Web-scale Discovery Service Adoption in Canadian Academic Libraries
L'adoption des services de découverte en ligne par les bibliothèques universitaires canadiennes

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Article abstract

This study presents an overview of web-scale discovery service adoption in Canadian academic libraries. Web-scale discovery services (WSDS) have been widely embraced in Canadian academic libraries. EBSCO Discovery Service (EDS) is the most adopted system for colleges and institutes while Primo Central from Ex Libris dominates the university market for web-scale discovery services. Bundling web-scale discovery services with library services platform (LSP) implementations are increasing in Canada. This study shows that Canadian academic libraries that have migrated from a traditional integrated library system (ILS) to an LSP have also opted for their LSP vendor's corresponding web-scale discovery service. As more Canadian academic libraries implement an LSP bundled with a web-scale discovery service, there may come a time when web-scale discovery services are no longer separated from discussions on LSPs. The choices available for LSP and web-scale discovery services are shrinking due to vendor mergers and acquisitions in this area.

Web-scale Discovery Service Adoption in Canadian Academic Libraries

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Abstract

This study presents an overview of web-scale discovery service adoption in Canadian academic libraries. Web-scale discovery services (WSDS) have been widely embraced in Canadian academic libraries. EBSCO Discovery Service (EDS) is the most adopted system for colleges and institutes while Primo Central from Ex Libris dominates the university market for web-scale discovery services. Bundling web-scale discovery services with library services platform (LSP) implementations are increasing in Canada. This study shows that Canadian academic libraries that have migrated from a traditional integrated library system (ILS) to an LSP have also opted for their LSP vendor's corresponding web-scale discovery service. As more Canadian academic libraries implement an LSP bundled with a web-scale discovery service, there may come a time when web-scale discovery services are no longer separated from discussions on LSPs. The choices available for LSP and web-scale discovery services are shrinking due to vendor mergers and acquisitions in this area.

Keywords

web-scale discovery services, discovery services, index-based discovery, WSDS, Canadian academic libraries, academic libraries, universities, colleges, institutes, post-secondary libraries

Web-scale Discovery Service Adoption in Canadian Academic Libraries

The rise in the acquisition of electronic resources by academic libraries spurred vendors and entrepreneurs to develop library technologies to manage access to these same resources. First came link resolvers with their associated knowledge bases (KBs) to facilitate openURL linking between electronic resources. Then came electronic resource management (ERM) systems to help librarians manage and administer increasing numbers of licensed electronic resources. Often, an academic library would subscribe to ERM and link-resolving services from a single service provider. When these same vendors introduced web-scale discovery services, the bundling of these services became more common. Since a web-scale discovery service often involved managing resources in a KB-like environment, many libraries looked for ways to simplify the maintenance of multiple KBs or moved their existing link resolver and KB service to their web-scale discovery service provider altogether (Breeding, 2012, p. 176). In recent years, academic libraries have been replacing their traditional integrated library systems (ILS) with new resource management systems often referred to as library services platforms (LSP). Where ILSs were initially developed to manage the acquisition and circulation of primarily print resources, LSPs are designed to manage resources in a variety of formats without the need for additional external services such as a separate link resolver or an ERM system. These LSPs are frequently bundled with the vendor's corresponding web-scale discovery service.

In this study, a web-scale discovery service means a service that includes pre-harvested and indexed metadata from multiple sources to form a unified central index (Vaughan, 2011). Breeding has referred to this as an "index-based discovery service" or a "discovery service (with index)" (2018). However, the term web-scale discovery service will be employed in this study, in keeping with the terminology used in the majority of research published on this topic.

A discovery layer means the front-end user interface for a library's resources. A discovery layer may be a library's traditional online public access catalogue (OPAC) derived from an ILS or a separate service used to present metadata from an ILS as well as other sources of data. Discovery layers do not inherently come with a unified central index. However, discovery layers may access and present metadata from a third-party's unified central index. Discovery layers are the descendants of "next-generation catalogues." Defined by Breeding, next-generation catalogues include a visual and intuitive interface, faceted navigation, enriched content such as book cover art, reviews and tables of contents, relevancy rankings, and Web 2.0 user contributions to add social interactions between the library and its users (2007, p.11). Where next-generation catalogues obtain most of their metadata from a library's ILS, discovery layers may access and present information and metadata from a variety of sources: an ILS, an institutional repository, a unified central index, as well as other sources. Web-scale discovery services are discovery layers that come with their own unified central index.

Research Purpose

The purpose of this paper is to provide an overview of web-scale discovery service adoption among Canadian academic libraries. Research questions include:

- How widely have Canadian academic libraries adopted web-scale discovery services and which services have they adopted?
- Are there any differences between the type of institution (college/institute or university) and web-scale discovery service adopted?
- Is there a relationship between a library's collection budget and their choice of web-scale discovery service?
- Do student enrollment numbers impact a library's choice of web-scale discovery service?
- What is the relationship between a library's web-scale discovery service and their ILS or LSP, if any?
- What impact has recent mergers and acquisitions among ILS, LSP and web-scale discovery service vendors had on library choices for such services?

By creating a dataset of Canadian academic libraries containing variables such as web-scale discovery service, ILS or LSP service adopted, collection budget expenditure, library type, and student population, the author identified trends in web-scale discovery service adoption in Canadian academic libraries.

Web-scale Discovery Service Players

There are four web-scale discovery services in the academic library market. However, web-scale discovery services do not operate in isolation. Understanding the relationship between these discovery services, their parent organizations, and ILS or LSP services adds insight and awareness into the academic library market. This information can help librarians make informed choices about the systems they select to manage their collections, provide access, and facilitate resource discovery for their users.

OCLC

OCLC is a non-profit membership organization primarily known for its cataloguing services to libraries. OCLC developed the first web-scale discovery service called WorldCat Local, launched in 2007 (Vaughan, 2011, p. 12). In 2014, OCLC released a new service called WorldCat Discovery, designed to replace WorldCat Local. By the end of August 2019, WorldCat Local subscribers had migrated to WorldCat Discovery and WorldCat Local was withdrawn. Indeed, WorldCat Discovery was automatically included for libraries with existing OCLC FirstSearch subscriptions. Breeding speculated that including WorldCat Discovery with libraries' existing FirstSearch subscriptions might have been OCLC's attempt to entice libraries away from its discovery competitors (2014, p. 7). OCLC pairs their LSP, WorldShare, with WorldCat Discovery. Despite being launched in 2010, WorldShare had not seen significant adoption in Canada by 2020.

EBSCO Information Services

EBSCO released EBSCO Discovery Service (EDS) in 2010 (Vaughan, 2011, p. 30). As a large content provider of abstracting and indexing databases as well as a popular aggregator of full-text content, EBSCO is a familiar interface for many academic libraries and their users. Although EBSCO does not offer its own native ILS or LSP, the company played a significant role in the development of the open source FOLIO LSP project (Breeding, 2017, p. 27). Hosted by the Open Library Foundation, FOLIO has potential to become a player in the LSP market. At the time of writing, FOLIO listed 14 libraries as implementers of the system, which was released in 2019 to early adopters.

Ex Libris, A ProQuest Company

ProQuest is the parent company of Ex Libris, which was acquired in 2015. ProQuest was already the parent company of Serials Solutions and their web-scale discovery service, Summon. With the Ex Libris acquisition, ProQuest became the owner of a second web-scale discovery service, Primo Central. ProQuest eventually merged the Serials Solutions products with Ex Libris to form a new subsidiary known as Ex Libris, A ProQuest Company. This merged entity supports both Summon and Primo Central web-scale discovery services under the Ex Libris brand name.

Ex Libris came to ProQuest with two traditional ILS products, Aleph and Voyager, as well as a fully developed LSP called Alma, which was released in 2012 and usually paired with the Primo Central web-scale discovery service. Serials Solutions had been developing the Intota LSP when ProQuest acquired Ex Libris. Not long after the acquisition, ProQuest abandoned development of Intota.

In late 2019, Ex Libris acquired Innovative Interfaces, Inc. Although Innovative does not have a web-scale discovery service, it has a discovery layer known as Encore that is meant to be used in conjunction with Innovative's Sierra ILS. In 2010, Innovative launched Encore Synergy, which integrated journal article results but did not contain a unified central index. Instead, article results were obtained through web services and the results were presented strategically in the Encore discovery layer (Breeding, 2010). A few years later, in 2014, Innovative partnered with EBSCO to offer users Encore Duet, whereby libraries used the Encore discovery layer and accessed metadata from the EDS unified central index. Innovative joined Ex Libris with three ILS products: Sierra, Millennium and Polaris.

ProQuest's acquisition of Ex Libris in 2015 ended development of the Intota LSP, eliminating a potential LSP from entering the market. However, the Summon web-scale discovery service remains an option for academic libraries. Ex Libris now supports two web-scale discovery services and one LSP. Their recent acquisition of Innovative Interfaces, Inc. has made them a dominant player in the academic library market for ILSs as well. Table 1 displays a summary of web-scale discovery services, ILSs and LSPs available from ProQuest subsidiaries up to and including the acquisition of Innovative.

Table 1

ProQuest Subsidiaries and Their Products

Brand Name	Web-scale Discovery Services	Integrated Library Systems (ILSs)	Library Services Platforms (LSPs)
Serials Solutions (a ProQuest subsidiary from 2004 until 2015)	Summon		Intota (development ceased in 2019)
Ex Libris (acquired by ProQuest in 2015) *	Primo Central	Aleph Voyager	Alma
Innovative Interfaces, Inc. (acquired by Ex Libris, A ProQuest Company in 2015)		Sierra Millennium Polaris	

* After ProQuest's acquisition of Ex Libris in 2015, ProQuest merged Ex Libris and Serials Solutions to form Ex Libris, A ProQuest Company.

Ex Libris has few competitors in the LSP and web-scale discovery service market: OCLC's WorldShare LSP paired with WorldCat Discovery and the open source FOLIO LSP and EBSCO's EDS. Although not an official EBSCO product, the FOLIO LSP was created with significant backing and support from EBSCO. Breeding predicts that libraries implementing FOLIO will likely adopt EDS as their web-scale discovery service (2018, p. 31). Table 2 is a summary of web-scale discovery services and LSPs by vendor. With only three options for LSPs, and with each of these options paired with a web-scale discovery service, academic libraries have few choices. The state of web-scale discovery service adoption in Canadian academic libraries provides evidence for the trend towards consolidating services under a single vendor. As the data will demonstrate, bundling web-scale discovery services with LSP implementations is increasing in Canada. This study provides insight for librarians who may be looking to implement a web-scale discovery service at their academic library or to change from their existing service to another.

Table 2

Web-scale Discovery Services and Library Services Platforms (LSPs) by Vendor

Vendor	Web-scale Discovery Service	Library Services Platform (LSP)
EBSCO	EBSCO Discovery Service (EDS)	
Open Library Foundation		FOLIO *
Ex Libris	Primo Central Summon	Alma
OCLC	WorldCat Discovery	WorldShare

* FOLIO developed with significant support and funding from EBSCO.

Literature Review

There is an abundance of library literature on web-scale discovery service selection, implementation, usability, assessment, and evaluation. These types of studies are beyond the scope of this paper, whose focus is web-scale discovery service adoption in Canadian academic libraries and the potential impact of vendor concentration on library options related to web-scale discovery services. Articles that analyzed Web 2.0 features on library websites and explored the implementation of next-generation catalogues provided early insight into discovery layers and web-scale discovery service adoption in various geographic locales.

Article references to WorldCat were understood to mean WorldCat Local or WorldCat Discovery, provided the authors were referring to WorldCat as a web-scale discovery service and not the merged union catalogue of OCLC member libraries, WorldCat.org. Articles that referred to Primo as a web-scale discovery service were amended to Primo Central from Ex Libris. In addition, articles referencing Encore were understood to be describing a discovery layer, since Encore does not meet the definition of a web-scale discovery service.

From September 2009 to July 2010, Yang and Hoffman (2011) analyzed a random sample of four-year institutions in North America to determine whether academic libraries in the United States and Canada were progressing towards adopting next-generation catalogues. From a sample of 260 colleges and universities, the authors found that 41 libraries (16%) of their sample were using a discovery layer; however, only nine (3%) were using a web-scale discovery service. There were seven instances of WorldCat Local and two instances of Summon. Only 12 Canadian institutions of wide-ranging sizes and types were included in this study, making up 4.6% of the sample (pp. 290-296). One year later, the authors published a follow-up to their study to see what changes had occurred in the two years since the original data was collected and analyzed. By that time, two additional web-scale discovery service products had entered the marketplace: EDS and Primo Central. Between October and November 2011, Hoffman and Yang re-evaluated the same library websites and found that the integration of discovery layers had almost doubled from 41 to 75 libraries (29%). Web-scale discovery service adoption also increased. There were now 16 instances of WorldCat Local, 15 instances of Summon, nine instances of Primo Central, and seven instances of EDS for a total of 47 web-scale discovery services in use among their sample, up from 3% in their original analysis to 17% in 2011. The authors also noted nine instances of Encore from Innovative but clarified that only three of the libraries seemed to have access to Encore Synergy. While both discovery layer and web-scale discovery service use increased, the authors hypothesized that academic libraries were not yet ready to replace their OPAC. Ninety-six percent of the libraries with a discovery layer also offered users access to their regular OPAC (Hoffman & Yang, 2012, p. 263).

Jones and Thorpe (2014) analyzed the library homepages of 313 medium-sized institutions in the United States, compiling common web features, design practices, and content elements, including coding for web-scale discovery services. The authors found that almost 40% of the institutions included a web-scale discovery service. EDS led with 42 instances (13%), followed by Summon with 31 (10%), WorldCat Local with 20 (6.4%), and Primo Central with 18 (5.7%). The authors also listed 10 implementations of Encore (3.2%) and three of the VuFind discovery layer (1%). The authors specified that a discovery service "needed to allow for the retrieval of at least electronic journal articles and catalog items, such as books or DVDs" (Jones & Thorpe, 2014, p. 9). Since the study was conducted in 2012, the authors likely encountered libraries using Encore Synergy. The authors did not specify the origin of journal articles in the libraries using the VuFind discovery layer. While the focus of Jones and Thorpe's study was library homepage design and content elements, the authors recognized that discovery service adoption was worth further study:

> Because this is one of the first studies that incorporated discovery service implementation on a population of library homepages, it will be beneficial to evaluate any changes in the adoption of these next generation library search tools, including changes in libraries' choices. (2014, pp. 19-20)

The UKSG, a library group in the United Kingdom (UK), distributed a survey to UK higher education institutions to solicit information and opinions about web-scale discovery service adoption and its impact on electronic usage. The survey was

accompanied by case studies on electronic usage as well as interviews with stakeholders to unearth opinions and insights regarding web-scale discovery services (Spezi et al., 2013, 2015). The authors found that adoption rates were relatively high, with 48 out of 62 respondent libraries (77%) having implemented a web-scale discovery service. In addition, seven libraries (11%) were in the process of implementing one at the time the survey was conducted, for a total of 88%. However, the authors mentioned the possibility of bias, cautioning that libraries without a web-scale discovery service might have elected not to participate in their survey (Spezi et al., 2015, p. 89). Summon led implementations with 36%, followed by Primo Central with 26%, and EDS with 24%. Additional discovery layers were included as "resource discovery services (RDS)". These included AquaBrowser, Blacklight, Encore, Endeca, VuFind, and a generic "other" option (2013, p. 8). It is not clear whether any of these discovery layers accessed a unified central index to return article level results. Regardless of this distinction between a discovery layer and a web-scale discovery service, the authors concluded that UK higher education had "eagerly embraced web-scale discovery services." However, like Hoffman and Yang (2012), the authors expressed uncertainty as to whether web-scale discovery services would replace a library's OPAC (Spezi et al., 2015, p. 96).

Verma and Devi (2016) analyzed the library websites of 12 Indian Institutes of Management, a network of post-graduate institutions in India for management education. Verma and Devi's study focused on website content such as navigation tools, information about collections and electronic resources, library services, and Web 2.0 features. The authors found that web-scale discovery services were available from three of the institutes. However, the authors neither defined a web-scale discovery service nor specifically stated which services were implemented (Verma & Devi, 2016, p. 225).

Comeaux (2017) analyzed changes in 37 library websites among members of the Association of Southeastern Research Libraries (ASERL) in the United States between 2012 and 2015. In addition to analyzing various web design elements, the author investigated web-scale discovery service implementations. Comeaux found that 31 out of 37 libraries (84%) had implemented a web-scale discovery service in 2012. Summon led with 13 implementations (35%), followed by EDS with seven (19%), Primo Central with five (14%), and WorldCat Local with four (11%). Three years later, all but two libraries had implemented a web-scale discovery service (95%). In 2015, Summon remained steady at 13 libraries (35%), EDS increased to nine (24%), Primo Central was up to six (16%), and WorldCat Local increased from four to five (14%). Meanwhile, Encore remained steady with two implementations (5%). Although Encore was included as a web-scale discovery service, the author did not indicate whether Encore included access to EBSCO's EDS index as a part of the Encore Duet (which would have been available by 2015) or if these libraries were using Encore Synergy. Comeaux also found that only two libraries had changed their web-scale discovery service during the 2015 review. One library moved from Summon to EDS and another from EDS to Primo Central. Comeaux concluded that "ASERL Libraries have widely embraced Web-scale discovery" (2017, p. 13).

Al-Qallaf and Ridha (2019) conducted a content analysis of 110 library websites from Gulf Cooperative Council countries, comprised of Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates. Like previous studies, the authors were examining website design and navigation elements as well as library services and Web 2.0 features. Their analysis of web-based library services included "discovery services"; this element was found in 54 or 49% of the libraries analyzed (p. 101). However, the authors did not define discovery services, nor did they specifically state which services had been implemented, so it is not possible to determine whether the authors meant a discovery layer, a web-scale discovery service, or both.

Balaji et al. (2019) analyzed Web 2.0 technologies among 75 top-ranked Asian universities. Included in this study was an analysis of "resource discovery tools", which the authors defined as "web OPACs, library management systems, Web-scale discovery systems (WSDS) and search engines including site search options" (p. 532). They also included a table called "Number and percentage of the websites using WSDS." In this table, Ex Libris was listed at the top with 28 instances, which included Primo (n=13), Summon (n=10) and Alma (n=1), as well as other Ex Libris products not identified since the numbers do not add up to 28 (p. 535). It seems likely that the authors intended to list resource discovery tools by vendor given the other entries in the table and given the inclusion of the Alma LSP in the Ex Libris total. The authors probably counted the Aleph or Voyager ILSs under Ex Libris as well. By extrapolating the specific web-scale discovery services named in the table, Primo Central and EDS were equally implemented with 13 libraries each (17%), followed by Summon with 10 (13%), and one instance of WorldCat Local/Discovery (1%). Based on this extrapolation, 37 libraries (49%) had implemented a web-scale discovery service. Encore was also listed in the table with two libraries, so it is possible that the number may be slightly higher if these libraries also licensed the EDS index. While the focus of this study was to analyze Web 2.0 technologies in a non-western region, it also demonstrated that non-western libraries were adopting web-scale discovery services.

A large implementation study by Breeding (2018) was published in a special issue of *Library Technology Reports* on web-scale discovery services. Chapter four of this issue was an analysis of web-scale discovery services implemented among 1,357 academic libraries in the United States. EDS led with 421 implementations (31%), followed by Primo Central with 349 (26%), WorldCat Local/Discovery with 223 (16%), and Summon with 154 (11%). In this study, 213 libraries (16%) did not offer a web-scale discovery service. Breeding found differences when libraries were divided by their Carnegie classification level. Almost half or 48% of the Doctoral Research Universities – Extensive category had adopted Primo Central. In this category, only four libraries (3%) did not offer a web-scale discovery service. Except for the Baccalaureate Colleges – Liberal Arts Carnegie classification level, where WorldCat Local/Discovery held 27% compared to EDS's 26% of the market, EDS held a higher proportion of the market in all the remaining Carnegie levels, ranging from 27% to 38% (Breeding, 2018, p. 23).

Breeding also analyzed ILSs and LSPs against web-scale discovery service adoption. Libraries that replaced traditional ILSs with LSPs frequently opted for the bundled web-scale discovery service from the same vendor. For instance, 90% of WorldShare

libraries were using WorldCat Local/Discovery as their web-scale discovery service. Libraries using Primo Central numbered 293 out of the 316 libraries with the Alma LSP or 93% (Breeding, 2018, p. 25). Breeding predicted that academic libraries adopting LSPs would normally bundle them with the corresponding web-scale discovery service from the same vendor. He also predicted that libraries implementing the FOLIO LSP would bundle it with EDS (2018, p. 31).

In spite of the scarcity of published literature on web-scale discovery service adoption, the evidence seems to indicate that academic libraries have implemented web-scale discovery services quite widely, especially in the English-speaking world. This study fills the gap for Canada and provides a model for creating a dataset for future studies in other geographic regions.

Research Method

A dataset was created by reviewing Canadian academic institutional and library websites between August 2019 and January 2020. Published annual statistical reports from Canadian academic library consortia and associations were used to populate collection expenditures, staffing levels, and full-time equivalent (FTE) student enrollments. Additional student FTE enrollment data was obtained from provincial and regional library consortia websites for the 2019 calendar year. Some student enrollment data was also obtained from Colleges and Institutes Canada or Universities Canada when institutions neither participated in a provincial or regional consortium nor were affiliated with another library membership organization that published statistical data.

Data on web-scale discovery service and ILS or LSP adoptions were obtained by reviewing library websites directly and cross-checking Breeding's *libraries.org* directory. The *libraries.org* directory was used to determine adoption years where available for ILS and discovery products. In some cases, web-scale discovery services and ILSs listed in the *libraries.org* directory contradicted a library's current web-scale discovery service or ILS at the time of their website review. For these libraries, the author included their live web-scale discovery service or ILS as of January 2020. For the purposes of this study, libraries using Innovative's Encore as a discovery layer were counted as EDS so long as journal articles appeared in sample search results and their EDS subscription was verified through Breeding's *libraries.org* directory under the Discovery Service (with index) category.

This dataset did not include theological post-secondaries nor any colleges or institutes from Quebec. Theological schools are defined by the Canadian Association of University Teachers (CAUT) as "[a]n institution (also known as a seminary, divinity school, or theological college), most often established for the training of theologians or the clergy" (2020). As the educational focus of a theological school is significantly more limited in scope, they were excluded from the dataset. Colleges and institutes from Quebec were also excluded because annual statistical data from the Regroupement des bibliothèques collégiales du Québec was not publicly accessible and because the author's French was insufficient to interpret French language library websites. Universities from Quebec were included because annual library statistics from the

Bureau de coopération interuniversitaire (BCI) were published and publicly accessible. BCI's summary data tables were easily translated.

Institutions were divided into two categories: colleges/institutes or universities. CAUT groups colleges and institutes into a single category and defines them as "[a] postsecondary institution that offers a variety of technical, vocational, or applied diploma or certificate programs" (2020). The universities in this dataset have been further assigned to one of three university categories: primarily undergraduate, comprehensive, or medical doctoral. These three categories match the definitions established by Orton (2009) for Statistics Canada and correspond to the categories used by *Maclean's* magazine for their annual university rankings. Primarily undergraduate universities focus on bachelor's degrees with few graduate programs. Comprehensive universities offer a wide range of undergraduate and graduate degrees including a significant focus on research. Medical doctoral universities have formal medical schools as well as a broad range of graduate programs (Orton, 2009, p. 16).

The *Almanac of Post-Secondary Education 2019* published by CAUT (2020) lists a total of 331 recognized colleges/institutes and universities in Canada, not including theological schools. Subtracting the 138 recognized colleges/institutes from Quebec, the potential number of Canadian academic institutions that could have been included in the author's dataset is 193. However, some colleges/institutes in the list did not have a publicly accessible library website and presumably had no library. In addition, some university and college entries in the CAUT Almanac were excluded because they were affiliated with a larger university already listed in the dataset. Thus, the author's dataset was composed of 85 universities and 68 colleges/institutes for a total of 153 academic libraries. The author is confident that this dataset is representative of the Canadian post-secondary library market for web-scale discovery services, excepting Quebec colleges/institutes.

Despite the author's best efforts, gaps in the dataset could not be avoided. Library collection budgets were missing for many colleges/institutes from Saskatchewan, Manitoba, the Atlantic provinces, and the North (Yukon, Nunavut and the Northwest territories). College-level academic library consortia and organizations do not exist in these geographic regions and so there were no annual statistics published as there were for most Canadian universities. Additional gaps on collection expenditures exist where institutions did not report such data to their provincial or regional library organization. Basic summary statistics and cross-tabulations were used to analyze relationships between variables and to look for trends in the dataset. A copy of the dataset along with its codebook and the full list of sources is available from the author's institutional research data repository, RADAR.
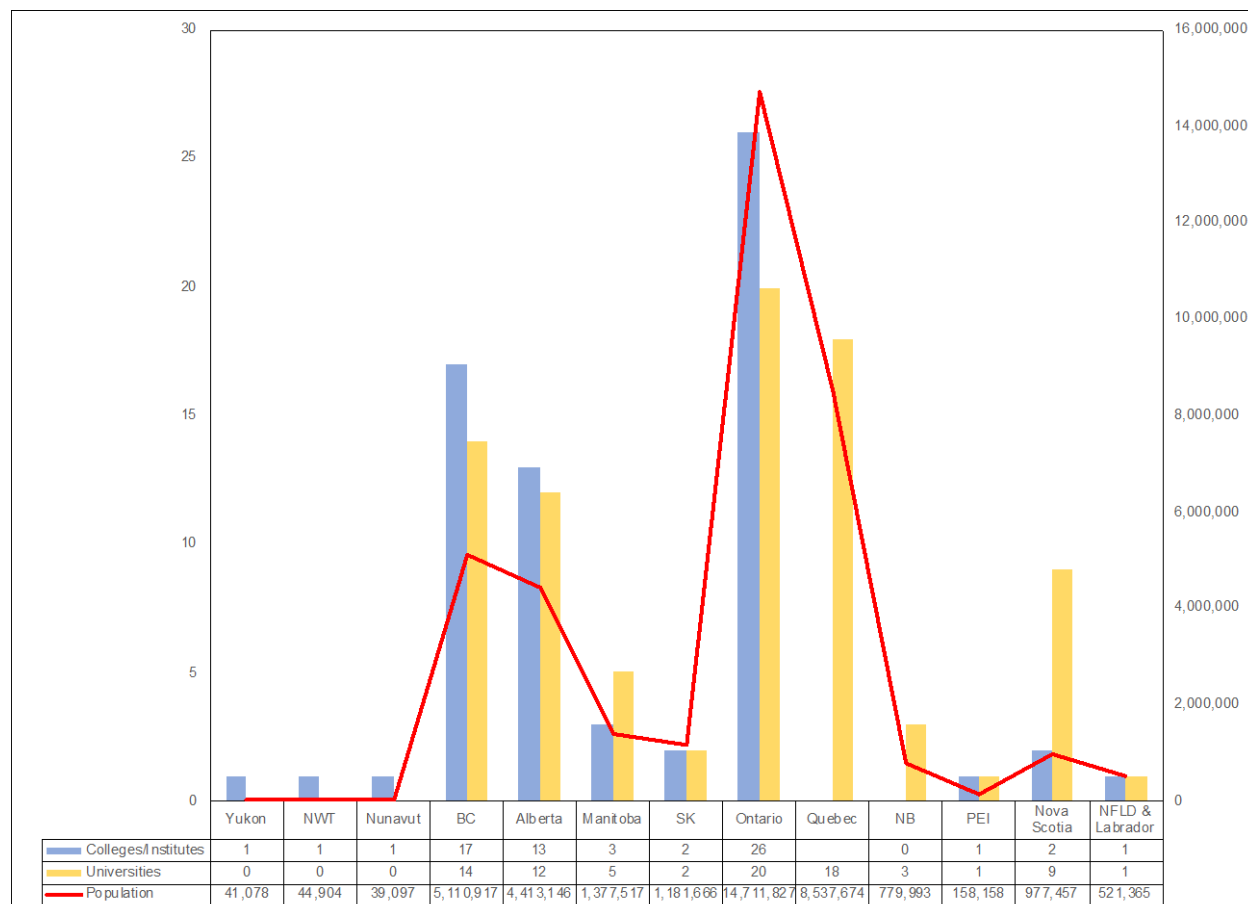
Findings

Figure 1 provides a breakdown of institution types by province and territory included in the dataset; population is indicated by the red line, based on data from Statistics Canada (2020). Actual figures are included in the table below the chart. The y axis on the left refers to the number of institution types and the y axis on the right refers to

population numbers. As Figure 1 shows, no colleges/institutes from Quebec are included in the dataset. British Columbia, Alberta and Ontario have high numbers for both universities and colleges, whereas Nova Scotia has an unusually high number of universities relative to its population. Nova Scotia's population is smaller than Manitoba's or Saskatchewan's, but houses more universities than either province. This will prove significant when analyzing web-scale discovery services by institution type.

Figure 1

Number of Institutions by Type and Population by Province/Territory in Canada

|	Yukon	NWT	Nunavut	BC	Alberta	Manitoba	SK	Ontario	Quebec	NB	PEI	Nova Scotia	NFLD & Labrador
Colleges/Institutes	1	1	1	17	13	3	2	26		0	1	2	1
Universities	0	0	0	14	12	5	2	20	18	3	1	9	1
Population	41,078	44,904	39,097	5,110,917	4,413,146	1,377,517	1,181,666	14,711,827	8,537,674	779,993	158,158	977,457	521,365

General Results

Twelve libraries (8%) in the dataset did not subscribe to a web-scale discovery service at all. Seven of these 12 libraries are colleges/institutes. Half of the libraries in the entire dataset implemented an Ex Libris web-scale discovery service: 20 libraries used Summon (13%) and 56 opted for Primo Central (37%). EDS was chosen by 54 libraries (35%) and WorldCat Discovery trailed with adoption in only 11 libraries (7%). Three of the EDS libraries are using Innovative's Encore discovery layer in lieu of the native EDS interface. Figure 2 provides a breakdown of web-scale discovery services adopted by Canadian academic libraries in the dataset. Among both colleges/institutes and

universities across Canada, web-scale discovery services have been adopted quite widely.

Figure 2

Web-scale Discovery Services Adopted by Academic Libraries in Canada, excluding Colleges/Institutes in Quebec
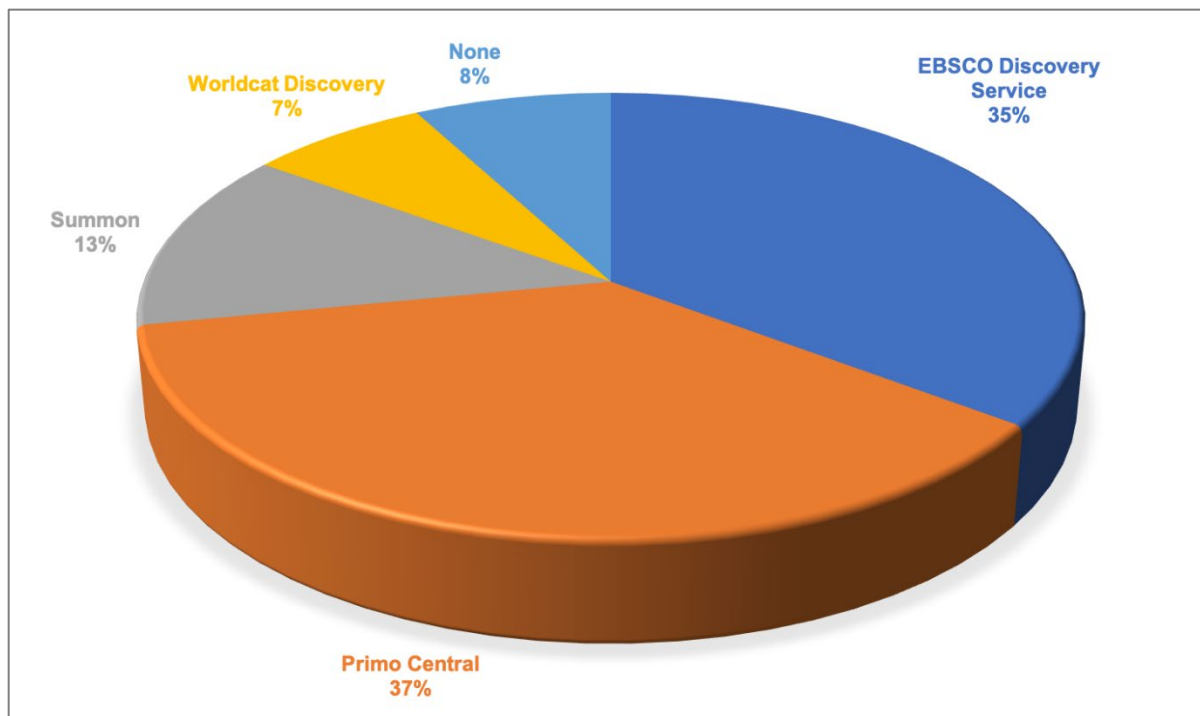

By geography, the presence of a provincial library consortial license for a web-scale discovery service can influence adoption significantly. The British Columbia Electronic Library Network has a consortial license for EDS, while none exist for Primo Central, Summon, or WorldCat Discovery. Correspondingly, 23 out of 31 academic libraries (74%) in British Columbia (BC) have implemented EDS. Only one of the 17 colleges/institutes in BC adopted Summon rather than EDS. Summon has been adopted by six libraries (19%) in BC, whereas Primo Central and WorldCat Discovery were each implemented by only one library (3%).

In Nova Scotia, Novanet has a consortia-wide agreement where all member libraries have implemented Primo Central in a shared consortium environment. Conversely, Ontario Colleges Library Services (OCLS) has consortial agreements for both Summon and EDS. Participation in OCLS licenses among the 26 colleges/institutes in Ontario favours EDS, with 10 EDS participants (38%) to Summon's five (19%). At the university level, 14 of the 21 members (67%) of the Ontario Council of University Libraries (OCUL) are participating in OCUL's Collaborative Futures project to share an LSP and a web-scale discovery service. Launched in December 2019, Omni was the name given to the 14 participating libraries' shared instance of Primo Central. Figure 3 is a breakdown of web-scale discovery services adopted by each province or territory, demonstrating the

dominance of products when licensed by provincial consortia: BC (EDS), Ontario (EDS, Summon, and Primo Central), and Nova Scotia (Primo Central).

Figure 3

Web-scale Discovery Services Adopted by Province or Territory
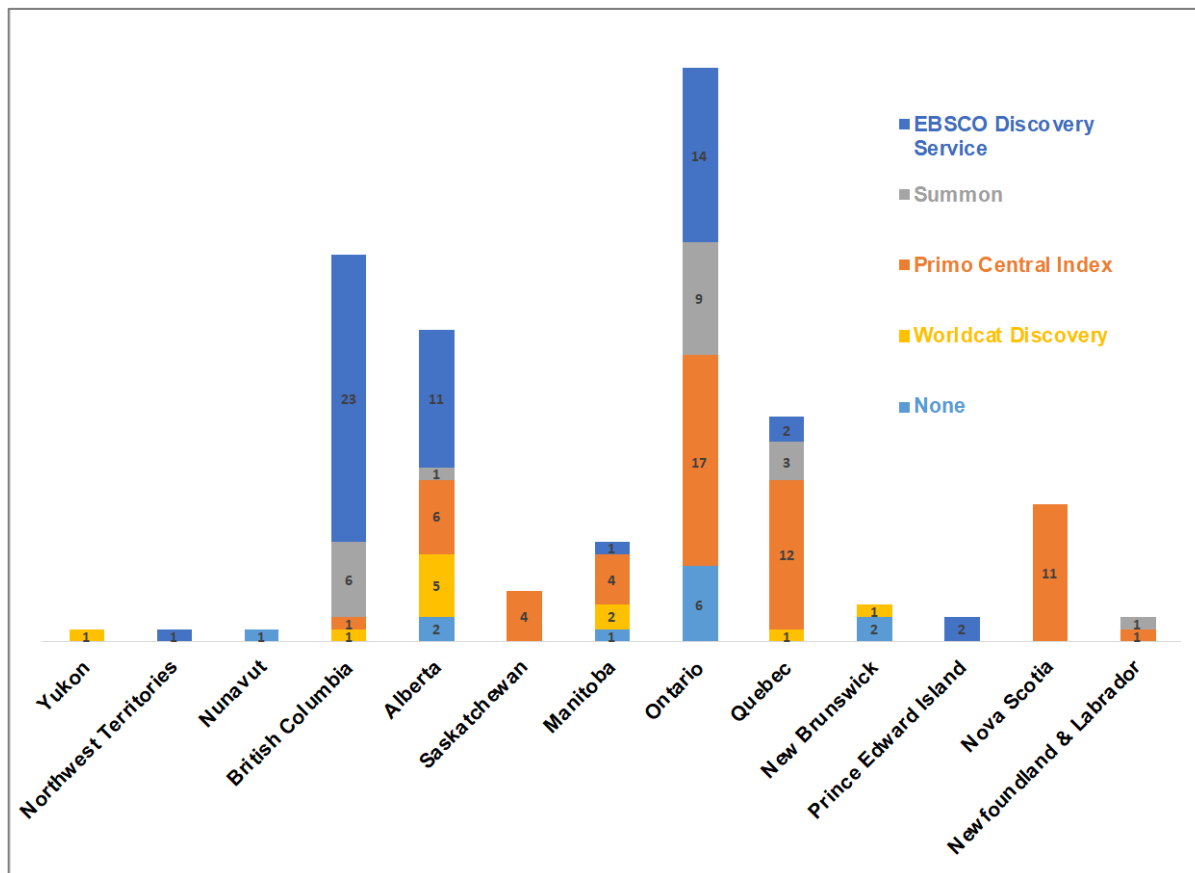
Colleges and Institutes

The majority of the colleges/institutes in the dataset are located in Ontario, BC and Alberta. By omitting Quebec, which has a significant number of colleges and is the second most populated province, this dataset is not entirely representative of colleges/institutes in Canada (Statistics Canada, 2020). The author hopes for a future update to this dataset to include the missing Quebec data, thus allowing for a clearer picture of the Canadian colleges/institutes' academic library market.

As mentioned previously, seven of 68 colleges/institutes (10%) in the dataset did not have a web-scale discovery service at the time of the writing of this article. Five of these seven libraries had annual collection expenditures under $200,000. The remaining two libraries did not publish their collection expenditures. Six of the seven libraries also reported student FTEs of less than 5,000; the seventh had a student FTE of 5,250.

In addition, all five of the college/institute libraries that implemented WorldCat Discovery had student FTEs of less than 3,000, with two of these WorldCat Discovery libraries also reporting collection expenditures under $200,000. The remaining three WorldCat Discovery libraries did not report their collection expenditures. Despite this information, it is not possible to conclude that colleges/institutes with smaller student FTEs and smaller collection expenditures typically either go without a web-scale discovery service or opt to implement WorldCat Discovery (which may have come automatically with their OCLC FirstSearch subscription). Indeed, 28 other college/institute libraries whose student FTEs were less than 5,000 did implement web-scale discovery services: EDS (n=24) and Primo Central (n=4). Moreover, 17 other college/institute libraries with collection expenditures under $200,000 also implemented web-scale discovery services: EDS (n=14), Summon (n=2), and Primo Central (n=1). Thus, many colleges/institutes with small collection budgets and/or small student FTEs still adopted a web-scale discovery service.

Meanwhile, more than half of the colleges/institutes in the dataset (56%) opted for EDS. Figure 4 provides a breakdown of the web-scale discovery services adopted by colleges/institutes in Canada, excluding Quebec. Although data from Quebec is missing, the analysis shows that English-language colleges/institutes in Canada have more frequently adopted EDS.

Figure 4

Web-scale Discovery Services Adopted by Colleges/Institutes in Canada, Excluding Quebec
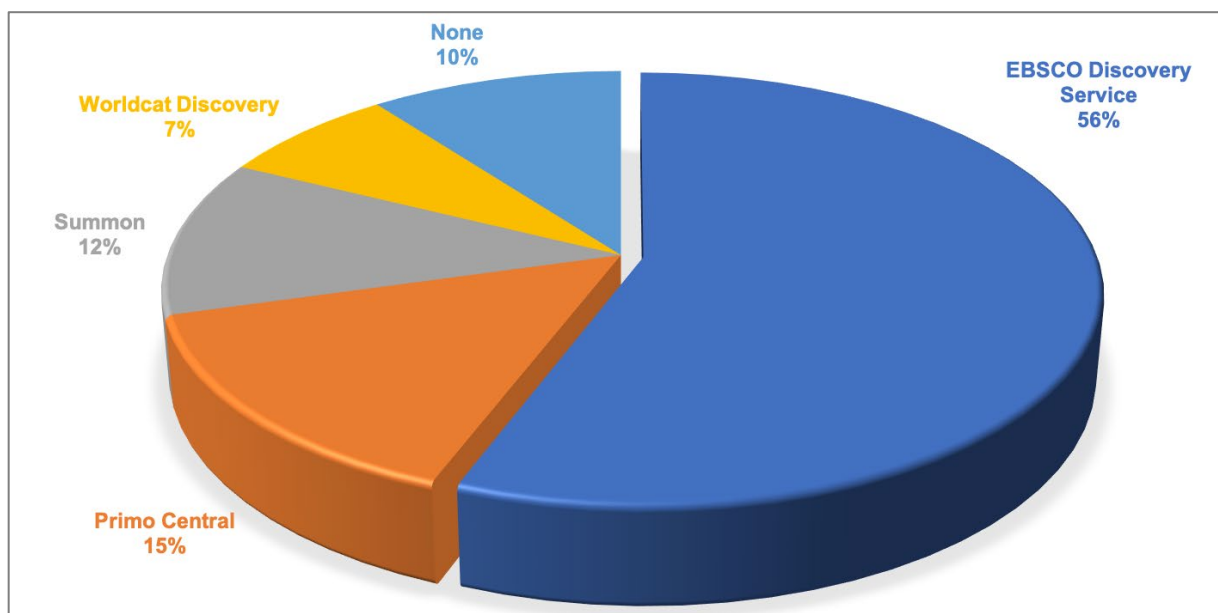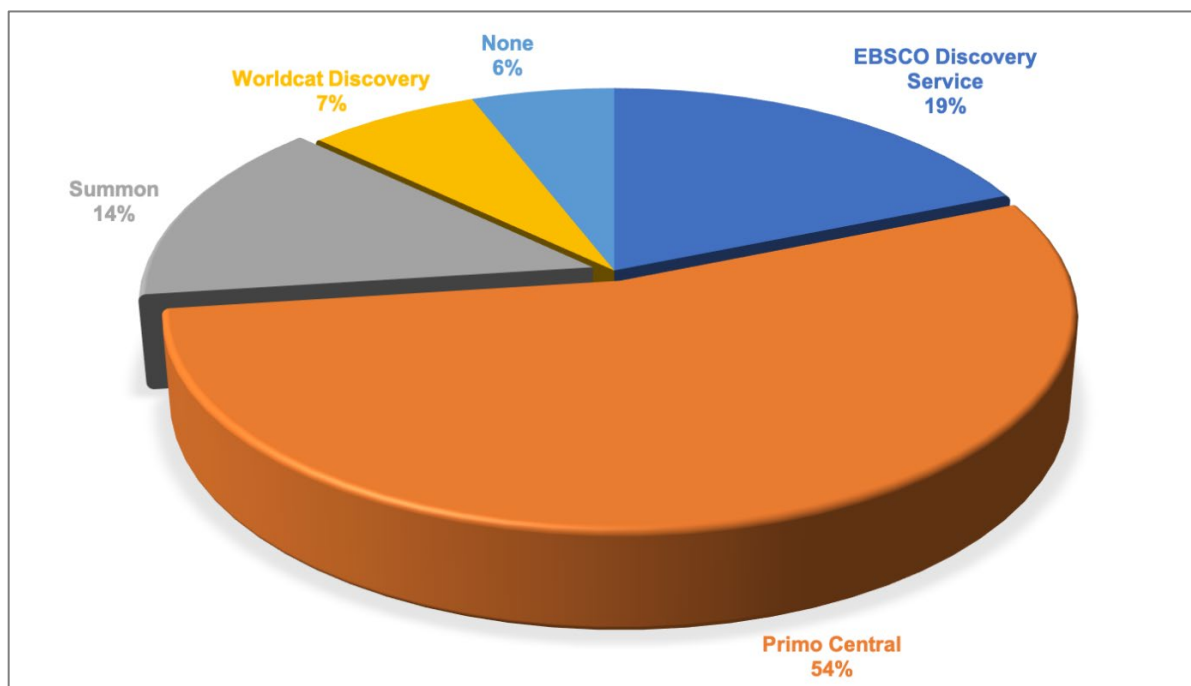

Universities

Among universities, five (6%) did not have a web-scale discovery service. Forty-six (54%) of the universities implemented Primo Central with another 12 (14%) deploying

Summon for a total of 58 (68%) adoptions of an Ex Libris web-scale discovery service product. Sixteen universities (19%) opted for EDS, while six (7%) implemented WorldCat Discovery. Figure 5 displays the breakdown of web-scale discovery services adopted by Canadian universities.

Figure 5

*Web-scale Discovery Services Adopted by Universities in Canada*

When analyzed by university type, the results are even more pronounced than Breeding's findings. In this dataset, 100% of the medical doctoral universities in Canada implemented a web-scale discovery service. Ten out of 16 medical doctoral universities adopted Primo Central while another two implemented Summon; in total, 12 (75%) selected an Ex Libris web-scale discovery product. Three medical doctoral universities adopted EDS and one opted for WorldCat Discovery. Indeed, with Ex Libris owning both Primo Central and Summon, Ex Libris dominates the medical doctoral category.

In the comprehensive university category, Primo Central was implemented by almost half, with 24 adopters (49%) out of the 49 institutions in this category. Surprisingly, Primo Central was also popular in the primarily undergraduate university category, accounting for 12 implementations (60%) out of 20 primarily undergraduate universities in Canada. This statistic is slightly skewed due to the high number of primarily undergraduate institutions located in Nova Scotia (n=6) relative to the province's size and population in Canada. Except for Ontario, which has five primarily undergraduate universities, other provinces have only one or two primarily undergraduate universities, including Quebec and BC, the most populous provinces after Ontario.

Some primarily undergraduate universities have significantly smaller student FTEs than many colleges/institutes in Canada, but only one primarily undergraduate university adopted EDS. Looking at Figure 6, which shows the web-scale discovery services adopted by university type, it is clear that Primo Central is the leading web-scale discovery service among all the university categories. At the university level, there were no discernible patterns in web-scale discovery service adoption based on library collection expenditures or student enrollment numbers.

Figure 6

Web-scale Discovery Services Adopted by University Type in Canada
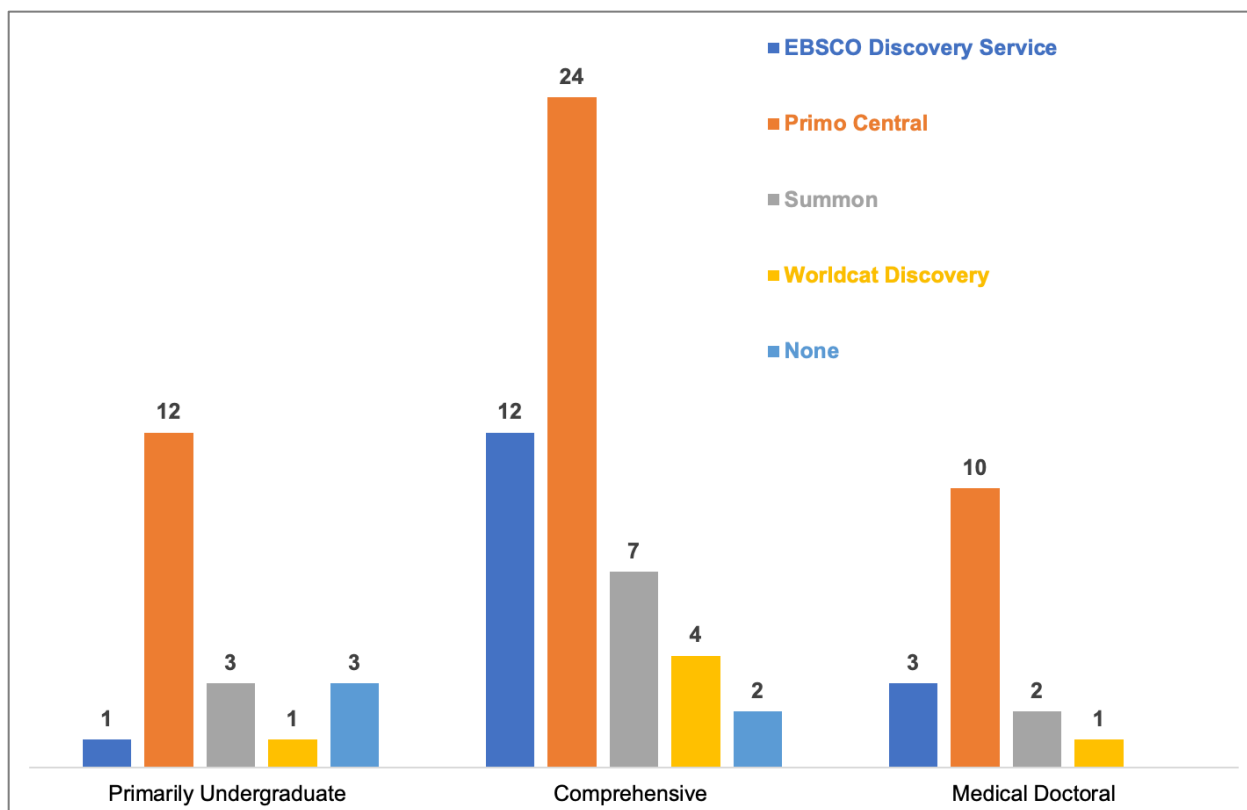
Integrated Library Systems and Library Service Platforms

Sixteen different ILSs and LSPs were listed in this dataset, including one library whose system could not be determined. Ex Libris products made up 37% of the total with 57 libraries. Ex Libris's market share increased to 44% with 68 libraries when Sierra from Innovative was included as an Ex Libris product. SirsiDynix ILSs were the next most implemented with 48 libraries (31%), followed by Evergreen with 14 libraries (9%). OCLC's WorldShare was implemented in 11 libraries (7%). Figure 7 shows the breakdown of ILSs and LSPs by product and vendor in the dataset.

Figure 7

ILSs and LSPs Implemented by Canadian Academic Libraries
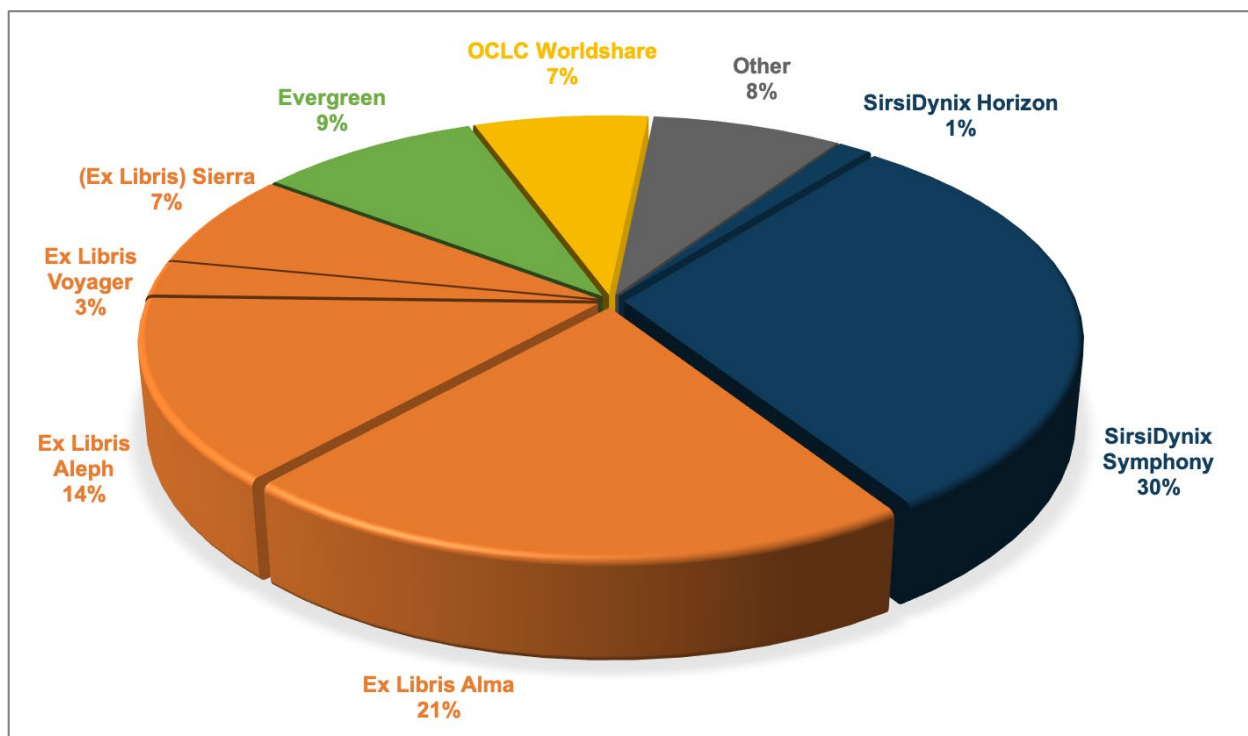
All 32 libraries with Alma as their LSP adopted Primo Central. Similarly, all 11 libraries using OCLC's WorldShare LSP adopted WorldCat Discovery. In contrast to Breeding's study of libraries in the United States, 100% of the Canadian institutions that implemented an LSP opted for the vendor's corresponding web-scale discovery service. Indeed, according to information obtained from Breeding's *libraries.org* directory, among the 43 libraries with an LSP, 14 switched their web-scale discovery service to the bundled option. Four institutions had previously implemented EDS and 10 had previously implemented Summon. Thirteen moved to Primo Central when they implemented Alma and one library adopted WorldCat Discovery alongside their WorldShare implementation. In addition, all 21 of the libraries using Ex Libris's Aleph ILS adopted Primo Central, with 10 already contracted to move to the Alma LSP.

Although Innovative has promoted Encore Duet, not all Sierra libraries have paired Sierra with EDS. Six of the 11 libraries (54%) with Sierra implemented EDS; the remaining five libraries (46%) adopted an Ex Libris branded web-scale discovery service: Summon (n=4) and Primo Central (n=1). Even among the six Sierra libraries with EDS, only three used the Encore discovery layer rather than the EDS interface. According to Breeding's libraries.org directory, one of these six libraries has already signed a contract to move from the Sierra ILS to OCLC's WorldShare LSP. It is not known whether this library will adopt WorldCat Discovery, in keeping with the trend to bundle services, or remain with EDS after implementing WorldShare.

As with web-scale discovery service adoption, ILS and LSP implementations varied significantly when institutions are assessed by type (colleges/institutes and universities). Figure 8 shows a summary of the ILSs and LSPs implemented among colleges/institutes by vendor and product. SirsiDynix was the dominant vendor for ILSs at the college/institute level with 32 implementations (47%) out of the 68 colleges/institutes in this dataset. Ex Libris remained a competitor in this market with 14 implementations, making up 21% of the market share when Sierra was included as an Ex Libris product. Even without the Sierra acquisition, Ex Libris-owned ILS and LSP products still made up 17% of the college/institute market, a higher proportion than all other vendors except SirsiDynix. Evergreen was implemented in eight college/institute libraries (12%), while 5 college/institute libraries (7%) implemented OCLC's WorldShare LSP.
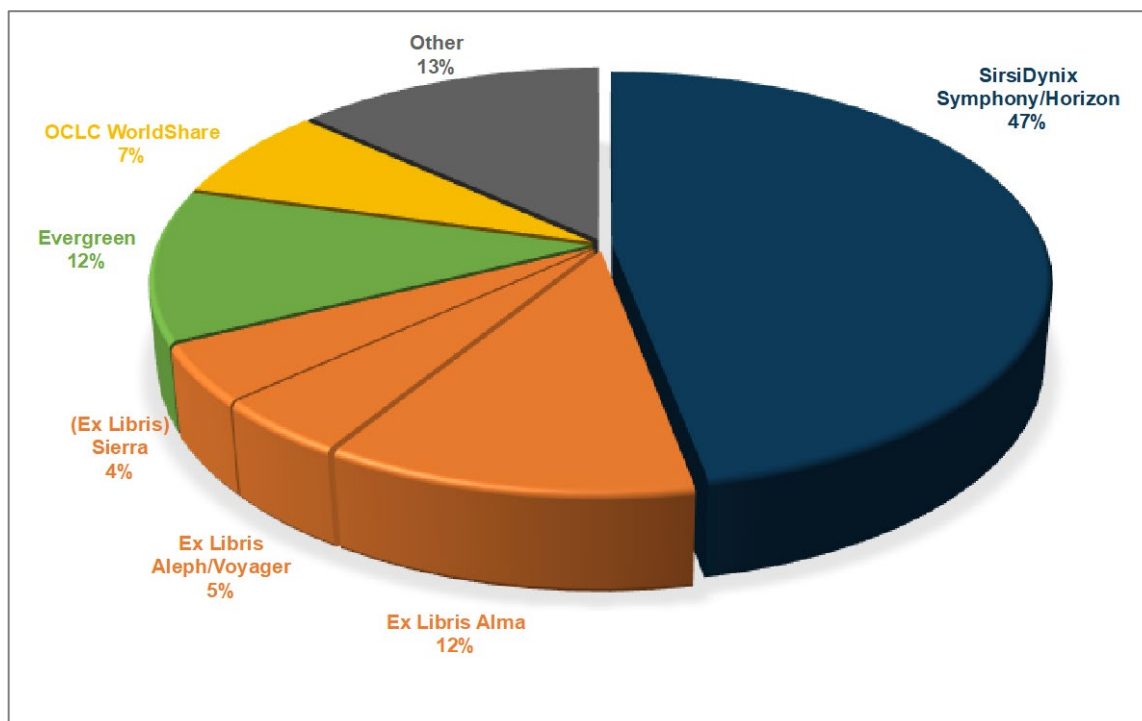

Figure 8. ILSs and LSPs Implemented by Colleges/Institutes in Canada, excluding Quebec

Figure 9 shows the ILSs and LSPs implemented in Canadian universities. Ex Libris products (Alma, Aleph and Voyager) were implemented in 46 universities, capturing 54% of this market. The recent acquisition of Sierra (via Innovative) further increased Ex Libris's university market share to 64%. The next largest ILS vendor among universities was SirsiDynix, implemented in 16 universities (19%), followed by Evergreen and WorldShare with 6 libraries each (7%). The market for ILSs and LSPs at the university level is dominated by Ex Libris. Indeed, at time of writing, five of the 16 SirsiDynix university libraries already had plans to implement an LSP: according to Breeding's libraries.org directory, two contracted Alma and three contracted OCLC's WorldShare. SirsiDynix's market among universities in Canada appears to be shrinking as university libraries replace ILSs with LSPs. Since SirsiDynix has neither an LSP nor a web-scale

discovery service, it seems likely that it will become less present as a competitor in the university market over time. The recent release of FOLIO as an open source LSP may also put pressure on the open source Evergreen ILS, although there have been no FOLIO implementations or contracts signed by Canadian institutions that the author is aware of.
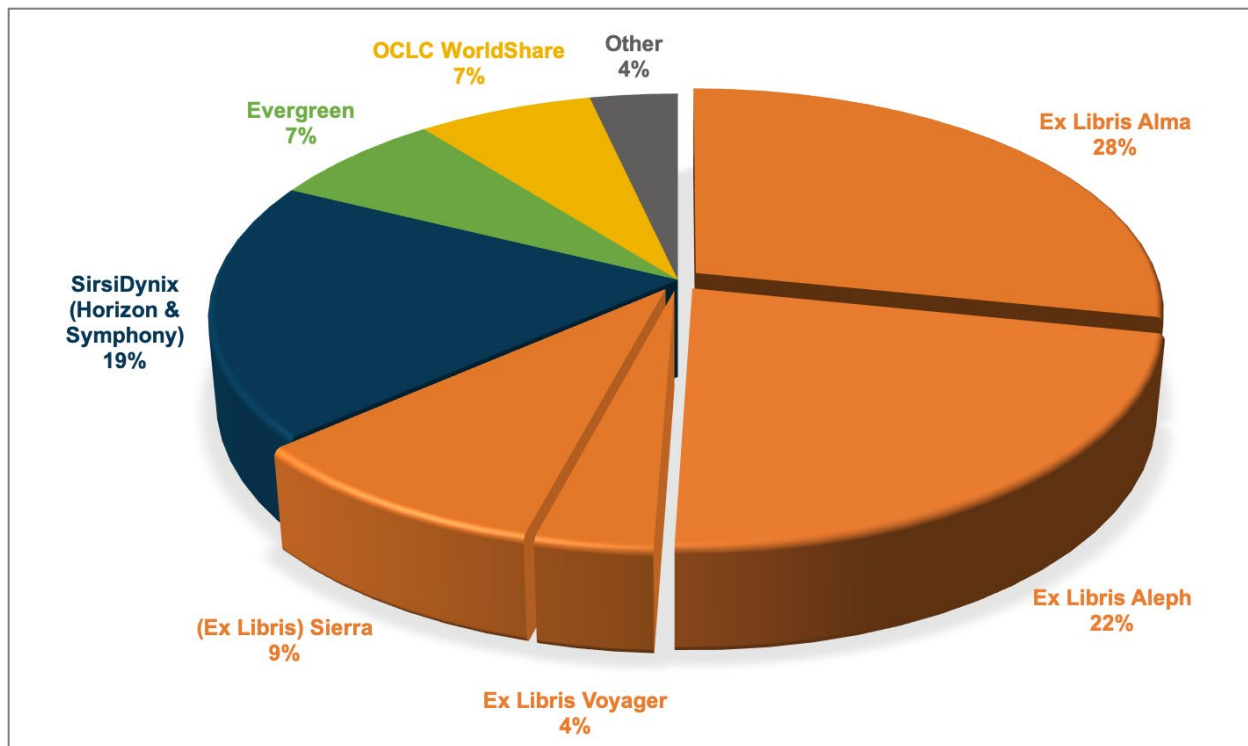

Figure 9. ILSs and LSPs implemented by Universities in Canada

Discussion

The analysis clearly shows a difference in web-scale discovery service adoptions between colleges/institutes and universities. Colleges/institutes tended to implement EDS while universities were inclined to implement Primo Central. However, for both types of institutions, web-scale discovery services have been widely adopted. The small number of vendors for web-scale discovery services and the bundling of these discovery services with the even smaller number of LSP vendors may be cause for concern. Vendor concentration due to corporate mergers and acquisitions is shrinking the number of options available for academic libraries, with Ex Libris dominating the market for both web-scale discovery services and ILS/LSP implementations.

At the time this study was conducted, 11 university libraries were contracted to move to the Alma LSP, 10 of which were already Primo Central adopters and using the Aleph ILS. The other library with plans to move to the Alma LSP was a SirsiDynix Symphony ILS institution that had implemented Summon. It is not known whether this library will move to Primo Central as a result of adopting Alma or remain with Summon; however, based on the Canadian data in this study, academic libraries that migrated from a

traditional ILS to an LSP have usually bundled their LSP vendor's web-scale discovery service.

In June 2019, BCI selected OCLC WorldShare to be its shared LSP system for its members in Quebec. Whether this adoption will result in losses for Ex Libris's web-scale discovery services remains to be seen. The press release from OCLC did not specifically state whether all these libraries would automatically adopt WorldCat Discovery with their WorldShare implementation, although it seems quite likely given the trend towards bundling a web-scale discovery service with an LSP. As of January 2020, 13 Quebec universities had implemented Primo Central as their web-scale discovery service and three others had adopted Summon. A single Quebec university implemented Encore Duet (EDS and Sierra). Only one Quebec university was an existing OCLC WorldShare and WorldCat Discovery institution. The author plans to monitor the outcome of the WorldShare implementation among BCI institutions to determine whether they migrate to WorldCat Discovery. Should all of these Quebec universities follow the consolidation trend and migrate to WorldCat Discovery for their web-scale discovery service, then OCLC's WorldCat Discovery and its WorldShare LSP will hold 27% of the Canadian university market for both web-scale discovery services and LSPs, a significant increase from 7% for each; such a shift could influence other institutions in Canada as they consider migrating from an ILS to an LSP.

Although OCLC has scored a sizable university market with its contract with BCI for WorldShare, the dominance of Ex Libris as a vendor for both ILS/LSP and web-scale discovery services cannot be overlooked. With Ex Libris's acquisition of Innovative, they own multiple ILSs. While the acquisition press release states that Ex Libris would "continue to support and develop the solutions that Innovative's customers have relied on for many years," maintaining five different ILS's cannot be sustainable long term (Ex Libris, 2020). In addition, the author wonders what impact this acquisition might have on the Encore Duet. Will Innovative, under Ex Libris ownership, continue to market this package considering that EDS is a direct competitor to both their Summon and Primo Central web-scale discovery services? It would be worthwhile to review the status of Encore Duet subscribers in a few years' time to see whether these institutions make any changes to their web-scale discovery service.

With web-scale discovery service adoptions so widespread among academic libraries in North America, the author speculates whether libraries without a web-scale discovery service might be disadvantaging their users. Should OCLC continue to offer WorldCat Discovery in a bundle with OCLC FirstSearch subscriptions, academic libraries may begin to leverage their existing OCLC FirstSearch subscriptions to implement WorldCat Discovery.

In addition, it will be interesting to monitor whether any Canadian institutions migrate to the FOLIO LSP with EDS, given that EDS already holds a significant share of the Canadian market for web-scale discovery services and given the number of libraries using the open source Evergreen ILS. How long will academic libraries remain with traditional ILSs when viable LSPs are on the market and when many of their counterparts are upgrading and migrating to LSPs?

As of January 2020, 43 libraries (13 colleges/institutes and 30 universities) or 28% of the dataset had already adopted an LSP and its corresponding web-scale discovery service. Fifteen of these libraries performed their migrations to Alma with Primo Central during the author's data collection period (from August 2019 to January 2020). Moreover, 27 academic libraries had already announced their decision to soon implement an LSP, which would bring the total to 70 Canadian academic libraries (46%) using an LSP. While the original focus of the study was to measure adoption of web-scale discovery services, there was no denying that LSP implementations were relevant to this study of web-scale discovery service adoptions.

Conclusion

Web-scale discovery service adoptions are increasingly tied to other vendor services or platforms. In the early days of web-scale discovery services, libraries often selected a web-scale discovery service associated with their existing link resolver and KB service to avoid managing multiple KBs. In other cases, libraries switched to the link resolver and KB service offered by their discovery vendor to ease workload and simplify support and troubleshooting (Breeding, 2012, p. 176). This study of the Canadian academic library market confirms Breeding's prediction of libraries bundling LSPs with a corresponding web-scale discovery service (2015, pp. 24-25). There may come a time when a vendor's library services platform is so integrated with their web-scale discovery service that they are all seen as a single service and are indistinguishable from one another.

While the data shows that Ex Libris is dominating the Canadian academic library market and already providing half of the available options for web-scale discovery services, the recent announcement by BCI to license OCLC's WorldShare may deliver some competition to Ex Libris. If the Quebec university libraries all implement WorldCat Discovery, then OCLC's market share for web-scale discovery services will increase significantly in the Canadian academic library market.

Taking into consideration Ex Libris's acquisition of Innovative Interfaces, Inc. and the recent launch of the FOLIO LSP, a longitudinal analysis of the existing data to monitor for institutional changes to web-scale discovery service adoptions and LSP migrations would be a worthy endeavour. Adding Quebec colleges/institutes would also significantly enhance the dataset to gain a more complete picture of the Canadian academic market for web-scale discovery services. Readers may expect an update to this study in a few years to monitor for future LSP implementations and changes to web-scale discovery service adoptions in the Canadian academic market.

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