Portraying the Landscape of Canadian Library and Information Science Research

Adèle Paul-Hus
Université de Montréal, Montréal, QC, Canada

Philippe Mongeon
Université de Montréal, Montréal, QC, Canada

Fei Shu
McGill University, Montréal, QC, Canada

Abstract: This paper provides a global portrait of the current Canadian Library and Information Science (LIS) research community. Looking more specifically at disciplines and country affiliations of co-authors, and research topics of faculty members, our results depict a mostly national and LIS-oriented community of collaboration.

Résumé: Cette étude vise à fournir un portrait global de la communauté de recherche en bibliothéconomie et sciences de l'information au Canada. L'analyse de l'affiliation disciplinaire, du pays d'affiliation des coauteurs ainsi que des sujets de recherche des professeurs en sciences de l'information dépeint une communauté principalement canadienne et majoritairement affiliée à des institutions des sciences de l'information.

Keywords: bibliometrics, library and information science, collaboration, research topics, Canada

1. Introduction

The knowledge and intellectual structure of a field can be studied through various methods. However, these methods have one point in common; they rely on published documents. According to Chang, Huang and Lin (2015), three main groups of methods have been used to study Library and Information Science (LIS) research topics: content analysis of published literature, bibliographic analysis, and combinations of various methods belonging to either the first or second category. Bibliographic analyses are mostly based on keywords, co-citations, co-authorship and bibliographical coupling. Using direct citations, bibliographic coupling, and co-authorship analyses for publications from 1978 to 2007, Chang and Huang (2012) found that LIS researchers heavily cite publications of fellow LIS researchers and that most co-authors of LIS articles are affiliated with LIS-related institutions. In their bibliometric analysis of the first hundred years of LIS research, Larivière, Sugimoto and Cronin (2012) used a combination of content analysis and bibliographic methods (terms and topics, and citations) to show that even though LIS programs are fewer in number and in size than some other Social Sciences and Humanities departments, they have developed through their history an "identifiable institutional character and share a distinct academic/professional ethos" (p.998).

However, disciplines and their constitutive communities do not evolve in silos. LIS research shares topics, tools, and methods with other disciplines, which in turn influence each other. In fact, many authors have discussed the interdisciplinary nature of the LIS field (e.g., Bates 1999; 2007; Vickery 1997). Bates (1999) described Information Science as a meta-field with links in

all traditional fields of scientific inquiry, from Arts and Humanities to Natural Sciences and Mathematics. She also showed how the spectrum of topics and sub-topics that are of interest to the Information Science community are aligned with the spectrum of traditional disciplines. In that sense, LIS is not a monolithic block forming one unique community of interrelated scholars, but can rather be perceived as a multitude of smaller communities that together form a large one. In addition those many internal communities, the interdisciplinary nature of LIS suggests that the field itself has permeable boundaries and that LIS scholars also participate in many communities outside the boundaries of the field.

Larivière, Sugimoto and Cronin (2012) report that numerous context-specific studies investigated LIS research in particular countries in the last decade (e.g. Slovakia, Botswana, Great Britain, Poland, Spain, and China) and conclude that geography, language and political systems all contribute to shaping a scientific community. The purpose of this paper is thus to provide a portrait of the current LIS academic community in Canada by looking at the various communities (both within and outside LIS boundaries) that Canadian LIS faculty members participate into. The Canadian LIS research landscape will be analysed using the scientific production of its faculty members in order to identify its constitutive communities based on disciplines and country of affiliation of their collaborators. More specifically, this paper aims at providing answers to the following research questions:

1) With which countries are Canadian LIS authors collaborating?
2) With which disciplines are Canadian LIS authors collaborating?
3) What are the self-declared research topics of Canadian LIS faculty members?

2. Methodology

For the purpose of the present study, the Canadian LIS research community members are defined as all faculty members affiliated to a school or department of LIS in a Canadian university according to ALISE Directory of Library and Information Science Programs and Faculty (2013) which includes the following eight institutions: Dalhousie University, McGill University, University of Alberta, University of British Columbia, Université de Montréal, University of Ottawa, University of Toronto and University of Western Ontario. ALISE Directory also provides the teaching and research areas of each faculty member following ALISE's LIS Research Areas Classification Scheme. A manual update of the ALISE 2013 Directory of Library and Information Science Programs and Faculty was done in July 2015 and used as a source of this study. The following analyses are based on the publications of the 120 faculty members listed in ALISE Directory.

Typically, bibliometric analyses are performed using databases like Web of Science and Scopus. However, numerous studies have found that these data sources do not cover extensively Social Sciences and Arts and Humanities (Archambault, Vignola-Gagné, Côté, Larivière and Gingras, 2006; Gavel and Iselid, 2008; Hicks and Wang, 2011). Mongeon and Paul-Hus (2016) have also shown that Web of Science and Scopus journal coverage have a strong English-language overrepresentation, which can have important effect when considering the scientific output of a research community where English is not the sole language of publication, such as the Canadian LIS community. Thus, using Web of Science and Scopus can only provide an incomplete portrait of an interdisciplinary field like LIS.

Google Scholar provides free access to scholarly documents of all types, languages and for all fields. Even though its suitability for bibliometric analyses has been questioned in regards of various inconsistencies in the data (Clermont and Dyckhoff, 2012) and a lack of transparency of the coverage (Wouters and Costas, 2012), it remains the most comprehensive source of scientific documents. Comparing bibliometric indicators of LIS scholars using Web of Science, Scopus and Google Scholar, Meho and Yang (2007) have shown that Google Scholar had the most extensive coverage of conference proceedings and non-English language journals. With these considerations in mind, we used Google Scholar to retrieve manually all research articles, proceedings, reviews, book chapters and monographs published between 2010 and 2015 by all members of the above defined Canadian LIS community. A total of 1,580 publications by 1,448 distinct authors were retrieved through Google Scholar. In comparison, a similar search in the Web of Science retrieved less than 21% (331 publications) of these LIS faculty members output. Moreover, for each publication, we retrieved all collaborators and their affiliation (country, institution and department) in order to map the different communities which LIS faculties participate into.

Once the data collection was completed, disciplines were assigned to each author of the corpus, based on their departmental (or institutional) affiliation and using the National Science Foundation discipline classification (National Science Foundation, 2006). It should be noted that given the LIS focus of our analysis, an inclusive conception of LIS as a field was favored here and authors either affiliated to an LIS school, department, library or archives center were all included under the "Information Science & Library Science" NSF category. Country assignation for each author was also based on the institutional affiliation.

We used the open-source software Gephi to visualize the communities formed by self-declared teaching and research topics of interests of faculty members, as indicated in the ALISE Directory. A link is formed between two topics when they are both associated to a single faculty member. The weight of a topic is measured by the number of individuals associated to it.

3. Results
Table 1 presents the scholarly production of Canadian LIS schools and departments for the 2010-2015 period. Almost half (48%) of the scholarly output was published as research articles, 39% were conference proceedings, and less than 13% were books or book chapters. These results confirm that the main mean of knowledge diffusion in LIS remain the research article, as compared to other fields, close to LIS in terms of collaboration, where conference proceedings (e.g. Computer Science and Engineering) and books (e.g. History) are the predominant forms of scholarly communication.

Table 1. Scholarly production of Canadian LIS schools and departments, 2010-2015

University	School/Department	Faculty members	Articles	Conference proceedings	Books/book chapters	Total Publications
Dalhousie University	School of Information Management	7	44	42	12	98
McGill University	School of Information Studies	13	99	90	27	216
Université de Montréal	École de bibliothéconomie et des sciences de l'information	15	111	63	31	205
University of Alberta	School of Information	8	57	39	12	108
University of British Columbia	School of Library, Archival & Information Studies	12	63	86	18	167
University of Ottawa	School of Information Studies	9	55	8	17	80
University of Toronto	Faculty of information	33	144	168	53	365
University of Western Ontario	Faculty of Information and Media Studies	23	190	120	31	341
Total		120	763	616	201	1,580

Based on worldwide data, Larivière, Sugimoto and Cronin (2012) found that sole authorship was the norm in LIS publications until the 1960s when co-authorship started to increase to attain an average of 2.4 authors per article in 2010. The Canadian corpus shows similar results with an average of 2.5 authors per article, for the 2010-2015 period, and an average of 2.7 authors per publication, when considering all types of documents.

Table 2 shows the country of affiliation of the 1,425 authors for whom the information was available (the country affiliation of 23 authors could not be found). Even though Canadian LIS faculty members collaborated with researchers from 43 different countries, more than 58% of the co-authors of our corpus were affiliated to a Canadian institution, depicting a mostly national network of collaboration. The USA appears as the closest collaborating country with 18% of authors in our corpus affiliated to an American institution. Remaining countries of collaboration appear as marginal with shares of less than 5% of authors for each country.

Table 2. Authors' country of affiliation

Country	Number of authors	%
Canada	852	58.8%
USA	261	18.0%
UK	70	4.8%
France	30	2.1%
China	28	1.9%
Germany	24	1.7%
Italy	13	0.9%
Greece	12	0.8%
Israel	11	0.8%
Sweden	11	0.8%
34 other countries	*10 or less*	*0.7% or less*

Note: 23 authors with unknown country affiliation are not displayed in the table

The analysis of authors' affiliation shows that the vast majority (71.3%) of authors included in our corpus are affiliated to Library and Information Science schools, departments or institutions (e.g. archives center or library). The proportions of authors from the LIS field vary from 62.3% for Dalhousie University to 80.2% for the University of Alberta. However, it should be noted that from the 1,448 distinct authors in our dataset, the discipline's affiliation of 112 authors could not be found; of those 51 were affiliated to private companies.

In order to examine the multidisciplinary nature of Canadian LIS research, Table 3 presents disciplinary affiliation of authors contributing to the research output, excluding affiliation to LIS institutions. Disciplines for which less than 10 distinct affiliations were found were merged into larger groups: *Social Sciences (others)* thus namely includes Anthropology, Criminology, Economics and Social Work, *Natural Sciences* includes disciplines such as Chemistry, Environmental Science and Mathematics, and *Engineering (others)* regroups all engineering disciplines with the exception of Computer Science.

Table 3. Disciplines of co-authors by university (excluding LIS)

	Dalhousie University	McGill University	University of Western Ontario	Université de Montréal	University of Alberta	University of British Columbia	University of Ottawa	University of Toronto	Total
Computer Science	42%	39%	24%	35%	6%	34%	10%	50%	36%
Health	6%	1%	15%	0%	12%	1%	12%	10%	8%
Arts & Humanities	1%	10%	4%	7%	52%	5%	0%	6%	7%
Clinical Medicine	2%	11%	15%	1%	2%	1%	2%	5%	7%
Communication & Media	2%	1%	3%	1%	4%	15%	6%	4%	4%
Management	9%	2%	6%	1%	0%	8%	2%	2%	4%
Engineering (Others)	0%	12%	0%	7%	0%	0%	0%	1%	3%
Natural Sciences	15%	6%	1%	0%	0%	1%	4%	1%	3%
Social Sciences (Others)	1%	1%	8%	3%	0%	1%	2%	1%	3%
Sociology	8%	0%	4%	3%	0%	2%	15%	1%	3%
Science Studies	0%	0%	0%	21%	2%	0%	0%	0%	3%
Law	0%	0%	3%	0%	0%	1%	38%	0%	2%
Education	0%	2%	3%	0%	12%	3%	0%	1%	2%
Political Sc. & Public Admin.	1%	0%	1%	2%	0%	3%	0%	4%	2%
Psychology	0%	3%	1%	1%	2%	0%	0%	1%	1%
Geography	2%	1%	0%	5%	0%	0%	2%	0%	1%
Language & Linguistics	0%	0%	0%	3%	4%	1%	6%	0%	1%
Multidisciplinary	0%	0%	2%	2%	0%	1%	0%	0%	1%
Unknown	11%	9%	9%	7%	6%	26%	2%	12%	11%

The closest discipline to LIS, in terms of the number of co-authors' affiliation, appears to be Computer Science, which represents 36.5% of all non-LIS affiliations, all universities taken together. However, Computer Science is particularly important at University of Toronto (49.8%), and Dalhousie University (41.5%). Authors affiliated to Health disciplines (e.g., Nursing, Public Health, Rehabilitation and Geriatrics & Gerontology) represent an important proportion of collaborators at the University of Western Ontario (15.1%), University of Ottawa (11.5%) and University of Alberta (11.5%). Affiliation to Arts and Humanities disciplines (e.g., Arts & Architecture, Design, History, Literature, and Philosophy) appears to represent more than half (51.9%) of all non-LIS contributors at University of Alberta. Disciplines of all co-authors contributing to LIS research at the University of Alberta thus appear to be highly concentrated in

two fields: Library and Information Science, accounting for 80.2% of the department's output and Arts and Humanities, accounting for 10.3%.

Collaborators from Law represent 38.5% at the University of Ottawa. The proximity with Law at the University of Ottawa can probably be explained by the collaborators of a cross-appointed professor affiliated to both the Faculty of Law and the School of Information Studies of the University of Ottawa. Science Studies represent a significant field of collaboration for Université de Montréal authors with a share of 21.2% of non-LIS collaborators. Authors affiliated to Communication and Media appear as an important field of collaboration for the University of British Columbia while collaborators from Natural Sciences disciplines are mostly associated with authors from Dalhousie University.

Figure 1 shows the network of topics communities based on LIS faculty members teaching and research topics of interest (ALISE, 2013). Six clusters were defined using Blondel's algorithm (Blondel, Guillaume, Lambiotte and Lefebvre, 2008). The technology oriented topics–which include topics like *Information Systems and Technologies*, *Information Visualization*, *Users and Uses of Information Systems*, *Information Retrieval*, and *Human-Computer Interaction*– constitute the most central cluster. Indeed, the two most frequent topics of the whole network are *Information Systems and Technologies* and *Human-Computer Interaction*, respectively mentioned by 24% and 18% of faculty members. *Users and Uses of Information Systems*, *Information and Society/Culture*, and *Information Needs and Behaviors/Practices* constitute the remaining core topics of Canadian LIS faculty members, with frequencies of more than 15%.

Four other main clusters are formed around the technology oriented cluster; the users and services oriented cluster, the archival oriented cluster, the cataloging and indexing oriented cluster and the LIS philosophy, policy and management oriented cluster. These five topics communities form the main component of the network. Finally, an isolated cluster of museum oriented topics is found at the periphery of the network. The absence of connections between this last cluster and the main component of the network shows a clear delimitation of two distinct areas of research. Inversely, none of the five other communities appears isolated from the others which means that faculty members are interested in diversified topics that belong to different clusters.

Each of the other clusters shows a technology related aspect which explains the centrality of the technology oriented cluster. Furthermore, these topics are typically situated closer to the center of the network. For instance, the *Metadata and Semantic Web* topic form an important bridge between the cataloging and indexing cluster and the technology cluster. The *Electronic Documents* topic creates a similar bridge between the archives cluster and the technology cluster. In the users and services cluster, *Information Needs and Behaviors/Practices*, and *Research Methods* are the two topics most closely interconnected to the technology cluster. *Information and Society/Culture*–a topic that belongs to the LIS philosophy, policy and management cluster– form an important bridge with the technology cluster but it is also connected to other clusters. This reflects the rather broad nature of that particular topic within the LIS field.

Looking closely at clusters' composition, some topics appurtenance to a certain cluster can appear counterintuitive. This is the case of *Pedagogy in LIS*, and *Services for Senior Citizens* which according to our data belong to the technology cluster. However, in that example, this

association is the result of a single individual's interest in those two topics as well as in *Information Architecture* and *Human-Computer Interaction*.
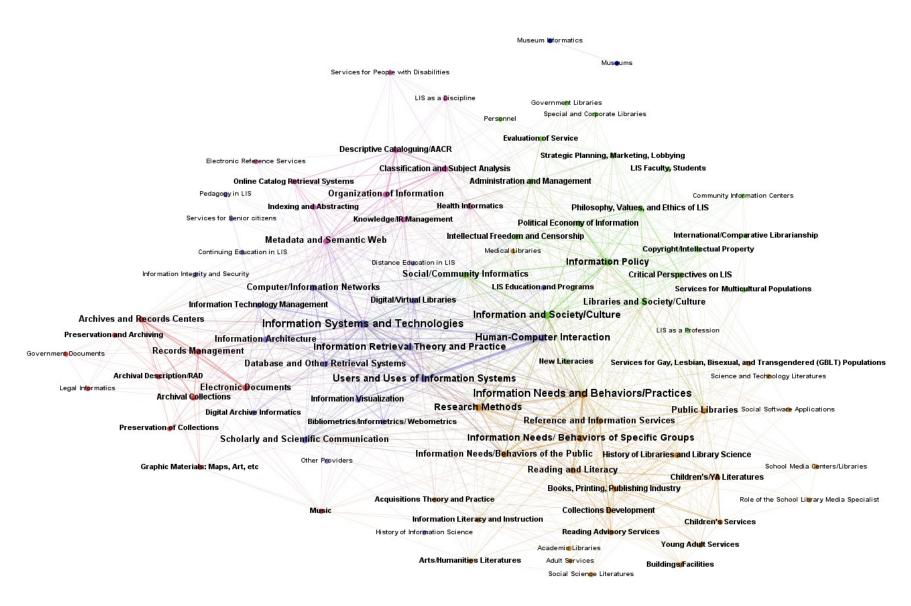
Figure 1. Communities formed around teaching and research topics of Canadian LIS faculty members

4. Limitations

Some limitations of this study should be acknowledged. Firstly, the Canadian LIS community was here limited to faculty members of LIS schools or departments, which represent the core group of scholars who contribute to the LIS research landscape in the country. However, LIS students and professionals also contribute to the research in the field. These contributions are captured in our dataset when they are done in collaboration with LIS faculty members, but would not be included if not produced in collaboration with faculty members. Secondly, another potential limitation is inherent to the source used to analyse the teaching and research topics of interest since the ALISE's Research Areas Classification is restricted to LIS related topics. Hence, faculty members' topics of interest are limited to the classification proposed and do not cover topics outside the boundaries of LIS. Finally, the relatively small number of faculty members (Canadian faculty members listed in the ALISE Directory) included in the topics' network analysis can also constitute a limitation. Indeed, the defined clusters show some counterintuitive associations between certain specific stopics that can be, for example, caused by the fact that a single researcher is interested in a particular combination of topics. Generally speaking, such limitations could be avoided by using larger datasets. This was however not possible in the present case since the whole population of Canadian LIS faculty members was included and analysed.

5. Discussion and conclusion

This paper provides a global portrait of the current LIS research in Canada looking more specifically at the various communities that emerge from the collaborative knowledge production of faculty members. Our findings show a highly national and interdisciplinary network, with many collaborators affiliated to fields outside of LIS. In the last decades, multiple authors have discussed the very nature of LIS (or IS) as a field, and many have questioned the fact that the field's constituting disciplines and specific research topics actually form a united and autonomous whole (Fondin, 2006; Wilson 2002). Such a lack of cohesion would be translated in a low number of connections between LIS co-authors and topics as well as in a high number of connections with co-authors from other disciplines. The multidisciplinary nature of the LIS field is here further demonstrated by the different disciplines with which Canadian LIS faculty members collaborate, as shown in Table 3.

However, our results also show that collaboration with co-authors from the same field is stronger than with co-authors from another field, as more than 70% of authors contributing to the Canadian LIS research output are affiliated to LIS-related institutions. The Canadian LIS community appears to behave in a manner that is similar to what is observed worldwide as our results corroborate what was found by Chang and Huang (2012). The network analysis of self-declared teaching and research topics of interest (Figure 1) shows that LIS do form a coherent but multifaceted field and not a simple combination of heterogeneous topics, since the clusters defined in the LIS topics network appear highly interconnected to each other.

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