Research Support Services for the Field of Civil and Environmental Engineering

Engineering & Computer Science Library
University of Toronto Libraries
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Introduction

This report outlines a study conducted by librarians from the Engineering & Computer Science Library (ECSL) at the University of Toronto (U of T), under the guidance of Ithaka S + R, exploring the research support needs of civil and environmental engineering researchers. Ithaka S + R is a not-for-profit agency that provides guidance to libraries and other types of institutions on conducting research that informs improving supports for constituents. Ithaka S + R has led several versions of the study in various fields including agriculture, chemistry, and history. The U of T iteration of the project occurred in conjunction with similar projects at ten other North American institutions with strong civil and environmental engineering programs.

At U of T, civil and environmental engineering sits within the Faculty of Applied Science & Engineering's (FASE) Department of Civil and Mineral Engineering (DCME). The department is split into five major research themes: cities and infrastructure, complex systems, energy and environment, transformative technologies, and mining and subsurface systems. Fourteen faculty members were interviewed. DCME faculty, staff and students are supported by librarians at ECSL, which is the second largest science library at U of T.

Study Methodology

This exploratory qualitative study was designed by Ithaka S + R. Possible participants were selected from the list of 44 faculty on the DCME website and emailed directly with an invitation to be interviewed. Fourteen researchers agreed to participate, and two librarians conducted one-on-one semi-structured interviews. The interview guide is included in Appendix A. All interviewees signed informed consent forms in accordance with the research ethics protocol. This report is organized according to three overarching themes that emerged from the interviews: research methods, collaboration, and research outputs.

Research Methods

This section describes the broad range and types of research the interviewees are involved in. It also includes subsections about the information seeking and citation management practices of the study participants.

Research Approaches, Data Collection, and Data Types

The three major categories of research conducted are experimental, field work, and data modelling but there is a lot of overlap in the actual research methodologies and data collected. Experimental research may be conducted in laboratory environments or natural environments. For example, some interviewees treat infrastructure as a natural experiment and collect information from the real world. These data may be related to events that have occurred or looking at construction methods and materials, including measuring properties, photographs and videos, x-ray images, lifecycle assessments, and chemical analysis. One of the researchers described their analysis as connecting physical elements to a material’s properties and then attempting to understand how the physical and material are connected.
Field work, field studies and field monitoring include onsite observations, full scale systems and collection of data using instrumentation. Some of the parameters that are monitored in the field are temperature, relative humidity, electricity consumption, natural gas consumption and other environmental emissions. As with lab work, some researchers do not conduct the field work themselves but instead collect records and data from contractors, designers, industry players and government agencies. Materials collected can include construction drawings, site plans, purchase orders, bills of quantity and construction specifications. Government agency data include a combination of publicly available and confidential survey and census data. Previously collected survey data, as well as using a survey instrument were both mentioned as methods by which several of the researchers were generating their data for analysis. One researcher said: “my research requires information from people... data could be observed from [what] people are doing, like observed traffic flow, observed emissions ...” Occupant surveys, exposure probes, biomarkers and health effects were some of the other data that was collected from these surveys. These types of data are used to forecast behaviour from a smaller group of people to an entire population using mathematical models. Spatial data, including maps, infrastructure and networks were mentioned as another type of data used for analysis. Another variant on collecting data in the field was described by a researcher as experimental economics, wherein people are asked to make choices based on a hypothetical situation and their responses are then used to forecast future demand for an item.

Modelling is a computer/software-based approach for collecting research data. Different researchers take slightly different approaches to modelling, ranging from the sole focus of the research being on the creation of a model to using data to estimate model parameters to testing models using experimental results. Some of the areas that are modelled are behaviour, re-creation of events or outputs, and economic modelling. A different approach that was described is using a simulation method. This particular researcher uses a combination of data from physical specimens and from numerical models and aims to improve the accuracy of the simulation model. Several researchers combine their experimental work with a modelling component. One researcher described the research as follows: “... we build stuff, we test it, and we learn from those results and we can then, through those experiments, then sort of formulate some mathematical models of how materials behave or how systems behave, how two different materials behave together.” This approach of using experimental results to develop analytical models was used by several of the interviewed researchers.

Information Seeking

The Information seeking patterns for the researchers that were interviewed were fairly similar. Scopus, Web of Science, Engineering Village, Library homepage search, PubMed, Science Direct, Google, Google Scholar, ResearchGate profiles and Mendeley Suggest were all tools that were mentioned as places both they and their students look for information. While there was no clear pattern to where they search, Google Scholar was indicated more than any other resource. However, in the majority of cases Google Scholar was mentioned as a place to search in conjunction with another resource, most notably Scopus. While journal articles were the primary items they were searching for, there was also a need for publicly available data from government databases and companies, books, conference papers and industry reports. Although interviewees described their search patterns, it should be noted that several of the researchers indicated that in practice they do little searching themselves and it is mostly their students who do the searching.
A few other strategies that were mentioned for finding materials included using reference lists, searching for people known to work in the field, looking at relevant journals on a regular basis, talking to a colleague and a strong “Google-fu”, which refers to having strong online searching skills, particularly in using search engines like Google. One researcher mentioned that they searched for review articles, journal papers and reports in order to understand the state of the art in a particular field. While generally the researchers were content with the material owned by U of T, conference papers were highlighted as resources that are sometimes more difficult to locate. Electronic journal access was deemed easy to use and, for the most part, the university has the material they need. When a journal or book was not available, the researcher who said this seemed aware that they could work with the library to try and either borrow it or purchase it for the collection.

Most of the issues relating to information seeking were mentioned by only one individual and so there were no larger patterns illustrated by the fourteen faculty that were interviewed. One salient piece of information that arose a few times was that students are doing a large portion of the searching for their supervisors. As a result of this, training students in doing research was repeatedly indicated as something that would be worthwhile. 'Time' was another challenge that was often highlighted and various examples given relate back to the large amount of time required to find information. A specific concern was the time required to examine every item with a critical eye because of the difficulty in determining the quality and credibility of material, while another interviewee more broadly indicated that they do not have time to search the literature.

Knowledge of the processes and thought patterns of researchers about their own information seeking behaviours and issues (and those of their students) highlights areas that the library could (and in some cases already has started to) offer workshops to help build up the skill set of both graduate students and faculty.

Citation Management

Managing journal articles was an area that many researchers indicated was an issue for both themselves and their students: “...I was never trained on how to use proper referencing software... So that might be another thing that definitely the students would benefit from. Because if you are not taught it, you just end up doing this hodge podge, hickory stick kind of job which is what I do most of the time.” The software packages that were discussed were Dropbox, Box, Excel, OneDrive, Mendeley, Papers, Zotero and EndNote. Excel seemed to be commonly used, but was often the go to after having tried other tools first and finding them lacking. One researcher explained, “people just – they’re comfortable with their own system and, frankly, I don’t even like the tools...I end up always reverting back to an Excel document and I have my own little annotated bibliography in there and that’s inefficient but it works for me.”

A few approaches to organizing their citations other than using standardized citation management software were mentioned. More than one researcher indicated that they use folders to organize their material. Each folder might contain pdfs or books with highlights and annotations to this material embedded within the content. Another researcher observed that, “the information is there on my hard drive so I can write the reference list and immediately access it, but once it's in the technical paper, I probably won't look at the files on my computer. I'll basically look at the reference list, go back to the
source and get the paper.” This sentiment was reiterated by another researcher, highlighting also the modification of the method over time as more and more material is available online:

In the past, I tried to download files and archive it and link it to the Mendeley database. And when I was a PhD student there were many journals that do not have the PDF files, older publications. I archived as a paper format in my cabinet and then eventually I scanned them and stored them in my computer. Nowadays I just store the titles and the author because I can download the files from anywhere anytime so I think storing the journal papers in a computer is getting less and less important.

This reliance on electronic material is important for the library to be aware of as it highlights the importance of continuing to maintain and grow our robust electronic collection, which is an integral part of the research process for many researchers.

A few issues arose for the researchers when it came to storing their citations in an organized manner. A key reason for wanting to organize papers and citations was to have a shared location for materials for the graduate and undergraduate students in their research group. “I think one of the main things is when you have, let’s say, new students, right and you want them to start reading and you don’t trust them that on their own – if they’re going to fool around and download stuff, they’re not going to download relevant things and you want to point them to the right thing.” More than one interviewee said that they attempted to find one system or tool for their students to all use in a collective library but that this was unsuccessful as every student wanted their own library rather than having one shared library. Another area that was troublesome was annotating materials as most of the tools mentioned were found to be clunky in this capacity.

Training was requested, for both students and faculty, in both choosing which tools are appropriate and in how to use them effectively. Supporting documentation was also mentioned as a resource that would be of interest, including a comparison of the different tools or methods available. How to merge libraries from either different students or different citation management tools was another suggestion for support that could be offered. This knowledge about the types of supports that researchers feel are helpful and the areas wherein they are having difficulty are useful for the library to be aware of in order to continue to build on supports for citation management software and citation management practices that are already in place.

**Collaboration**

This section highlights that the majority of researchers work on highly collaborative projects, not only with other researchers in the department but with partners in other disciplines and at other institutions. Collaboration takes many forms, both within and outside U of T. Students play an important role in research and this association was documented in the interviews. Challenges with collaborative research were also discussed.
Interdisciplinarity

Interdisciplinary research was a major theme that emerged from the interviews. Among the researchers, there are a small number cross-appointed with departments outside of FASE. However, all but two researchers that were interviewed regularly collaborate with researchers in other engineering disciplines and in other non-engineering disciplines. Some of the other disciplines that researchers engage with include geology, geography, health sciences, public health, architecture, environmental sciences, economics, chemistry, physics, mathematics, and biology. The researchers discussed several reasons for choosing to work across disciplines, such as benefiting from the subject expertise of others and to gain access to data generated in other areas. One researcher said that working with experts in other fields has led to a realization that they “can measure things that couldn’t be measured before... [and that] might lead to a mystery, an answer to a mystery that no one’s known for 50 years.” This interdisciplinarity has several implications for the librarians working with and supporting these researchers. The traditional method of designating liaison roles along departmental or subject lines does not fit well with this way of working and the library may need to rethink how to support the research practices described in the interviews.

Types of Collaboration

Many researchers are working on multidisciplinary projects and this naturally leads to collaborative, multi-researcher teams. In contrast, one researcher described collaboration in terms of sharing data with researchers at other institutions conducting the same experiments at the same time. This type of collaboration does not involve cross-disciplinary partnerships at all. A common theme that emerged in the interviews is that many have projects that involve collaborating internally within the department but that they also have projects involving researchers at other Canadian institutions as well as partners at institutions all over the world. Many also discussed working with students and co-supervising students as forms of collaboration.

One researcher, whose focus is not conducting experiments, described partnering with experimenters who can generate data as an example of collaboration. Interviewees also stated that they commonly collaborate with industry and government partners. Collaborating outside the academy is an obvious step for engineers due to the applied nature of their work. Often, these researchers are working on solving very practical and very pressing social, environmental, or infrastructural problems and government policy or decisions can be directed by their research. One interviewee described regularly working and publishing with government scientists rather than just doing contracts for them. This researcher also discussed that government partners have very high expectations about the deliverables that will result from the research partnership. They expect the researcher to build capacity within the government to help aid in policy creation rather than simply providing a model that they may not be able to use.

One researcher admitted to preferring to work alone. Additionally, an early-career researcher said “I’m trying to be mindful of not over-collaborating to show that I can develop research - impactful research projects on my own”. These two comments represented an interesting contrast to the preferability, inevitability, and necessity of collaborating that came through in most of the interviews. Another researcher put it this way:
now the pressure is on. Developing large teams that actually function well together and produce well together and...write winning grants. That also makes it really risky because sometimes you put all your eggs in one basket and then you get nothing. So, that is certainly a big challenge in my field.

Student Roles in Research

The researchers that were interviewed indicated a range of ways in which students contribute to the research in their labs. Students in this context are usually graduate students, but occasionally may also be undergraduates, although the type of contributions they make to the research differ. “In my area, most work is done by PhDs and post-docs – master students do a lot of grunt work in terms of actual experiments with the faculty member figuring out what does it mean, what do experiments actually show.” More than one researcher indicated that a large portion of their research is conducted by their graduate students with guidance from the faculty member. However, two researchers expressly stated that they also had their own distinctive research area separate from their graduate students. The types of roles that students can play are as follows: obtain data from industry, develop methodology, run experiments, publish results, analyze data (majority of analysis run by students with guidance from faculty), write scripts and/or code to generate input files, model results using software, conduct literature reviews and literature searches, conduct primary research, and co-author articles.

A few suggestions were made for ways in which the library could assist the students in their research. At least one researcher commented on being shocked by students’ lack of research skills and more than one indicated that it would be valuable for the librarians to be involved in teaching students how to do a comprehensive literature review and how to report their findings. Some of the other areas of weakness that were mentioned were determining appropriate sources, the level of detail sufficient for a review, and how to organize sources. All of these are areas that the library could increase workshop offerings to help build up the skill set of both graduate students and faculty.

Challenges of Collaboration

Aside from lack of time, data sharing and data management were named as the main difficulties when interviewees were asked about the challenges of collaborative research projects. Specifically, several researchers expressed concern over the lack of data sharing and data management protocols at the institutional level. They described how having these types of standards would help them reassure collaborators that their data are safe and it would also go a long way toward helping them have clearer data management plans for their own data going forward. As discussed elsewhere in this report, this is an important issue that the library is aware of and is well situated to provide support for in conjunction with the Office of Research and Innovation.

The other major challenge that came up throughout many interviews involved working with graduate students as collaborators. Specifically, the problem is that students leave once their theses are complete, but they do not always leave a clear ontology for their data. This means their data are essentially lost. One researcher commented, “in practice we’ve lost the vast majority of data that students collect over the past. The stuff that’s in the thesis lasts forever, the stuff that’s electronic we
don’t yet have a system for that, and that is a weakness”. Again, the implications for the library are clear: a stronger focus on training graduate students on RDM principles is essential.

Another noteworthy challenge that came up is the fact that current funding models do not support collaborations. One interviewee explained how knowing about and/or having access to funding opportunities that specifically support collaborative research projects would make forming partnerships a lot easier. Additionally, an interviewee described the challenge of not having a way to know who is producing what data and how to make others aware of your own data needs. To deal with this challenge, this researcher imagines a data curation service whereby you would be “able to know what other professors in your research environment - what kind of data they're producing - have some sort of a dictionary...that would be very, very useful.” This researcher learned the hard way how this type of curation service could be useful after spending a large sum of money to acquire a specific data set from the United States only to discover later that a researcher at U of T was producing similar data and could have supplied the relevant data at no cost. The library’s history as not only a steward of information but also as curators of information make this an interesting, if blue sky, idea to pursue.

The implications of these challenges are clear: researchers need more support in the administration of collaborative projects and more importantly from the library’s perspective, they need support around sharing and preserving data across these institutional and disciplinary boundaries.

Networking and Keeping Current

Conferences were most often mentioned as the best way to network and keep up with trends in the field. It was also cited as a way researchers have found new people to collaborate with. Twitter was also mentioned a few times as a way to keep current. For one researcher in particular, Twitter is a useful way to network and to hear about what people are doing. Interestingly, several researchers mention work that they do outside the academy – consulting work or training of practitioners – helps to keep them up to date. Additionally, several researchers cited their work as peer reviewers as a way to keep up with trends. Many of the researchers interviewed have set up email alerts for when new research has been published. Many also admitted a lack of time to read through the latest research. Yet, one researcher said that getting email alerts from various associations and journals,

    has let me know about some stuff that's peripheral to what I'm doing but still interesting. So, you go pick up on an article that's just a little off centre because it's like getting out of the office mentally. Because when people say, do you know this professor? No, I work in this building. I rarely leave this building. Whereas, something like that kind of extends your reach a bit beyond what you're doing.

Research Output

DCME research output takes many forms and is distributed to a wide array of audiences in different ways. Multiple venues for publishing research were noted, including open access options as well as the importance of distributing the research beyond the academy. Challenges associated with storing and disseminating research output in its various formats was also discussed.
Dissemination Through Journal Articles

All of the researchers involved in this study mentioned disseminating their research through journal articles, with specific emphasis on peer reviewed journal articles. The researchers took many things into consideration when determining where and how they would disseminate the results of their research. When it comes to journals, the fit of the research to the journal was mentioned on more than one occasion, and includes factors such as if their peers are publishing there and what the audience of the journal is. One researcher stated,

You can game that system so well and so easily and different areas have different...you want to publish where people are most likely to read the stuff, and find it of value. If you’re not doing that, then what are you trying to hide? Maybe your paper, you don’t want it to be cited, or you want it to be cited by the wrong people who don't understand it. So, to me it's very clear cut: if the conversation has been in [name of journal redacted] then that's probably where you should publish.

The quality of the journal itself is also a consideration, taking into account who the chief editors are, who the big names involved in the journal are, the impact factor of the journal, the Source Normalized Impact per Paper (SNIP) measurement, and the reputation of the journal. Researchers are also cognizant of where they had published previously and did not want to overpublish in one journal. The quality of the work and the strength of the students’ writing were also mentioned as considerations. Time and ease are other factors that researchers consider when determining where to publish, with turnaround time mentioned by more than one researcher and acceptance rate also discussed. Practical factors were also mentioned, including “the sort of very cynical impact factor, is it going to help me get tenure?”

Open Access

Responses around making publications available through open access (OA) were varied, and indicated a possible lack of knowledge around granting requirements. While most researchers interviewed indicated that they are generally in favour of OA, most had not published in an OA journal. Major barriers to publishing in OA journals that were mentioned more than once included the high cost of publishing in OA journals and the lack of funding to do so. One researcher stated,

...it’s difficult to justify the money for that expenditure, because we do work for a project whether it’s an NSERC or whatever project, and we publish papers after the project ends, most of the time. Then we ran out of the funds. We don’t have funds to supplement that cost. So open access publication for authentic publishers is a financial challenge to me. That’s the only reason I don’t publish in open access.

Another researcher interviewed only publishes in open access journals when the funds required are written into the grants. Even so, another researcher mentioned that some sponsors do not see the value of OA and are not willing to fund publishing in OA journals. Only one researcher specifically mentioned the Tri-agency granting requirements around OA, but had not yet published in OA journals or made any
publications available through T-Space (U of T’s Institutional Repository, or IR) or another repository that was approved in the Tri-Agency’s granting requirements. In most cases, interviewees viewed OA as synonymous with publishing in OA journals and not about making their papers available through an IR like T-Space. Surprisingly, ResearchGate was mentioned more than once as a way that researchers made their publications OA. This may be an area that UTL can increase outreach, as ResearchGate is not an approved repository when it comes to Tri-Agency OA policies.

Dissemination Through Other Venues

Along with journal articles, researchers disseminated their research through conference papers, technical papers, trade journals, standards, codes, presentations, workshops/seminars, and even short videos about their research. Besides distributing their actual research outputs, researchers also promoted their research using social media. Facebook and Twitter were both mentioned, as well as ResearchGate. One interesting trend mentioned by more than one researcher was the importance of disseminating their research and findings beyond the academy, and ensuring that their research impacted society. In some cases, this takes the form of standards and codes; in others, government policies or guidelines. When talking about codes and standards, one researcher commented “That’s the biggest way in which my work changes the way humans do what they do.” The researcher also shared an anecdote:

When the Bahen Centre was being constructed in 2002 to 2003 and I looked and saw how big the slabs were, I felt a partial responsibility for that. Because changes made in the Canadian code in 2004 which people knew beforehand, were partly because of work done at the University of Toronto. And we said what we are currently doing isn’t good enough and therefore we need to spend more money to do it this way. And we're seeing buildings that are built that way thankfully.

Other examples of ways that researchers disseminate their knowledge and research results include offering courses and presentations to industry or practitioners in their area of expertise. One interviewee was working on creating one- or two-page handouts summarizing research results to publicize their findings and make them more accessible to the public. Interest in disseminating the research beyond the academy also extended to funders, with one researcher commenting, “Every contract I’ve had recently, there's a very big government push for better ways to do knowledge dissemination. They want to see their dollars actually contributing to capacity building in the department.” It is clear that many civil and environmental engineers at U of T are not doing research for research’s sake, but are working towards making a positive contribution to society and are interested in getting their research results to people who will benefit from it.

Challenges When Publishing or Disseminating Research

Some of the researchers that were interviewed indicated that they had run into challenges when trying to publish their work. One researcher who encountered racism stated that it was when submitting to single-blind review journals, where the reviewers were aware of who the author was but not the other way around, and that the problem was not as persistent in double-blind reviews. The researcher
suspected that reviewers were criticizing writing skills instead of content because they could not find anything to comment on. When speaking of hostile reviews, one researcher commented

I think it's one of the areas I am still too sensitive about because you've got to take these thing objectively, but the reality is once you've calmed down you find you're defending the paper that you thought you wrote and not the actual paper. And usually in most of the cases where we've had bad reviews we've said no, we weren't clear, we were not well organized and I think half the best papers came as result of a concerted effort to show reviewers were wrong.

Other comments regarding the review process included that the researcher thought that some reviewers intentionally misunderstood or that they were getting pushback from non-experts. One researcher suspected that the reviewer of one paper had a grant application in the same area that the paper proposed to solve and that was why there was so much pushback from the reviewers – it took 6 years and 5 rejections before the paper was actually published. The researcher stated, “and I’m thinking… I know what's going on here…this paper is proposing to solve a problem, and someone’s got a research grant that's looking into the problem. It's hard to make that work if someone’s already solved it.”

Finally, time was a challenge mentioned by more than one researcher. Time to write articles, time to edit students’ writing and theses, and the time it takes for the peer review process were all mentioned as issues researchers face when it comes to writing and disseminating research outputs.

Storing and Sharing Research Outputs

Raw and processed data in the form of Excel files, tables, graphs, figures, statistics, images, models and videos were all mentioned by the researchers. Some of the research output is original data, produced or collected in the lab or in the field, while other outputs take the form of models or calculations based on information or data produced by others. Only one researcher did not consider themselves to be producing data, stating “we mainly use. I mean we produce results based on the data and those results can be used to inform further data collection and things like that.” Some research is producing massive amounts of data, terabytes of data per experiment.

Researchers use a variety of methods to store their research outputs. All researchers mentioned storing data on their laptop or hard drive. Zip files, thumb drives, and external drives were also mentioned. In some cases, the data is stored on the computer or instrument that measures the data. A few of the researchers also store or back up data using cloud computing services, such as Dropbox, Box, Google Drive or OneDrive. Some researchers also consider students’ theses as a form of storage of the research and the data.

Sharing data and other research outputs also involve using cloud services, like Dropbox or OneDrive, especially in the case of sharing with students. FTP servers, shared computers/drives, email, and just walking down the hall were other ways that researchers are sharing their data. None of the researchers had shared their data using data repositories, although a few are aware of ones such as Network for Earthquake Engineering Simulation (NEES). In a few cases, data was shared as an appendix or supplementary information to a journal article.
The types and amount of data produced have implications for storage, retention and privacy issues should the university consider implementing any type of institutional data repository or data storage solution. The library is currently involved in discussions and planning related to institutional solutions for data preservation and sharing.

Challenges with Research Data Storage and Sharing

Researchers run into a number of challenges when it comes to data storage and sharing. The transient nature of graduate students leads to lost data for a number of researchers, as the students leave the institution without transferring files to their supervisors. Storage space is an issue for one researcher, who was in the process of working on a grant proposal with a colleague for a server that automatically backs up the data to a separate server. More than one researcher indicated that they are interested in guidelines, best practices, or other direction when it comes to research data storage. This is an area that the library could implement workshops or handouts for faculty. Researchers were also interested in human resources in terms of help with servers and storage, which may be out of the scope of what the library can offer.

Key Takeaways for ECSL

As previously mentioned, lack of time was one challenge that came up as an issue in all areas of the research process. While one researcher’s tongue-in-cheek suggestion of a time-turner (like that used in J. K Rowling’s Harry Potter series) is not a practical solution, there are many actionable items that UTL can act on in order to streamline the research process for our faculty:

**RDM and data sharing standards**

- With the recent release of the Draft Tri-Agency Research Data Management Policy, the institution may be required to take an active role in supporting researchers with their research data management plans (see section 3.1). Given that the researchers who were interviewed as part of this project clearly articulated a need for support in this area, ECSL librarians should prioritize working closely with U of T’s data librarians to stay abreast of the changes and to contribute to the development of institutional RDM guidelines.

**Data storage**

- Along with protocols for data management, a place to store data was also identified as a need. The non-standardized way that researchers are storing data indicate that ECSL librarians should stay abreast of the conversation at the institutional level around developments in data storage and security.

**Training**

- Increase promotions of UTL’s RDM best practices workshop.
- Increase awareness for graduate students about existing training in how to access resources via the library, find reliable sources, conduct adequate literature reviews, and manage published information.

**Outreach**

- Outreach to researchers to help them comply with Tri-Council OA policies.
• Improve communication to faculty and graduate students about ECSL and UTL services and resources.
• Re-think the current liaison model to better reflect the interdisciplinary and collaborative nature of researchers’ work.

Conclusion

Civil and environmental researchers at U of T are engaged in a diverse array of research activities involving multidisciplinary, multi-researcher teams. While UTL currently offers a number of services that researchers expressed an interest in, our promotion of these services is evidently lacking. This study highlights a need to improve our communications and enhance our services. Furthermore, with the information collected in this study, ECSL is well-placed to provide feedback in the event of any institutional discussions about infrastructural improvements especially around research data storage and management.

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Appendix A

Semi-Structured Interview Guide

Research Focus and Methods

- Describe your current research focus and projects.
- How is your research situated within the field of Civil and/or Environmental Engineering?
  - Does your work engage with any other fields or disciplines?
- What research methods do you typically use to conduct your research?
  - How do your methods relate to work done by others in Civil and/or Environmental Engineering [and, if relevant in the other fields you engage with]?

Working with Others

- Do you regularly work with, consult or collaborate with any others as part of your research process?
- If so, who have you worked with and how?
  - Lab or on-campus research group
  - Other scholars or researchers [e.g. faculty at the university or other universities, student assistants, independent researchers]
  - Research support professionals: e.g. librarians, technologists
  - Other individuals or communities beyond the academy
  - Others not captured here?
- Have you encountered any challenges in the process of working with others? [focus on information-related challenges, e.g. finding information, data management, process of writing up results]
- Are there any resources, services or other supports that would help you more effectively develop and maintain these relationships?

Working with Data

- What kinds of data does your research typically produce?
- How do you analyze the data? [e.g. using a pre-existing software package, designing own software]
- How do you incorporate the data into your final research outputs? [e.g. included in the appendices, visually expressed as a table or figure]
- How do you manage and store data for your current use?
- What are your plans for managing the data beyond your current use? [e.g. protocols for sharing, destruction schedule, plans for depositing in a closed or open repository]
• Have you encountered any challenges in the process of working with the data your research produces? If so, describe.
• Are there any resources, services or other supports that would help you more effectively work with the data your research produces?
• Does your research involve working with data produced by others? If so,
  • What kinds of data produced by others do you typically work with?
  • How do you find that data?
  • How do you incorporate the data into your final research outputs? [e.g. included in the appendices, visually expressed as a table or figure]
  • How do you manage and store this data for your current use?
  • What are your plans for managing the data beyond your current use?
  • Have you encountered any challenges working with this kind of information?
  • Are there any resources, services or other supports that would help you more effectively work with the data produced by others?

Working with Published Information
• What kinds of published information do you rely on to do your research? [e.g. pre-prints, peer-reviewed articles, textbooks]
• How do you locate this information? [Prompt for where and how they search for information and whether they receive any help from others in the process]
• How do you manage and store this information for your ongoing use?
• What are your plans for managing this information in the long-term?
• Have you experienced any challenges working with this kind of information?
• Are there any resources, services or other supports that would help you more effectively work with this kind of information?

Publishing Practices
• Where do you typically publish your scholarly research?
• What are your key considerations in determining where to publish?
• Have you ever made your scholarly publications available through open access? [e.g. pre-print archive; institutional repository, open access journal or journal option]. If yes, describe which venues.
  • Describe your considerations when determining whether or not to do so.
• Do you disseminate your research beyond scholarly publications? [If so, probe for where they publish and why they publish in these venues]
• Do you use social networking or other digital media platforms to communicate about your work [e.g. ResearchGate, Twitter, YouTube]?
  • If yes, describe which venues and your experiences using them.
  • If no, explain your level of familiarity and reasons for not choosing to engage with these kinds of platforms.
• How do your publishing practices relate to those typical in your discipline?
• Have you encountered any challenges in the process of publishing your work?
• Are there any resources, services or other supports that would help you in the process of publishing?

State of the Field and Wrapping Up
• How do you connect with your colleagues and/or keep up with trends in your field more broadly? [e.g. conferences, social networking]
• What future challenges and opportunities do you see for the broader field?
• Is there anything else about your experiences or needs as a scholar that you think it is important for me to know that was not covered in the previous questions?