

A survey of the growth of Canadian research in information science
Une enquête sur la croissance de la recherche canadienne en science de l'information

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Abstract:

The development of information science in the United States has been discussed in a number of papers. In comparison to the United States very little is known about the development of information science in Canada. This paper presents a survey of the research contributions Canadians have made to information science and describes how the discipline has grown in Canada.

Our data show that the strength of Canadian research has been in the areas of classification and indexing, and information storage and retrieval. Research was generated from different disciplines. The highest producers of research were from library and information science schools, followed by those from computer science departments. Although Canadian journals were founded in the 1970s as forums for research, Canadians still prefer to publish in foreign journals. The cumulative growth of Canadian research publications over the last three decades is evidence that Canadians will continue to contribute to the development of the discipline as a whole.

Le développement de la science de l'information aux États-Unis a grandement été discuté dans la recherche. Par comparaison avec les É.-U., très peu est connu au sujet du développement de la science de l'information au Canada. Cet article présente une enquête sur les recherches faites dans le domaine par les Canadiens et décrit la croissance de la discipline au Canada.

Les données démontrent que la recherche canadienne traite surtout des sujets de classification et d'indexation ainsi que du stockage et de la recherche d'informations. Les plus grands collaborateurs viennent des Facultés de bibliothéconomie et de science de l'information, suivis de ceux des Départements d'informatique. Bien que des revues canadiennes furent fondées durant les années soixante-dix comme tribune de recherche, les Canadiens préfèrent encore publier dans les revues étrangères. La croissance cumulative de publications en recherche canadienne durant les trois dernières décennies est une évidence que les Canadiens continueront à contribuer au développement de la discipline.

Article:

Introduction

Information science, as an area of inquiry, evolved from documentation in the era after World War II (Shera and Cleveland, 1977). The discipline has undergone approximately forty years of development and is ripe for a review of its research composition. Although the development of the discipline in the United States has been broadly studied, the situation in Canada remains largely unexamined. This paper traces the development of the field in Canada through an analysis of the published research contributions Canadians have made to information science. As published research contributions Canadians have made to information science. As well, an overview of the Canadian literature is also presented, which reveals the research strengths within information science in Canada.¹

Literature review

West (1983), in her review of research and information science, found that there is no authoritative, definitive history of information science which clearly separates it from other fields, especially librarianship. A number of

reasons account for this absence of history. One is the difficulty of definition ... ; another is the relative youth of the field. (p. 2)

Despite the relative youth of information science, a few descriptive histories of the field have already been published. The early historical analyses (Harmon 1971; Rayward 1985; Shera and Cleveland 1977) attempted to reconstruct the history of the field and to show the basis of its foundation by discussing select papers that contributed to the development of the discipline. Harmon (1971) reviewed the growth of information science emphasizing the interdisciplinary nature of the field. Lilley and Trice (1989) focused on three facets of information science: activities that have become trends, people who have contributed to these trends, and environments in which these trends have occurred. The trends discussed relate to automation in general and automation in libraries. These historical analyses begin to address Shera and Cleveland's (1977) concerns for a badly needed "scholarly history of the documentation movement in the United States and the emergence of information science" (p. 267). Although there are a few reviews of the field by Canadians, these do not include a historical treatise nor a survey of information science in Canada. A more historical overview of the contributions Canadians have made and the evolution of this discipline in Canada is now available (Wolfram and Chu 1989).

The difficulty of defining information science is evident in the literature and continues to be a nagging problem for those in the information field. There are many analyses of information science which include discussions of its legitimacy as a discipline (Bertrand-Gastaldy 1980; Goffman 1970; Tague 1984; Vagianos 1972; West 1983), reviews of the many existing definitions (Wellisch 1972), and conceptual analyses (Houser 1988; Schrader 1984, 1986). Schrader (1984) has examined 695 definitions and conceptualizations of information science found in the scholarly literature published since 1900 and has developed a chronology of disciplinary names which have been used over the past eighty years. There are seven major categories among the forty or so terms proposed in the literature. These are bibliography, documentation, information retrieval, information science, informatics, bibliometrics, and related theoretical terms. Schrader (1986) found that the problems of arriving at a universally accepted definition are a result of

uncritical citing of previous definitions; conflation of study and practice; obsessive claims to scientific status; a narrow view of technology; disregard for literature without the science or technology label; inappropriate analogies; circular definition; and, the multiplicity of vague, contradictory, and sometimes bizarre notions of the nature of the term "information." (p. 192)

The difficulties experienced in defining information science stem from the different notions held of "information," which have led to the development and use of not one but various definitions. In his review of information concepts Belkin (1978) classified them into the following categories; selective information, general information, information as category and as property matter, formal semantic information, information as event, information and uncertainty, information and decision making, social, scientific information, information as knowledge surrogate, and information as structure. The lack of a common definition poses information scientists with one problem while the lack of varying methods of measuring information presents them with a second one. Traditionally, when librarians and information workers have conducted information-related research, they have adopted the documentary view which is the measuring and studying of information in terms of documents. The treatment of information in such physical terms means that the qualitative aspects of information are yet to be fully addressed. These include the value of information and knowledge, their meaning, and their transfer. Solutions to this measurement obstacle would further research and development of information theories.

The scope of information science adopted for this study covers aspects of information which can be studied. It is the study of information in all its forms, dealing with its creation, representation, organization, dissemination, and utilization. It spans the spectrum of cognitive, social, and mechanical aspects of information systems. This definition outlines that information science encompasses the study and understanding of any information-related activity and incorporates the approaches and methods of various disciplines to achieve its objectives. Therefore,

information science appears to have emerged not only as an expansion and metamorphosis of documentation and information retrieval; it directly incorporated or paralleled several prevailing objectives and concepts of the communication and behavioral sciences and other contributory disciplines. (Harmon 1971, 240)

Disciplines which have contributed to the formation of information science include documentation, librarianship, computer science, linguistics, and behavioral sciences.

A tool which would aid research but is lacking is an authoritative, comprehensive bibliography. Such a tool would make it possible to trace the development of information science through its publications. The existing bibliographies list only key works, but even the task of compiling such selected lists has not been particularly easy. Belzer and Robertson (1976) discovered that:

In reviewing the literature we found it difficult, if not impossible, to identify those publications which by themselves were keys to the unknown ... we decided to provide a sample of the literature which indicate these trends. (p. 35)

In addition, without a widely accepted definition of information science, it is impossible to compile a definitive bibliography of the field. At present a search through indexing and abstracting journals covering information science research (e.g., *Library and Information Science Abstracts*, *Information Science Abstracts*) offers the best substitute for a comprehensive bibliography. This approach was adopted for this study.

The origins of information science can be traced back to the early 1900s when bibliographic methods were being developed and implemented to manage the growing number of publications. During the 1920s to 1950s, the documentation era in the United States, research focused on controlling the rapid growth in scientific and technological publishing. During the latter part of this period research efforts were focused on automating this process. The 1950s to 1960s marked the initial research period into the process of information storage and retrieval. Information science came to the fore during the 1960s and was formally defined as a discipline in 1962 at the Georgia Institute of Technology Conference. The establishment and growth of the discipline were marked by the following events: publication of the *Annual Review of Information Science and Technology* beginning in 1966, the name change of the American Documentation Institute (ADI) to American Society for Information Science (ASIS) in 1968, and the publication of the *Journal of the American Society for Information Science*, formerly *American Documentation*, in 1970. In the 1970s, two areas of information-related research, informatics and bibliometrics, became prominent, broadening the scope of information science. A comprehensive chronology of events in the development of information science can be found in Lilley and Trice (1989, 144-49).

Events in Canada during the 1960s also marked the beginnings of formal information science training and research in this country. Little education in information science was available prior to the late 1960s in Canadian library schools (Rothstein 1965). The first Canadian library school to formally recognize information science as a component in its curricula, by incorporating the discipline in its title, was the School of Library and Information Science at the University of Western Ontario, founded in 1967. The remaining schools have since incorporated "information" into their titles. In 1968 an ASIS chapter was formed in Western Canada and began publishing its proceedings in 1969. Interest in information science in Canada led to the formation of the Canadian Association for Information Science in 1970 and later to the publication of the *Canadian Journal of Information Science* in 1976.

There are currently library and information science/studies master's degree programs at seven Canadian universities: Alberta, British Columbia, Dalhousie, McGill, Montréal, Toronto, and Western Ontario. The last two offer doctoral programs. In the fall of 1988 the University of Toronto began offering a separate program for a Master of Information Science. An information science component is offered in some computer science programs, such as at the University of Guelph and Queen's University. Other university departments, such as business, mathematics, and psychology, offer courses which fall under the scope of information science.

Methodology

It is possible to explain the nature of a field by "discovering what the basic concepts of a field are, who the practitioners of the field are, and what methods they use to solve the domain problems" (Houser 1988, 8). To explain the nature of information science in Canada, it was necessary to gather or develop the following: (1) a classification of the discipline outlining the scope of information science; (2) a list of contributors of Canadian research in information science; and (3) a list of research publications authored by the contributors in the previous list. The research literature was then surveyed to show the different areas of research concentration in Canada, the nature and extent of research contributions, the number of contributors, and the source of contributions.

The first task was to identify the areas which comprise the discipline of information science. In the absence of a comprehensive classification scheme of information science, a classification was developed by the investigators. The lack of a model of the discipline made the task difficult.² The classification for this study was created by examining and synthesizing the scope of definitions of information science, the curricula of information science programs, and the coverage of information science journals and indexing services. The resulting classification has divided information science into the following five major areas: bibliometrics, indexing and classification, human factors in information studies, information storage and retrieval, and information processes and social issues (See Appendix A) (Wolfram and Chu 1989). These areas reflect the interdisciplinary nature of the field.

Before Canadian research publications could be located, the names of researchers had to be identified. The time frame considered in the study spanned the years 1960 to 1988. Two types of researchers were located: those working in academic institutions, and those working in non-academic settings. Those contributors affiliated with Canadian educational or business institutions were accepted as Canadians. The following sources were used to compile a list of names of Canadian research contributors:

1. The annual directories of the Association of Library and Information Science Educators from 1960 to 1988. Canadian library and information science faculty who were listed under the headings "documentation," "information storage & retrieval," or "information science" were selected.³
2. The annual conference proceedings of the American Documentation Institute and American Society for Information Science to 1988.
3. The annual conference proceedings of the Canadian Association for Information Science from 1973 on.
4. Issues of *Canadian Journal of Information Science* from 1976 to 1988.
5. Issues of *Information Storage & Retrieval* and *Journal of Documentation* up to 1970 to obtain more data for the early period.
6. *ASIS 1989 Handbook and Directory*.

The authors recognize the possible parallel research being performed in disciplines such as management studies and some areas of computer science which may be published in other than information science journals. These publications would be indexed elsewhere and therefore are excluded from this study. It can be argued that such an exclusion would eliminate a considerable proportion of research. However, this paper attempts to deal primarily with the core areas of information science. Inclusion of possibly debatable peripheral areas of study would expand the scope of the field well beyond what was intended. As well, inclusion of authors who never publish in recognized information science journals, and who assumedly would not identify themselves as information scientists, would result in the unjust inflation of researchers in the field.

Once a list of Canadian information science researchers was compiled, all the researchers' publications indexed in *Library and Information Science Abstracts* (LISA) were located. The search was conducted on the compact disc (CD) version of LISA, which covers the period 1969 to April 1989. LISA offers comprehensive, international coverage of library and information science literature. Each researcher's name was searched; then each citation retrieved was evaluated to determine the study's research contribution to information science. A research contribution was considered to be a publication which served to advance knowledge in the field.

Publications which might be loosely termed research, such as reviews or descriptions of implementation of systems, were excluded. For example, a paper considered to be a research publication would be: Tague, Jean, 1981. The success-breeds-success phenomenon and bibliometric processes. *Journal of the American Society for information Science* 32(4): 280-86, which deals with the development of bibliometric models based on the success-breeds-success phenomenon. Conversely, a publication by the same author not considered to be a research publication would be:

Tague, Jean, 1981. The success-breeds-success phenomenon and bibliometric processes. *Journal of the American Society for Information Science* 32(4): 280-86.

Which deals with the development of bibliometric models based on the success-breeds success phenomenon. Conversely, a publication by the same author not considered to be a research publication would be:

Tague, Jean. 1979. Computer potential for management information. *Canadian Library Journal* 36(5): 268-70, which provides an overview of the applications of management information systems in libraries.

Each citation was categorized in the following manner:

- area of information science, according to the classification developed,
- year,
- institution, and
- document type, and periodical name where applicable.

Each citation, regardless of the number of authors, was recorded only once. The number of contributions made by each researcher was also recorded. Each author of a multiple-authored document was given credit for the document.

The collection of citations uncovered names of authors which were not in the initial list of researcher names. These names belonged to secondary authors of

Table 1. Publications by information science area

Field	Year											
	66	67	68	69	70	71	72	73	74	75	76	77
Bibliometrics	1				1		5	1		3	3	3
Indexing/classification		2		3	1		2	7	5	7	8	10
Human factors						1		1	1	1	3	2
Info. storage/retrieval		1	3		2	5	4	7	8	7	6	9
Info. processes/social issues			1	2	3		4	5	4	3	8	7
Total	1	3	4	5	7	6	15	21	18	21	28	31

Field	Year											
	78	79	80	81	82	83	84	85	86	87	88	
Bibliometrics		4	3	5	2	3	3	5	2	4	2	
Indexing/classification	6	7	8	5	8	6	5	6	5	8	4	
Human factors	5	7	1	5	7	5	5	12	10	5	2	
Info. storage/retrieval	13	10	1	15	6	5	1	2	8	10	3	
Info. processes/social issues	10	6	9	5	5	3	8		4	4	1	
Total	34	34	22	35	28	22	22	25	29	31	12	

multiple-authored publications and were added to the existing list of contributors. A search for papers by these authors was conducted on LISA. Additional Canadian contributions were located by searching the "source" field in LISA using the names of provinces. The citations retrieved from these additional searches were categorized according to the above criteria and added to the list of contributions.

In gathering the data an attempt was made to be comprehensive; however, exhaustivity cannot be claimed. In addition to the exclusion of documents neither indexed in LISA nor published in information science journals, the application of a rigorous definition of "information science research" precluded many publications.

Results

Our study uncovered 454 Canadian research publications in information science up to and including 1988, the earliest dating from the mid-1960s (See Table 1). During the early development of the discipline, research interests continued to concentrate on documentation and information retrieval, which were areas of research interest before the 1960s — that is, studies emphasizing the use of machines to aid in the process of storing, managing, and retrieving documents

Table 2. Publications by type

<i>Type of publication</i>	<i>Year</i>			<i>Total</i>
	1960s	1970s	1980s	
Monograph	1	13	4	18
Chapter	0	2	13	15
Technical report	0	1	4	5
Occasional paper	0	1	0	1
In periodical	19	200	196	415

Table 3. Periodical publications

<i>Periodical</i>	<i>Year</i>			<i>Total</i>
	1960s	1970s	1980s	
<i>Canadian:</i>				
CJIS		18	35	53
CAIS Proc.		46	2	48
Cdn. Lib. J.		6	8	14
Doc. & Biblio.		5	9	14
Argus		1	12	13
W. Can. ASIS Proc.		10	0	10
Biblio. Med. Can.		0	3	3
Alberta Lib. Bull.	1	1	0	2
QLA Bull.		0	1	1
MLA Bull.		0	1	1
Ont. Lib. Rev.		1	0	1
Total	1	88	71	160
<i>Foreign:</i>				
ASIS Proceedings	10	27	20	57
Info. Proc. & Mgt.	2	16	17	35
JASIS	1	16	15	32
J. Documentation	0	0	5	5
J. Info. Science	0	1	2	3
Lib. Sc. Slant Doc.	1	2	0	3
J. Chem. Doc.	1	1	0	2
Others	3	49	66	118
Total	18	112	125	255
Total: Cdn. & Foreign	19	200	196	415

using bibliographic data. Research into the human aspects of information was not published until 1971.

The cumulated data were fitted to models to examine the growth of research. Contributions increased exponentially until the early 1970s, but the growth has since been linear, averaging twenty-eight papers per year. Regression of the data from 1972 onwards shows that a linear model provides the best fit where the coefficient of determination (R^2) is 99.7%. When all the data were included in the linear regression model the R^2 value dropped slightly to 96.9%. In other words, there were few publications in the beginning; then there was a quick increase of publications until 1972, when research output began to level off.

The areas which have received the most research attention in Canada are "indexing and classification" and "information storage and retrieval," with 113 and 126 papers respectively. In the 1970s these areas along with "information processes and social issues" were the focus of research, while "human factors in information studies" became a timely research area in the mid-1980s.

Canadian contributions are distributed by document type as follows: 415 periodical articles and 39 non-periodical publications (see Tables 2 and 3). Non-periodical publications included monographs, book chapters, occasional papers, and technical reports. English is the most frequently used language of publication.

More research articles have been published in foreign than in Canadian periodicals. An average of 30% of the periodical literature is published in Canadian sources: whereas 160 periodical articles were published in Canada, 255 were published elsewhere. It was rare to find more articles published in domestic over foreign periodicals in a given year. This only occurred during the years 1974, 1976, 1979, and 1980 (see Table 4). The majority of Canadian articles were published in the *Canadian Journal of Information Science* and the proceedings of the annual Canadian Association for Information Science conference. The three foreign periodicals publishing the most Canadian research were the proceedings of the annual ASIS conference, *Information Processing & Management* (including *Information Storage & Retrieval*), and the *Journal of the American Society /or Information Science*.

There were 268 authors responsible for Canadian contributions (see Table 5). While more than half of the authors contributed only one paper, twenty-two authors published more than five articles each. Of these twenty-two prolific authors, five are affiliated with the University of Western Ontario. This distribution of research fits an inverse model of research productivity, whereby there are few high producers of research and inversely there are many researchers contributing only one article.

Contributors represented various backgrounds including academe (library and

Table 4. Distribution by year between Canadian and foreign periodical publications

Year	Foreign		Canadian	
	No.	Prop.	No.	Prop.
1966	1	1.00	0	0.00
1967	2	1.00	0	0.00
1968	4	1.00	0	0.00
1969	4	0.80	1	0.20
1970	7	1.00	0	0.00
1971	5	1.00	0	0.00
1972	9	0.60	6	0.40
1973	18	0.86	3	0.14
1974	4	0.24	13	0.76
1975	12	0.57	9	0.43
1976	10	0.40	15	0.60
1977	16	0.57	12	0.43
1978	16	0.53	14	0.47
1979	13	0.45	16	0.55
1980	9	0.47	10	0.53
1981	16	0.62	10	0.38
1982	18	0.75	6	0.25
1983	14	0.70	6	0.30
1984	14	0.70	6	0.30
1985	19	0.76	6	0.24
1986	16	0.55	13	0.45
1987	18	0.58	13	0.42
1988	10	0.91	1	0.09
Total	255		160	

information science, computer science and management, etc.), industry, government, and libraries (See Table 6). Almost half of the publications (112) came from academic institutions. With the exception of one librarian, all authors who published more than five works were from academic departments.

Discussion

A review of Canadian research publications in information science shows that the development of information science in Canada has not been very different from

Table 6. Background of authors

Background	No. of works															Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	24	25	
Lib./info. sci.	20	12	6	7	5	2	3	2		1		1		1	1	61
Comp. sci./mgt.	12	2		1			1	2	1	1	3		1			24
Other academic	18	7		1					1							27
Industry	23	4		1	3											31
Government	14	7	2	1												24
Libraries	21	7	6		3					1						38
Unknown	52	8	3													63

that in the United States (Shera and Cleveland 1977; Lilley and Trice 1989). However, little Canadian research in information science was being published before the 1970s. Research publications dealt with all areas of information science. Research output was highest in "Classification & Indexing" and "Information Storage & Retrieval," and a noticeable growth in "Human Aspects of Information Science" research occurred in the 1980s.

Research relating to the above three areas continues to receive strong attention, for technology is always advancing and adopted to improve information access and storage. "Automated Processes (Indexing, Translation, Editing)," a subarea of "Indexing and Classification," accounted for more than one-third of the research output in that area between 1970 and 1988 (twenty-one out of fifty-three publications in the 1970s and twenty out of fifty-five publications in the 1980s). As it became more apparent that information systems developed with little or no consultation with users and potential users were not working, interest in human aspects of information science increased. Researchers have become aware of their need to know how users process information, how they use it, and how they go about obtaining it, especially in an automated environment. "Interface Design (Human-Machine Interaction)" and "Online Searching/Query Negotiation" were the two sub-areas which accounted for more than half of the publications in "Human Factors in Information Science" research (twelve out of twenty-one documents in the 1970s and thirty-seven out of fifty-two documents in the 1980s (to 1988)).

As stated earlier, most of the research has been published in foreign periodicals. The introduction of Canadian periodicals covering information science has provided additional sources for Canadians to publish their research but has not significantly reduced the numbers of research articles appearing in foreign Periodicals. An inspection of the proportions of Canadian versus non-Canadian periodical publications over time reveals that there is a noticeable difference

Table 5. Contributions per author

No. of works	1	2	3	4	5	6	7	8	9	10	11	12	13	24	25
No. of authors	160	47	17	11	11	2	4	5	2	2	3	1	1	1	1

between publications appearing in Canadian and foreign periodicals; however, the difference is reduced in the 1980s.

Although Canada is officially bilingual (English/French), the most frequently used language of publication is English. Three periodicals from the province of Quebec publish French-language information science research. These are *Amus*, *Documentation & bibliothèque*, and *QLA Bulletin* (Quebec Library Association), which accounted for twenty-eight documents. Although some of the papers appearing in these periodicals contribute to the general knowledge of information science, most articles deal with local concerns. *Documentaliste*, a non-Canadian journal, has also published Canadian research in French.

Information science researchers draw upon many disciplines to understand the various aspects of information use, transfer, storage, and access and to develop information theory. It is then no surprise that information science research involves not only scholars from library and information science but also from other disciplines. Although the data represent those publications indexed by LISA or published in information science journals and do not include publications outside of these sources, the institutional affiliations show the interdisciplinary nature of the field. Other disciplines that generated information science research include computer science, mathematics, management, business, and education, with the largest number of publications coming from computer science. Research from computer science deals with automated information storage and retrieval.

In his editorial on the current state of information science research, Katzer (1988, 83) found that there is a lack of research, giving three major causes for this situation:

1. Too much of what has been called research falls under the heading of consulting or demonstration projects.
2. Too few of our academic and professional colleagues have the inclination or training needed for research.

3. Not enough resources are available to support the conduct of research on anything more than an opportunistic basis.

The Canadian research situation fits Katzer's description. A search through the literature revealed many descriptions of automation projects. These works, however, were not included in this study, as a rigorous definition of research was used which excluded descriptions of applications. Although these descriptions may not further knowledge in information science, they are helpful to other information workers who plan to be involved in similar projects.

This study found there were about as many information professionals as academics publishing research. Not counting the 63 contributors from unknown sources, 93 were professionals and 112 were academics. When one considers research output, academics are expected to publish and on average do publish more than professionals. However, it is not possible to overlook the fact that there are many more professionals than academics in the field who could be doing research and many academics who do not do much research. Low research output in information science may be explained by the following factors: (1) some older faculty members come from the library profession and may be more interested in *doing* library-related research; (2) few graduates from library and information science schools would have the training to do research because most Canadian schools require students to take only one basic research methods course; (3) professionals are hired to do information work and do not have the time to do research, although those who are involved in automation projects often publish descriptions of their experiences. Again, these descriptions were not included in our data.

Limited funding sources for information science research for Canadians restrict the number and type of research projects which researchers may conduct (*Funding of Library Research in Canada* 1984). These agencies are more likely to support applied research, such as design of information retrieval systems, assessment/ evaluation studies (e.g., use of the library by seniors), and compilation of research tools (e.g., bibliographies, thesauri, indexes), instead of theoretical or exploratory research.

In 1971 Harmon predicted that "information science will be fully mature, with pronounced specialization within its ranks [about 1990]" (p. 239). This prediction has not materialized, as many researchers in library and information science are still grappling with its identity: Is it a discipline or a profession? Is it an area which can be incorporated into other disciplines such as library science, sociology, psychology, management? Does it have a research base?

Conclusion

The information science research record in Canada has spanned the wide-ranging interests of the discipline, as demonstrated by the published research contributions. Activities in the late 1960s and early 1970s helped to establish information science as a discipline in Canada. Such activities included the introduction of graduate programs and research journals devoted to information science. One can argue that more research, both applied and theoretical, is still needed to firmly set the foundations of the field. However, it is unlikely that a greater knowledge base than already exists will provide sudden illumination about the hidden nature of information science which has eluded researchers until the present. Therefore, Canadian information scientists should focus further on conducting more rigorous research using appropriate methodology, as well as studies which build upon previous efforts and have a theoretical base. Applied research, which can be isolated in nature, should be de-emphasized. Canadian research will grow with the availability of: (1) more funding, (2) academic and professional colleagues inclined and trained to do research, and (3) education programs which will train and motivate academics as well as professionals to do research.

This survey provides only one picture of the development of information science in Canada. Future studies are needed to examine the research methodology used, and to make comparisons with the development of information science in other countries. To facilitate research, a comprehensive bibliography of the field is also needed.

Notes

- 1 "Canadian literature" is defined as materials published in Canada by Canadian residents as well as materials published in other countries by authors who are Canadian residents.
- 2 During the writing of this paper, a classification was published by *JASIS* (1989, 303), but the authors decided to maintain their own which, it is felt, adequately outlines the various areas of information science research.
- 3 Other sub-areas subsumed by information science (e.g., bibliometrics) have also been included in the directory since the mid-1980s and were checked. However, the newness of the terms and the large overlap of names with the above categories produced few new authors.

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Appendix A: Classification of Information Science

- B00 Bibliometrics
- B01 Applications
- B02 Citation Analysis
- B03 Laws
- B04 Measure

- C10 Indexing and Classification
- C11 Indexing
- C12 Classification
- C13 Abstracting
- C14 Applications
- C15 Authority Control/Controlled Vocabulary/Thesaurus
- C16 Automated Processes (Indexing, Translation, Editing)
- C17 Bibliographic Control/Documentation
- C18 Cataloguing
- C19 Evaluation of Systems
- C1A Linguistic Issues

- H20 Human Factors
- H21 Applications
- H22 Cognitive Processes/Cognitive Styles
- H23 Information Seeking Behaviour (Use, Needs)
- H24 Interface Design (Human-Machine Interaction)
- H25 Online Searching/Query Negotiation

- I30 Information Storage and Retrieval
- I31 Information Storage
- I32 Information Retrieval
- I33 Applications
- I34 Conceptual Models (Data Models, Retrieval Models)
- I35 Expert Systems/Artificial Intelligence
- I36 Modelling and Simulation
- I37 Systems Analysis/Evaluation (Recall and Precision)
- I38 Systems Design

- P40 Information Processes/Social Issues
- P41 Economics of Information
- P42 Information Networks/Flow
- P43 Scholarly Communication
- P44 Sociology of Knowledge
- P45 Education and Research
- P46 Information Science (General)