significant impact on scientific communication while changing its paradigms at the same time. Having strong foundations in IT, digital libraries can further advance communication within the system of higher education making it more competitive and thus resulting in further advancement in the development of the basic information infrastructure and content creation. Digital libraries already have great impact in making electronic information more available to the academic staff and students by letting them being involved in various ongoing international and interdisciplinary projects. As an outcome, digital libraries are becoming technical and organizational centers for interinstitutional cooperation in projects thus engaging technology, financial means, human resources in formation of new communication paradigms and creation of national strategies of development of new information resources.

Introduction

If we try to think for a moment about phenomena which marked the last decade of this century, we can certainly think of the Internet, popularization and widespread use of the telecommunications equipment, and creation of many new information sources and services related to some of the key institutions of our society.

One such institution is library. Libraries are well known as centers of knowledge and providers of information services for the community in which they exist. In one form or another, they have survived many centuries changing their shapes (but retaining their essential functions and values) from being private collections of rulers to becoming public institutions serving wider community by offering their services to their users locally or nowadays on the Internet.

As we are approaching and are actually entering the information society, we are facing number of rather difficult choices. In its essence each choice represents a new challenge which brings change to our professional and personal lives. Putting our focus more on the professional life, each challenge we take represents a new form of evaluation of our existing knowledge and skills, our ability to adapt to changes in general, and our readiness to advance

our professional competencies. To achieve these goals, we need new means, which will help us to use our current professional potentials and to increase them in order to make our knowledge competencies and information services better and to help our users to find their way to relevant information.

What is our starting point? Existing modern libraries and their current phase of development going towards the organization and use of electronic information sources.

What are the means necessary for the advancement of professional competencies of an individual (information professional) and library services in general as well to develop new ones? Information technology.

What is the name of the institution which already shows a great potential of being a center of technical and knowledge excellence? Digital library.

For whom are we doing all this? For users.

Role of computer technology in the development of libraries and scholarly information systems

Libraries are for users. This famous librarian's sentence[1] reveals no new truth and seems to be very obvious. Yet, as we will see, many things has changed since the printing of this sentence, for instance the very notion of a category of a library user which has been modified over the time as information technology and knowledge industry have penetrated schools, universities, industry and our homes. The truth is, some things have remained the same, we still have libraries, libraries indeed have their users, and users are getting information relevant to their needs. However, libraries and their users are not isolated and they are strongly affected by the current changes initiated by IT.

Let us take a closer look at libraries, information technology and role it plays in the process of transformation of modern libraries and the transformation of traditional library users into online information seekers.

In last 50 years, the development of libraries has been strongly influenced by information technology. More than 50 years ago libraries had witnessed introduction of the first electromechanical devices which were installed in libraries in order to make library routine more automated. This pioneering phase of the advancement of library services by use of technology is known under the term library automation. A decade later, during the 60s, microcomputers brought about another (re)volution into libraries. Computers became cheaper and their application in different library jobs was inevitable and more and more indispensable. There is one very important remark to be made at this point, and this is that during those first days of library automation, librarians and users had almost no contact with the computers, all information processing was done by computer scientists and engineers. Introduction of microcomputers slightly changed this situation in favor of librarians who became more involved in use of computers in their work in library. In this phase of library development, users still had no contact with computers. This situation was about to change. It was the invention of the first online information (database) systems during the 70s that introduced computers directly to users. A decade later, in the 80s, online systems became a normal source of information used

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[1] Urquhart, Donald J. Nacela bibliotekarstva. Izdavacki centar Rijeka : Rijeka, 1996. str. 20.

both by trained librarians and users of libraries. This addition to the traditional library services meant that librarians and users had to acquire additional knowledge and skills to use computers and find the relevant information. This is very important information, because since then the pace of change of information technology and its implementation in libraries has become faster and the request for new and advanced competencies of librarians and users have put in focus many times. These basic knowledge requirements put certain amount of unwanted pressure on users (and of course, on librarians), however, many among them accepted new computer systems in libraries which were in fact installed in their favor. This problem would be more dealt with systematically in the following decades.

At the same time when the first online databases became available, another means of information dissemination was created. A computer network designed at the beginning of the 70s known as the Internet had been created and soon became very popular primarily in the academic community from which it emerged. As personal computers and networking got more popular during the 80s, the foundations for the growth of the system of networked knowledge have been laid. At that time, during the 80s, the quantity of knowledge essential for handling the computers in libraries was still high, but personal computers broke the barrier and ended age of the mystification of their use. Common users finally, although not fairly acquainted with the information technology, started to use them more extensively.

In the following decade, during the 90s, personal computers and the Internet have became technical basis for the creation of many new types of information sources and traced the route for the transformation of the existing ones such as libraries. It was not until the mid 90s when PCs became common thing and the Internet began to be a major phenomenon which will change the way we create, collect, process, store and use information.

This important facts will help us in further review of the importance of information technology in development of libraries, in education of both professionals and users, creation of new information services and general ability of libraries and other institutions to provide timely, relevant and quality information for academic community for the purpose of research and in the teaching process at the universities.

As we know, computer networks and personal computers alone were never and still are not sufficient to complete all these tasks we have just mentioned. To do this we need an institution (and professionals) which has proven over the centuries to be the most important and vital knowledge institution in the society. We need a library.

We should also not forget that creating, collecting, selecting, processing and storing information, and giving information for use, processes that are frequently mentioned in literature in different contexts are in fact basic library functions. Influenced by many changes in society all these library functions have change over the time. Major changes happened mostly in the sphere of media used for storage of information and application of new generation of information technology in improvement of presentation and use of the stored information.

Before we proceed to the new generation of libraries known as digital libraries let us take a glance at the role of (traditional and still based paper on paper material but still) modern libraries in life of academic community.

Basically, there are two big categories of users of information sources libraries provide: scholars (doing research and teaching), and students. Each of these two categories has

different requests and needs regarding information supply, but they share a great deal of the existing information channels through which they obtain information.

Dissemination of scholarly information and development of digital libraries

Since the publishing of the first scientific journal in France in 1665.[2] a journal article remained the primary source of scientific information. Over the time, the number of scientific journal has increased strengthening the position of scientists in their own environment thus creating a system of dissemination of scientific information in printed form. During the centuries, the stability of the system of the printed journal publications insured the dissemination of original ideas and enabled the development of science.

In his book "Komunikacijske filozofija znanstvenih casopisa" Tvrtko Šercar (1988) explains the lasting phenomenon of journal article. From his point of view, journal article is the standard communication form which creation includes jobs like peer review, task and responsibility distribution, reference analysis etc. The author also correctly registers the proliferation of journals resulting in formation of a strong information market which helped scientists to be recognized among colleagues. It was expected that the number of journals will grow at rate which can't be exactly stated but was at one point estimated as a period of 15 years during which the number of journals doubles.

Proliferation of journals introduced another problem: information absorption. Too many journal articles, some of them being to complex with too many details or to exotic to be published in journals accumulated problems like information organization and processing and created expenses beyond any estimation. It was proposed that there should be a secondary information source which would bring information about primary sources.

This situation brought about another idea of creating big institutions such as clearinghouses or even better - libraries (Davis, 1930s) which would have at their disposal all the necessary information about articles published in relevant journals. A user with a request for certain information would go to any library in his vicinity, issue his request, and would get necessary information acquired from the whole system of interconnected libraries and the result will be presented to him in his local library. The idea of networked information was born. Such an idea was not an exaggeration even then and sure isn't today, since the computer technology enabled such systems of networked libraries which proved to be ideal for this task when we think about their organizational and human resources.

Another important point is that the very notion of a need for networked information at that time didn't rely exclusively on technical infrastructure, which actually didn't exist but on organizational scheme for information management and that it came true when the computers became an integral part of libraries. With the invention of the Internet and its wider application and use in the academic community in 90s, this idea was finally realized not just in libraries but also in form of some other commercial information channels such as big information agents (SWETS, Ebsco etc.) which offered their information resources on the Internet.

Today, when we think about dissemination of scientific information we often think about commercial databases reachable on the Internet 24 hours a day. The problem with the databases is that there is no proper system of online information rating. Of course, what they present are articles from peer reviewed journals, but they offer only the mechanical access to information without almost any value added service. As Šercar states in his book[3], the problem of selection and dissemination of relevant information is not just technical, so it can be

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[2] Šercar, Tvrtko. Komunikacijska filozofija znanstvenih casopisa. Globus : Zagreb, 1988.- pp.37.
[3] Ibid. pp. 49.

compared with the storage, selection and dissemination of an inventory of a firm. The basic problems of scientific communication and the quantitative growth of information is the quality and relevance of information. The problem of quantity can be solved with the technical means like computers, but there is still the question of quality of information and services which add value to the digitally stored information. As a result, we need an institution which will process and store great quantities of information but will also offer services similar to those offered by modern libraries we use every day. Digital libraries carry great potential for taking over this important task.

The task is even more complex if we think about the exponential growth of published scientific documents which reflects the growth of scientific communication. With good technical infrastructure which is a prerequisite for proper functioning of digital libraries, they can be both the centers of technical excellence and centers for dissemination of quality information.

What are the grounds for this thesis? As it was mentioned earlier in this work, we are witnesses of proliferation of information of every kind. Special social groups of population such as scientists and students require quality information from authentic sources. This information must be provided on time and in format readable to the majority of users of digital information sources on the Internet. Acceptability of formats is relatively easy to achieve since major knowledge institutions (e.g. libraries) comply with national and international standards (e.g. ISO standards, metadata, different communication protocols etc.). Digital libraries are also introducing various new hardware and software applications and solutions which were implemented nowhere else but they are also ready to comply with international standards.

The Internet has also provided an environment for the development of information market which is an important factor in the process of dissemination of information. Moreover, different members of the so called information chain[4] which exist on the current information market we use every day, such as database vendors, online bookshops, electronic journal publishers are also interested in becoming the most important point in the process of the creation, collecting, selection, processing, storing and use of information. This raises a question of the role of libraries in the society and their future development. Should the new evolutionary form of libraries - digital libraries - be the most important institution for the dissemination of quality information for the academic community or should there be another institution or firm which would take over these tasks?

There are several reasons for a positive answer. First one is the fact that digital libraries have very strong foundations in information technology. They were designed, developed and some of them implemented as scientific projects, therefore their creators understand the necessity of having a good IT infrastructure on which there will be built excellent information infrastructure. For instance, Croatian Academic and Research Network (CARNet) built a national computer network of high speed which can be used and it is used for exchange of scholarly information and for the online teaching process at the Croatian universities.

Based on the quality IT infrastructure, scholars and students need modern and complex information systems which will satisfy their demand for quality information. With the support of CARNet and its computer and network systems, digital libraries can act as multidisciplinary information system specialized for dissemination of scholarly information. At first this system would be the alternative system of the traditional "paper" academic information dissemination

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[4] Structural frame within which exist authors, publishers, database vendors, bookshops etc. which all together create, process, store and provide information for the end user.

system since the printed information is still the most important source of scholarly information for the purpose of research and teaching. Digital libraries do not mean the end of the world of print, an idea which has its roots in predictions made at the time of the invention of microcomputer in the mid 60s.[5] Despite the predictions that by 1984. paper libraries would disappear, the quantity of paper material in libraries has largely increased. One reason is that there will never enough money in the world to convert all possible documents to digital form. In light of these ideas digital libraries are often misunderstood. They were frequently thought as the institution which will end paper print and become an dehumanized institution which will employ only computers and not real librarians. On the contrary, digital libraries offer to be extension of existing paper and automated/computerized libraries offering content and services over the Internet not just to the local academic and wider local community but also to anyone interested in such content displayed in the global information environment.

Further reason for the use of digital libraries among scholars and students is the increase of use of electronic primary sources of information and the current information technology represents good vehicle for effective dissemination of such information. In this case there are no additional costs of conversion of paper material into digital from, yet, there are some other problems. Most of them are computer related. For instance problems related to document formats which can be solved by compliance with standards and then there is a big problem of different levels of usage of information technology in different regions of the world. The second problems calls for international cooperation on development of core educational programs for the use of information technology. Lack of funds in certain regions of the world has created big digital divide between those who can afford the access to the online content and those who cannot.
This situation is causing the problem known as the ability to access the online information (so called digital divide). Such small percentages of those who can actually access the Internet creates great problem for information systems planners as well as teachers at universities because of the uneven distribution of technical means for the access to the online information.

For instance, rather large number of students in Croatia still do not have proper access to the online information at their faculty, home or dormitory. This can mean that online content cannot be prepared and put online in desired quantities because the part of the target audience will never reach it. What we need is better planning and immediate action in two areas: computerization and popularization of use of the Internet in order to raise the quality in education and research. Well equipped computer labs as well as original scientific information available on the online servers in Croatia will help us create educated professionals and good researchers which will in the end help Croatian academic community to present its own achievements to the rest of the global academic community. Then we will be able to create complex systems of networked information with centers such as digital libraries to provide us with the quality information and services.

So, what are the requests and suggestions put in front of digital libraries regarding the scholarly communication in the online environment? Some of them can be summed up in following points(Bailey 1994):

- electronic documents should be accessible 0-24
- scholars should be able to find needed documents by using search techniques
- possibility of free exchange of scholarly ideas
- different levels of editing for authors should be provided

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[5] Lesk. Michael. Practical digital libraries. Morgan Kaufmann Publishers : San Francisco, 1997. pp. 3.

- different use measures should be employed to determine importance of work (e.g. citation analysis)
- electronic documents should be given for use at the lowest possible cost
- scholars should hold the copyright for their work
- scholars should be able to use electronic information for noncommercial purposes freely
- author should be able to correct, update and change his/her document, the original should be preserved
- user request for information should be confidential

These are just few request which should be taken into consideration when creating policies for use of electronic sources of information provided by digital libraries. In addition, when considering pros and cons for the development of complex information systems like digital libraries there are several very significant advantages which should be looked at:

- smaller number of quality sources is offered to users
- use of similar user interfaces
- authenticated documents
- development of networks of similar information (math, information science...)
- ease of communication (like for instance invisible colleges)

Smaller number of quality sources are necessary because an individual cannot reach into the immense quantity of information sources that exist on the Internet today. A scholar can use online library catalogues, online databases with primary or secondary sources of information or even online electronic versions of journals. Acting as a center of quality information, digital libraries would offer selection of reliable information sources selected by user himself and stored in his online profile. This means that scholar can access new and relevant information very quickly and that he can rely on the source of information. By using different and multiple information sources scholar is forced to use different user interfaces. He can ask a librarian or other specialist to do information retrieval instead of him because the interfaces are too divers to be used with comfort. One specialized user interface would help user to focus on information not on the means of getting it. Trust in the institution which provides information for research and teaching is one of the prevailing or the most important factors when users decide to use an online source of information. They ask for authentic documents (journal articles, books, notes etc.) because such an information source can be reliable reference in their work. Who stands behind the mark of authenticity? Mostly large government institutions or professional associations which provide certificates of authenticity for certain documents. When we mentioned smaller number of quality sources and the need for short but precise information retrieval, we also had in mind one of the new trends in the organization and presentation of information in the online environment: development of networks of similar information. This phenomenon can be best noticed in the form of information portals for special groups of users on the Internet for math, architecture etc. What they contribute to the online user community presents the essence of any information service: tailored information.

If digital libraries succeed in satisfying some if not all of the enumerated requests, they have great chances for becoming centers for the advancement of communication within the system of higher education making it more competitive on the information market and thus resulting in further advancement in the development of the basic information infrastructure on which they were designed and built. They will also push forward creation of new and original content and services for the purpose of research and teaching which is today when we speak of continuos education equally important. Digital libraries already have great impact in making original quality electronic information more available to the academic staff and students serving as a

platform for various ongoing international and interdisciplinary projects.[6] Projects present great means for creation of new communication paradigms among scholars by engaging information technology, electronic sources of information as well as adequate information services in institutions such as libraries, financial means and human resources.

And finally what can be gained by digitalization of existing paper resources (if this is the choice)? In her report "Why digitize?" Abby Smith (1999) enumerates several added values of digitalization:

- enhanced intellectual control through creation of new finding aids, links to bibliographic records, and development of indices and other tools;
- increased end enriched use through the ability to search widely, manipulating images and text, and to study disparate images in new contexts;
- encouragement of new scholarly use through the provision of enhanced resources in the form of widespread dissemination of local or unique collections;
- enhanced use through improved quality of image, for example, improved legibility of faded or stained documents; and
- creation of a "virtual collection" through the flexible integration and synthesis of a variety of formats, or of related materials scattered among many locations.

Conclusion

Digital libraries are here. They are modern complex information systems based on up to date information technology. At the present moment they offer quality content for certain groups of users such as scholars and students (and many other), but their main goal is to offer their digital collection to much wider community.

In his book "Redesigning library services : a manifesto" Michael Buckland casts some light on the potential benefits and drawbacks of use of electronic documents:

1. "In many domains of science we are leaving the world of printed information in favor of virtual scientific communication, i.e. distribution of knowledge in digital form over networks. In this area, information and communication technologies are enablers for developing new modes of knowledge representation, distribution and retrieval. The current convergence of traditional (printed) and new (digital) media in the hybrid model is a characteristic of the transitional phase we are moving through. Traditional media will continue to exist, but will operate in within a different model. separated from the virtual model.

2. The academic community itself is taking over responsibility for and control of the entire communication process. Publishers and libraries are included in this process only when they provide useful and cost-effective functions, and their involvement increasingly will be in an outsourcing-relationship controlled by the academic world. Already new models for scholarly communication based on academic consortia are being proposed which demonstrate this point [Buck 1999]."

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[6] This is especially true in countries like USA where number of different IT related projects are funded by the government institutions and their results are implemented in various existing digital libraries (e.g. projects from the Digital Library Initiative I and II).

Digital libraries extend current services of modern automated libraries and present creative environment for different multidisciplinary projects. As Croatian information technology infrastructure serves as foundations for the development of new complex information systems, digital libraries have basic conditions to be developed here in Croatia. They will help advancement of communication in academic community and create nation strategies for the development of new information resources and services.

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