

THE TRANSITION OF SCHOLARLY COMMUNICATIONS IN CANADA

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For over a decade the Canadian Association of Research Libraries (CARL) has been studying and responding to the implications of the technological, economic, and other forces impacting on the scholarly communication process. The situation had become so acute that in 1994 the Canadian Association of Research Libraries (CARL) and the Association of Universities and Colleges of Canada (AUCC) formed a joint Task Force on Academic Libraries and Scholarly Communication. This Task Force issued its final report, *The Changing World of Scholarly Communication: Challenges and Choices for Canada* in 1996. In 1999, CARL took the leadership in preparing a proposal to the Canada Foundation for Innovation (CFI) for the Canadian National Site Licensing Project, an innovative national approach to licensing databases for 64 universities. More recently, CARL/ABRC has published a *Backgrounder Series* of papers on digital preservation issues, alternative modes of scholarly publishing, and the open archives initiative (<http://www.carl-abrc.ca>).

Ten years on, the situation and its effects on the academy have become steadily more critical. This paper presents an analysis of the current situation and outlines a conceptual framework for the scholarly communication process, the actors within it, the drivers transforming it, and the issues arising out of that transformation. These issues have an affect on all Canadian researchers in every discipline and make the case for further research into scholarly communication in Canadian.

THE SCHOLARLY COMMUNICATIONS SYSTEM

The creation, dissemination, and application of new knowledge are fundamental to the advancement of research, the development of an informed citizenry and a healthy national economy. These processes are facilitated, in large part, by institutions of higher education. From the lab, to the classroom, to industry, to the public, the advancement of knowledge through research and teaching is the invaluable contribution made by higher education to the public good. Underlying this system is the premise that knowledge is a key driver of economic performance and social well being in Canada (Canada's Innovation Strategy, 2002).

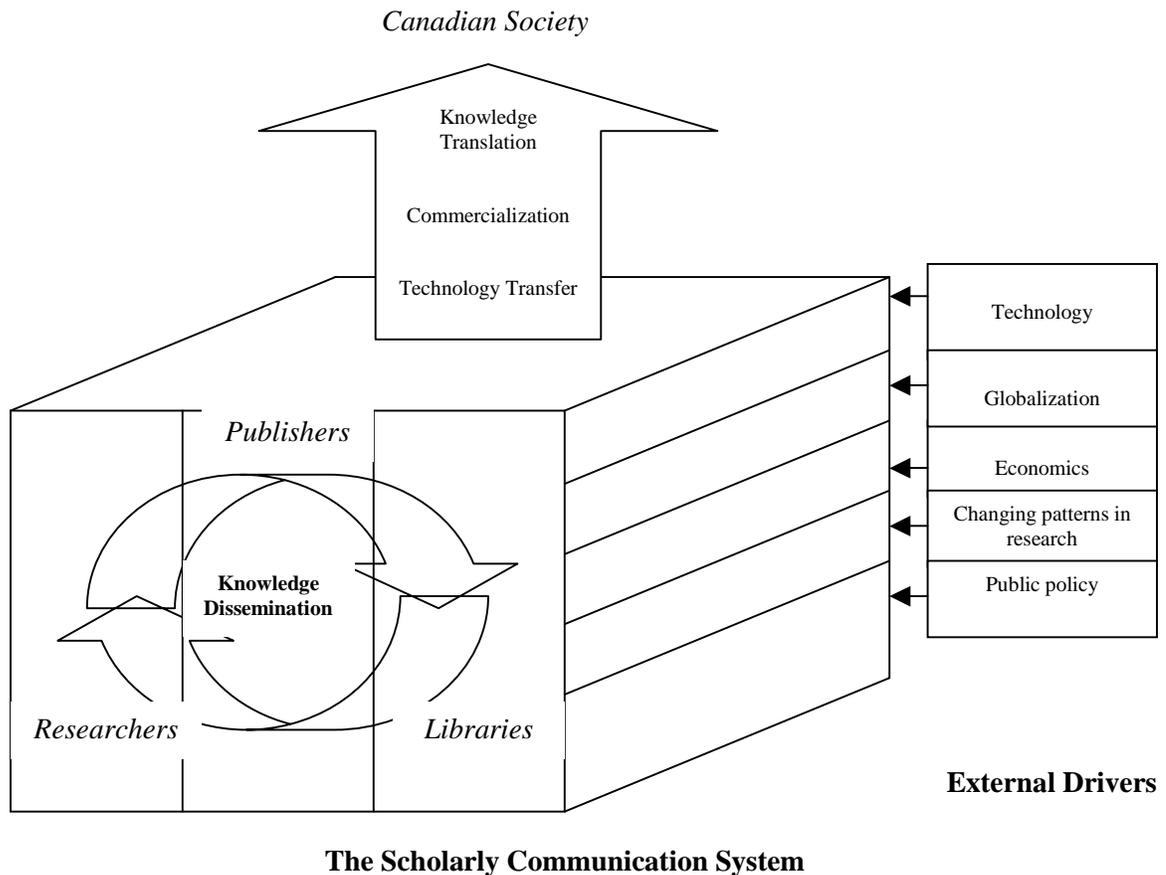
In Canada, scholarship has three main roles: (1) teaching; (2) making formal knowledge available to the public; (3) and spurring new research which in turn creates new knowledge. This involves a network of complex relationships between a number of actors. Researchers, editors, publishers, distributors, librarians and consumers of scholarly information are all involved in this cycle. As well, the architects of public policy, government regulators and the public themselves all perform a role in determining the rules within which the system operates. It is within this system, referred to here as the scholarly communication system, which intellectual and creative activity is shared between scholars and with the public. Knowledge is created and disseminated through the scholarly communication system in both formal and informal ways. Formal scholarly communication, or scholarly publishing, is the process through which newly discovered knowledge is refined, certified, distributed to, and preserved for researchers, professors, students and the public and usually takes the form of published journal articles, conference proceedings or monographs. Informal methods, on the other hand, include visiting conferences, using discussion groups, distributing preprints, and general networking to find out what is happening in a particular discipline.

The formal system of scholarly communication has a number of very important functions in Canadian society. Firstly, scholarly publishing disseminates knowledge through the publication of papers and monographs, allowing researchers to distribute important findings to the wider research community and beyond. Secondly, it ensures quality control through peer review and editorial processes. Thirdly, it creates a public domain archive of knowledge. Once published, materials become part of the public domain and research libraries can collectively act as a distributed archive, preserving the knowledge embodied in them for current and future scholars. Fourthly, scholarly publishing provides formal recognition for authors, raising their profile to gain recognition, further research contracts, or promotion. And finally, the scholarly communication system establishes ownership priority over a particular discovery or advance. These are the functions of the formal scholarly communication system, however, it is important to recognize, that the content of many published papers will previously have been discussed informally.

Scholarly communication methods differ somewhat depending on discipline. In the sciences, journals have played a distinguished role for over 300 hundred years. The first scientific periodicals were first published in 1665 and provided a practical way for scientists of the day to communicate with each other. Throughout the eighteenth and early nineteenth centuries, the nature of journals slowly changed, resulting in a relative decline in the importance of learned society proceedings, and the successful creation of more specialized journals, reflecting the fragmentation of knowledge into more specific disciplines. By the end of the nineteenth century, features like the peer-review of submitted papers had begun to become standard in many disciplines. Scholarly and scientific papers published in peer-reviewed journals remains "the established medium of record and dissemination" for the sciences (Day, 1999). While in the arts and humanities, researchers are more likely to publish findings in both monograph and journal articles.

This traditional system of scholarly communication consists of four major groups of actors: (1) researchers, who produce scholarly research, (2) publishers, who package scholarly research and create information products, (3) libraries, who collect, disseminate, and preserve scholarly research, and (4) users, who translate research into new research initiatives, government policy, commercial products, public services, and so forth. With regard to academic researchers specifically, knowledge that is disseminated through its publication is then sold back to university libraries where it re-enters the research cycle. This knowledge is diffused into society through knowledge translation, technology transfer and commercialization, providing the critical link between knowledge creation and the application of that knowledge.

The current system of scholarly communication is conceptualized in Figure 1.1. It illustrates a system consisting of the four groups of players, each of which is feeling the impact of external drivers upon the scholarly communication process. Each of the elements is examined briefly below.

Figure 1.1

THE ACTORS

Researchers

Researchers are both the creators and consumers of scholarly knowledge. In Canada, as elsewhere, university-based scholars and researchers have an important, though not exclusive, role as producers of knowledge and they depend on access to timely and comprehensive knowledge in their fields in order to create new knowledge.

One of the major driving forces of the formal scholarly communication system is the “publish or perish” phenomenon. Academic researchers’ careers are dependent on the publication of research work. Promotion and tenure committees judge professors' worth by how much and where they publish. It is seen as a necessity for post-secondary institutions to show that their staff can produce a sizable volume of good quality research (Mason, 1998). Although communicating research findings can be effectively accomplished through other, less formal means (preprints, conferences, etc.), the tradition of journals as the acceptable route has long been established. Thus, the emphasis placed on publication for tenure review and promotion is a major factor for academics in Canada (Dealy, et.al., 2000).

Publishers

The principal vehicles for the communication of scholarly and scientific works are scholarly journals and monographs, published by both commercial and not-for-profit interests. Publishers' function as gatekeepers to the world of scholarly communication in managing scholars' and researchers' peer review, which in turn determines what is printed and what is not. The chief players in academic publishing in Canada are commercial publishing houses (many of which are European), learned societies, and university presses.

Underpinning the process of scholarly communication is the concept of copyright. Protection of the ownership of original expression vested in the creator is an essential condition for knowledge creation. Equally essential, both for knowledge creation and for knowledge dissemination, is access to copyrighted material for scholarly purposes. In the current model, academic creators forfeit the copyright of their works to publishers in order to be published. The publishers then charge the universities, which supported the scholars during the creative process, very high prices to buy back this material (AUCC, 1996).

Libraries

For centuries the library has been a repository of the written record and a powerful symbol of human intellectual achievement. Libraries collect, manage and preserve the scholarly publications in the traditional scholarly communication system, and also serve as indexers and pathfinders for information they do not own. As the traditional collectors and disseminators of knowledge, libraries have been experiencing some profound changes in their role within the scholarly communication system, in particular the changing concept of library collections from "ownership" to "access" (Cummings, 1992).

Users

An Industry Canada study outlines a number of different paths for the diffusion of scholarly research into Canadian society. By far, the most prevalent means of disseminating knowledge created through research is through its publication. In this case, intellectual property created through university research is transferred to the economy as a public good (through publication in an academic journal). Research may also be transferred to industry through collaborative research effort with private industry. Alternatively, intellectual property is commercialized by the university, which initiates the process by seeking intellectual property protection. This research is then brought to market by licensing the technology to an existing firm or creating a spin-off firm to further develop and commercialize the new technology (Gu, 1999).

THE DRIVERS

The scholarly communication system has undergone many changes in recent years, in effect blurring the traditional roles of its actors. And, many believe that there are even more profound changes in store, the implications of which are far from understood (Cummings, 1992). These changes are the result of external forces or drivers, which range from economic, to political, to demographic, and in particular to technological.

Technology

New technology is a major driver transforming the scholarly communications system. Information technologies offer easy access to richer, multimedia formats, allowing the integration of text, sound, graphics, and video, and high levels of interactivity. It permits immediate worldwide delivery of publications and data to the researcher's desktop and has profoundly affected scholars' abilities to report, review, and distribute research results, challenging traditional models of publishing, storing, and preserving research.

Globalization

Research has always been an international undertaking and the continuing globalization of economies and research has a major influence on how knowledge is managed within the scholarly communication system. Canada is a "net importer" of information, and thus has a considerably greater need for the research results of other countries with larger populations and economic resources. On the other hand, the collections in the research libraries of Canada represent a large part of the accumulated documentary knowledge wealth of the country (Hill, 1995). Canada does have unique strengths and resources, and it is upon these, which we must capitalize, so that we can rightfully maintain our place in the global arena of scholarly research.

Economics

Economics is another very significant driver influencing the traditional scholarly communication system. This is particularly so in Canada, as the exchange rate with the United States, a major exporter of information to Canada, has increased significantly. In addition publishers have been increasing their prices each year by considerably more than inflation. As a result, even though Canadian libraries have increased expenditures over the last five years, their average purchasing power has dropped by between 21.6% and 32.7% depending on the region (Delamothe, 1999).

Changing Patterns of Research

Canadian research patterns are continually evolving. New fields of research, as well as interdisciplinary and multi-disciplinary collaborative research have unique information needs and place new requirements of the scholarly communication system.

Increasing Quantity of Scholarly Publications

There has been a phenomenal increase in the amount of published literature in the past two decades (AUCC, 1996). This is true in particular in the hard sciences, where it has been estimated that the number of published papers doubles every 10 to 15 years. For example, scholars in the field of mathematics have published about one million scientific papers to date -- half in the past decade alone (AUCC, 1996). This poses a real challenge for the scholarly communication system, which seeks to provide access to all the resources required by scholars in order to remain up-to-date in their field.

Public Policy

Public policy issues have a huge influence on the nature of the scholarly communication system. Government policy and funding of towards academic research in Canada has a tremendous effect on the nature of research being pursued in Canadian universities. The commercialization of research generates issues relating to research priorities, applied versus pure research, intellectual property and publication rights, and so forth. Similarly, evolving legal regimes such as copyright and licensing change the shape of the scholarly communication profoundly. Underpinning this entire process is the concept of copyright. Protection of the ownership of original expression vested in the creator is an essential condition for knowledge creation. And, equally essential, both for knowledge creation and for knowledge dissemination, is access to copyrighted material for scholarly purposes (AUCC, 1996). As Canadian public policy changes from year to year, and administration to administration, so must the scholarly communication system adapt to these changes.

The highly interrelated forces described above are challenging many elements of the scholarly communication system. The effects of these drivers on the Canadian scholarly communication system are far from understood, however it is clear that they raise issues critical to the continued vitality of Canadian scholarship in all disciplines. A number of important issues affecting scholarly communication have arisen from these forces:

THE ISSUES**Changing Knowledge Needs**

The well being of Canadian society is dependent on leading edge and innovative research in all fields. As the knowledge needs of Canadian society evolve, academic researchers and indeed, the entire the scholarly communication system, must respond to these changing knowledge requirements. Canadian scholars rely on the scholarly communication system to supply them with the knowledge resources they need to remain up-to-date on the research being conducted in their field. The unprecedented rates of change in the patterns of research in the Canadian universities is accompanied by a change in the knowledge requirements of scholars. There is an ongoing need for investigations into the information needs of researchers at Canadian universities in order for libraries and publishers to provide the relevant knowledge resources required by scholars.

Alternative Publishing Models

Commercial publishers have been able to command high prices because, as near monopolies, they have a captive audience and are not subject to normal market forces. In the case of Canadian learned societies, who publish mainly in the social sciences and humanities, government grants have traditionally helped to subsidize publication activities, keeping prices down. However, there has been a significant erosion of this support in recent years. University presses have also been affected by government cutbacks. The reduction in operating grants to universities is compelling the university presses to operate on a more commercial basis, with the predictable effect on the number and price of their publications. In all scholarly publications, the hidden cost of quality control through peer review is a contribution of scholars and scientists. This cost is borne, not by the publishers, but by the scholars' employers -- the universities and other research institutions. The content of monographs and articles is also a gift to publishers. In an effort to achieve the widest possible dissemination of the results of scholarly research, scholars and their universities have frequently surrendered to publishers the copyright to works they have created and funded. Yet university libraries pay especially high institutional rates in order to serve the needs of their scholars and students. These traditional models of scholarly publishing are being challenged on many fronts. The electronic media is facilitating the development of a variety of new publishing models and new economic models are beginning to appear which address the soaring costs of scholarly literature. Despite these new models, there is still little consensus about the ultimate direction of scholarly publishing in Canada.

Copyright, Licensing, and Intellectual Property

Electronic publication has revolutionized the distribution of information, disrupting historical balances that have set the rules according to which researchers, publishers, libraries, and users participated in the dissemination of knowledge. Publishers can disseminate information faster, cheaper, and for a wider readership client community than ever before, while users can consult a multitude of information sources located all over the world, from a single point of access. However, there are major intellectual property and economic issues. Since digital information can be copied at almost zero cost—at lightning speed, and without any loss of quality—making information available in digital form can be unattractive both for authors and distributors. In addition, due to the low cost of electronic publishing in combination with economic globalization, new information providers may emerge, which will compete with the existing publishing institutions in a global market for electronic information.

Interoperability and Technical Infrastructure

Digital communication requires interoperable architecture. Existing heterogeneity of access and retrieval protocols poses a real problem in the short to medium term. The solution is technical, but also requires various interest groups to negotiate their way to a satisfactory solution. Digital libraries rely heavily on technological infrastructure to connect their users with their collections. These digital library systems involve three types of technologies: A system architecture that defines overall system structure and provides common services and interfaces; Individual technologies, such as search technology, retrieval technology, contents entry technology, etc.; And, an integration technology that combines individual technology with the system architecture (Dyer, 1998).

Access and Retrieval

Access and retrieval of scholarly knowledge presents a whole range of issues, which demand extensive research and development. With the shift of traditional roles in the scholarly communication system, numerous questions have arisen. For example, whose role is it to provide access? How should electronic objects be described? What authentication and encryption systems are required? What user interfaces meet the needs of different types of users? What constitutes a catalog of holdings in the electronic environment and metadata? And, What are the most effective techniques for information retrieval and the potential use of expert systems?

Availability of Knowledge Resources

Another key issue facing the Canadian scholarly communication system is the continuing availability of knowledge resources. Canadian research libraries' coverage of the world's publishing output is diminishing at a time when demand for international information is increasing. Libraries have less buying power than ever, because of the rising costs of many journal subscriptions and monographs and scholarly output is on the rise. On the other hand, there is a growing demand for new knowledge resources and services by scholars as scholarly disciplines expand and, interdisciplinary studies grow. The problem is exacerbated by the huge funding cuts leveled against post-secondary institutions, inflation, increases in the price of academic publications, problems with space, the costs of binding, and exchange rates. Libraries can no longer maintain subscriptions to all the journals that their scholars demand, and that is what is at the heart of the dilemma -- what to keep, and what to cancel. These decisions have major implications for both students and faculty members particularly in the sciences, but also affect the budgets for monographs in the humanities and social sciences. It is also problematic for librarians, who have historically operated in the framework of a service industry, and felt capable of providing information to everyone.

Document Preservation

In recent years, knowledge resources in the scholarly communication system have begun to include a growing number of digital information resources. Traditionally, it has been the responsibility of academic libraries to preserve and provide access to paper-based resources, and they now have a new and more complex responsibility for digital resources. In Canada, at present there is no legal obligation, nor formal mechanisms for ensuring that such digital information is preserved for posterity. As digital resources become a significant part of the knowledge resources in scholarly communication it will be up to all stakeholders to ensure that those resources are maintained in perpetuity over the longer term. Some of the main preservation issues are: Preserving collections built on transient or temporary platforms; long-term archivability and preservation of materials whether they are owned by the library, the publisher, or a third party agency; the development of strategies for digital preservation that encompass all forms of digital information resources; and, the potential obsolescence of some digital formats.

Content Preservation

Content preservation goes beyond preservation of the medium and the technology to assure the protection of the intellectual structure of information as it was recorded by its author. To meet user expectations, authentication and integrity techniques that combine mathematical security with ease of use, public trustworthiness and privacy protection must be implemented. For example, bit patterns of texts, sound and images may be preserved through cryptographic hashing and encoding methods such as the digital time-stamping technique. The availability and consistency of digital content can be compromised by server failure, network partitioning or delays, as well as questionable or non-existent collection-management standards. The architecture of the scholarly communication system will require new policies and mechanisms thus ensuring the integrity of content.

Budget Cuts

Today, universities command a smaller operating revenue base in current dollars than at the start of the nineties. Canadian universities receive 30% less government support per student than 20 years ago. Between 1995 and 1998 nine out of ten provinces cut back funding for higher education with the worst records belonging to Québec, Ontario and Newfoundland. Within this setting, the cycle of scholarly communication - from creation, peer review, publication and dissemination of information, which in turn stimulates further knowledge, is under an immense strain (AUCC, 1996). Reductions in funding have resulted in budget cuts throughout the scholarly communication system.

Privatization of Research Functions

Connected with decreased funding for research and other aspects of the scholarly communication system, is the rapid growth in commercially sponsored research. This reflects a broader change in public policy that has been quickly transforming the nature of universities in Canada in recent years. The statistics reveal that governments have been reluctant to boost general operating revenues, which would benefit all universities. The rapid decline in public financial support over the past three decades has led universities to aggressively pursue other sources of revenues, often in the form of significant increases in private sector funding of sponsored research. One consequence of this is that it benefits Canada's largest and most research-intensive universities, creating a larger gap in funding between them and the smaller Canadian universities. The Canadian university is becoming less a public institution and more a private one, less accountable to the public interest and more beholden to private interests, ultimately changing the shape of research to respond to the explicit interests of the private sector (CAUT, 2001).

DISCUSSION

This is by no means a comprehensive list, and the issues are presented here without assigning priority to one over the other. However, they do serve well to point out the vastness of the challenges faced by the players within the scholarly communication system. The impact of these various drivers on the traditional scholarly communication system in Canada is not fully understood, however, it is clear that the issues that have emerged require urgent attention by all of the actors involved. Researchers, librarians, university administration, and publishers alike must respond. The predicament is, that each player is reacting to the changing scholarly communication environment individually, rather than as a group, having the unfortunate consequence of the actors often being at odds with each other. This has served to compound to the problems within the scholarly communication system, rather than provide constructive solutions. Take, for example, the variety of responses to new technologies: Libraries are focussing their resources on developing "digital libraries". The 1996 AUCC-CARL report called

for the building of a distributed digital library. Similarly, each of the four regional academic library associations (CAUL/CBUA, CREPUQ, OCUL, COPPUL) has or is preparing a digital library proposal. Despite the intense interest, the digital library is not yet a well-defined concept, and libraries, to a certain extent, are proceeding towards a somewhat uncertain future. While libraries work towards the “digital library”, publishers are encroaching on the traditional role of the library, by offering direct access to digital publications, and assuming the archiving and indexing functions for these publications. Researchers, on the other hand, have been responding to new technology, in some cases, by completely bypassing the entire formal scholarly communication system through the use e-print servers. This illustrates the disparate responses to external drivers that are possible if players act on an individual basis rather than as a group. There is an imminent need for system-wide solutions and the development of a united strategy, in which researchers, publishers, librarians, and users are guided by a clear agenda founded on comprehensive and impartial research into the future of the scholarly communication system. It is obvious that an immediate effort must be made to establish a Canadian national research strategy to address the pressing issues arising within the Canadian system.

Current Research into Scholarly Communications

On an international scale, substantial resources are being devoted to developing national research strategies and programs into scholarly communication. The National Science Foundation (NSF), in collaboration with numerous other US federal agencies, is channeling millions of dollars into digital library research both within the United States and towards international collaborative studies. Its International Digital Libraries Collaborative Research Applications Testbeds program alone is a \$10 million dollar initiative in FY 2002. Private U.S. foundations are also supporting research into scholarly communication. The Mellon Foundation recently funded a Scholarly Communication Institute to be developed by Dartmouth College and the Council on Library and Information Resources.

The NSF and the European Commission sponsored a series of working groups to formulate an international research agenda on digital libraries (Schauble and Smeaton 1998). The European Commission recently published its *DigiCULT Report* on libraries, museums, and archives (European Commission 2002). In the United Kingdom the British Library has a Digital Library Research Programme (Jefcoate 1998). In Australia a national Project Workshop on “Australia’s Information Future: Innovation and Knowledge Management for the 21st Century” in 1999. In Singapore the Nanyang Technological University organizes the annual International Conference on Asian Digital Libraries.

In Canada, numerous reports about the individual elements of the scholarly communication system have been published over the past forty years. These publications begin with the Williams report, sponsored by the National Conference of Canadian Universities and Colleges (Williams 1962), and are followed by the Downs report, sponsored by AUCC and the Canada Council (Downs 1967), the Canada Council Consultative Group on University Research Libraries (Canada Council 1978), the Cheney report sponsored by the SSHRC (Cheney 1982), and the already noted AUCC-CARL report in 1996. There has been no recent national, systematic study of the Canadian scholarly communication, the challenges it faces, and possible solutions. These reports are outdated and suffer from several methodological limitations. The information contained in the reports was provided by consultants or advisory bodies, with little or no participation by those who produce and consume research. Furthermore, they do not examine the scholarly communication process as a whole, but rather tend to focus on one player and their role within the system. The methodologies employed were traditional, such as the use of

questionnaires, site visits, reviews of the literature, and the collective wisdom of library practitioners and other experts.

Clearly, in other countries there is much activity promoting research on this and other aspects of scholarly communication. However, this is not so in Canada, which lacks any substantive profile in digital library and scholarly communication research. Although individual libraries and regional and provincial library associations are pursuing building digital libraries, and scattered research is underway throughout the country on aspects of scholarly communication, there is no national research agenda, no funding directed to this specific priority, and no infrastructure promoting digital library research. Consequently, there is little general understanding in Canada of the digital library concept, of whether it is an effective response to the transformation of the entire scholarly communication system, and if so, how to construct it.

For those who generate, publish, and disseminate research, there is no substantive body of Canadian research upon which to draw for direction. Managers and administrators within the scholarly communication system, including CARL library directors, are forced to look to research and development initiatives outside this country. International research is helpful in many ways, but does not reflect the unique characteristics of the Canadian context. In order for Canadian scholarly research to excel, it must create its own areas of excellence through the development of a coherent and unified strategy for scholarly communication, taking into account the research needs and demographics of Canada. The experience of the Canadian National Site Licensing Project is instructive. During the planning stages, other models in the US, UK and Australia were examined, however, in the end a unique Canadian strategy was required in order to meet the needs of Canadian researchers.

In conclusion, the traditional system of scholarly communication is undergoing profound transformations, the impacts of which are far from clear. Outside of Canada there are numerous national research initiatives underway in order to implement new and effective models of scholarly communication. In Canada, there is an unacceptable lack of research and supporting infrastructure aimed at the analysis and responses to the changing scholarly communication system. To gain a better understanding of the consequences of the changes to the Canadian scholarly communication system, there is a critical need for a multidisciplinary research agenda (library and information studies, computing, law, public policy, communication studies, economics, linguistics, sociology, psychology, and engineering). This research will serve as the basis for the development of effective public policy, as well as the basis for sound strategic planning.

BIBLIOGRAPHY

Association of Universities and Colleges of Canada-Canadian Association of Research Libraries/ABRC. 1996. *The Changing World of Scholarly Communication, Challenges and Choices for Canada: Final Report of the AUCC-CARL/ABRC Task Force on Academic Libraries and Scholarly Communication*. Ottawa: AUCC.

Canadian Association of University Teachers. 2001 *Creeping Privatization University Finances, 1998-1999*. CAUT Educational Review, Vol.3, No.1, February, 2001. http://www.caut.ca/english/publications/review/200102_privatization.asp

Cheney, Terry. 1982. *Solitudes and Communities: A Review of Prospects and Options for Social Sciences and Humanities Research Library Resources in the 1980s*. Ottawa: SSHRC.

- Consultative Group on University Research Libraries. 1978 *University Research Libraries: Report of the Consultative Group on University Research Libraries*. Ottawa: The Canada Council.
- Council of Prairie and Pacific University Libraries. n.d. *Western Canadian Digital Library: Project Summary Submitted to Canada Foundation for Innovation*.
- Cummings, Anthony M.; Witte, Marcia L.; Bowen, William G.; Lazarus, Laura O. and Richard H. Ekman. 1992. *University Libraries and Scholarly Communication: A Study Prepared for The Andrew W. Mellon Foundation*. Association of Research Libraries.
<http://etext.lib.virginia.edu/reports/mellon/mellon.html>
- Day, Michael. 1999. *The Scholarly Journal in Transition and the PubMed Central Proposal*. Ariadne Issue 21; 20-Sep-1999. <http://www.ariadne.ac.uk/issue21/pubmed/>
- Dealy, Jacqueline; Golubowski, Ann; Kapa, Dubravka and Ruth Noble. 2000. *The Journal Crisis, Information Technology, and the Restructuring of Scholarly Communication*. BiblioFile: The Libraries' Newsletter for Faculty Special Issues, February 2000.
<http://library.concordia.ca/services/journalcrisis.html>
- Delamothe, Tony and Richard Smith. 1999. *Moving Beyond Journals: The Future Arrives with a Crash*. British Medical Journal, 1999; 318: 1637-1639, June 19, 1999.
<http://bmj.com/cgi/content/full/318/7199/1637>
- Downs, Robert B. 1967. *Resources of Canadian Academic and Research Libraries*. Ottawa: Association of Universities and Colleges of Canada.
- Dyer, John. 1998. *UK Academic Network Architecture: A Study commissioned by the CAN, September 1998*. http://www.ja.net/documents/net_arch.html
- European Commission. 2002. *The DigiCULT Report: Technological Landscapes for Tomorrow's Cultural Economy*. EU: Luxembourg.
<http://salzburgresearch.at/fbi/digicult/start.htm>
- Gu, Wulong and Lori Whewell. 1999. *University Research and the Commercialization of Intellectual Property in Canada*. Occasional Paper No. 21, April 1999. Industry Canada.
<http://strategis.ic.gc.ca/pics/ra/op21-e.pdf>
- Hill, Graham and Carole Moore. 1995. *A proposal for the coordinated development of a distributed national digital library system in Canada, prepared by a group of academic and research libraries*. The CAN-LINKED Initiative. http://www.lib.uwaterloo.ca/documents/CAN-LINKED/canlinked_IVA.html.
- Houghton, John. 2000. *Economics of Scholarly Communication*. Center for Strategic Economic Studies, Victoria University.
<http://www.anu.edu.au/caul/cisc/EconomicsScholarlyCommunication.pdf>
- Industry Canada. 2002. *Investing in Excellence: 1996-2001*. <http://innovation.gc.ca/s-tinfo>.

- Jefcoate, Graham. 1998. *Priorities for Digital Library Research: A View from the British Library Research and Innovation Centre*.
<http://www.ukoln.ac.uk/services/papers/bl/blri078/content/repor~16.htm>
- Joss, Simon, John Durant. 1995. *Public Participation in Science: The Role of Consensus Conferences in Europe*. London: Science Museum.
- Mason, Moya K. 1998. *Academic Research, Scholarly Communication, and the Serials Crisis: Is It Time to Jump Off the Roller Coaster of Publishing for Prestige?*
<http://www.moyak.com/researcher/resume/papers/var17mkm.html>
- McLean, Neil. 1999. Strategic Directions for Australia's Research Information Infrastructure. Commonwealth Scientific and Industrial Research Organization.
- National Science Foundation. 2002. *International Digital Libraries Collaborative Research and Application Testbeds. Program Solicitation. NSF-02-085*.
<http://www.nsf.gov/pubs/2002/nsf02085/nsf02085.html>
- Ontario Council of University Libraries. n.d. *An Information Infrastructure for an Ontario Digital Library*. www.ocul.on.ca/news/odl_submission.html
- Owen, John M. 2000. Digital Libraries and Scholarly Communication: Transforming the Information Chain. <http://www.hum.uva.nl/bai/home/jmackenzie/pubs/Thessaloniki-2000-JMO.htm>.
- Phillips, Susan D., Michael Orsini. 2002. *Mapping the Links: Citizen Involvement in Policy Processes*. CPRN Discussion Paper No. F21. Ottawa: Canadian Policy Research Network.
- Schauble, Peter, Alan F. Smeaton. 1998. *An International Research Agenda for Digital Libraries. Summary Report of the Series of Joint NSF-EU Working Groups on Future Directions for Digital Libraries Research*. Brussels: NSF-EU.
www.iei.pi.cnr.it/DELOS/NSF/Brussrep.htm
- Wells, Alison. 1999. Exploring the Development of the Independent, Electronic, Scholarly Journal. University of Sheffield- Department of Information Studies. Sheffield, England.
<http://panizzi.shef.ac.uk/elecdis/edl0001/index.html>