SELF-STUDY REPORT

School of Computer Science
College of Engineering and Physical Sciences
University of Guelph

November 2019

The School of Computer Science (SoCS) was founded in 1971 and will celebrate its 50th anniversary in less than 2 years. To date, it has graduated more than 3,000 students, prepared them to Improve Life through developing and using technology in innovative ways. Throughout its history, SoCS has maintained its focus on undergraduate education — to develop strong technical and analytical skills in our students using hands-on experience in leading edge technology. On the other hand, SoCS is embracing exciting changes as well: its undergraduate programs are increasingly popular in the last 6 years; it welcomed 8 new faculty members in the past 3.5 years who brought in diverse research background and strong research profile; its historical home (Reynolds Building) received major renovation and reopened in August 2018; it celebrated outstanding achievements of our alumni for the first time in March 2019; and welcomed new students for its first professional Master in Cybersecurity and Threat Intelligence (MCTI) program in September 2019. Hence, it is a good time to reflect on where we have been, where we are now, and where we want to go.

At the institutional level, the University of Guelph completed its strategic framework in 2016 — Our Path Forward — which describes who we are as an institution, where we will focus and how we will move forward as a University. In May 2018, the College of Engineering and Physical Sciences (CEPS) launched a comprehensive strategic planning process under the leadership of Dean Mary Wells. Based on essential statistics collected and consultation with faculty members and staff, the following 5 college-level goals were established:

- Maintain and build on our strengths in undergraduate education, including enhancing the cooperative education and research opportunities our students receive, and increasing the percentage of international students we enroll in our programs.
- Enhance our graduate education through the introduction of new professional master's programs.
- Increase our research intensity and impact.
- Focus on issues of equity, diversity and inclusivity (EDI) in our College and ensure all our students, faculty, and staff feel valued and respected.
- Take advantage of interdisciplinary opportunities in research and teaching across our College, the University of Guelph, and beyond.

As part of the CEPS strategic planning process, this self-study looks at what SoCS hopes to achieve over the next 5 years, the actions needed, and how these actions align with the College's goals. The self-study considered feedbacks collected through several surveys and retreats by the SoCS

Strategic Planning Committee, first under the leadership of D. Gillis (until 2018), and then S. Scott (2018-present). Detailed methodology and activities can be found in Appendix A.

A. Resource and Organization

We start with evaluating the human, physical, and financial resources that SoCS currently has, as well as its organization structure.

A.1. Faculty

As of October 2019, SoCS has 26 faculty members, including 2 teaching-focused Contractually Limited (CL) members, 4 tenure-track Assistant Professors, 13 Associate Professors, and 7 Professors. One of the faculty members is scheduled to retire in January 2020. His position and an additional position for supporting the Centre for Advancing Responsible and Ethical Artificial Intelligence (CARE-AI) are expected to be filled soon. The percentage of female faculty members has been historically low at 16%; see Figure 1. Recent hires helped to improve the gender balance, with the percentage fluctuating between 20~25% in the past 2 years. Figure 1 also plots the current age distribution of SoCS faculty members, which shows that the 46~55 age group has the highest number of 11 faculty members.

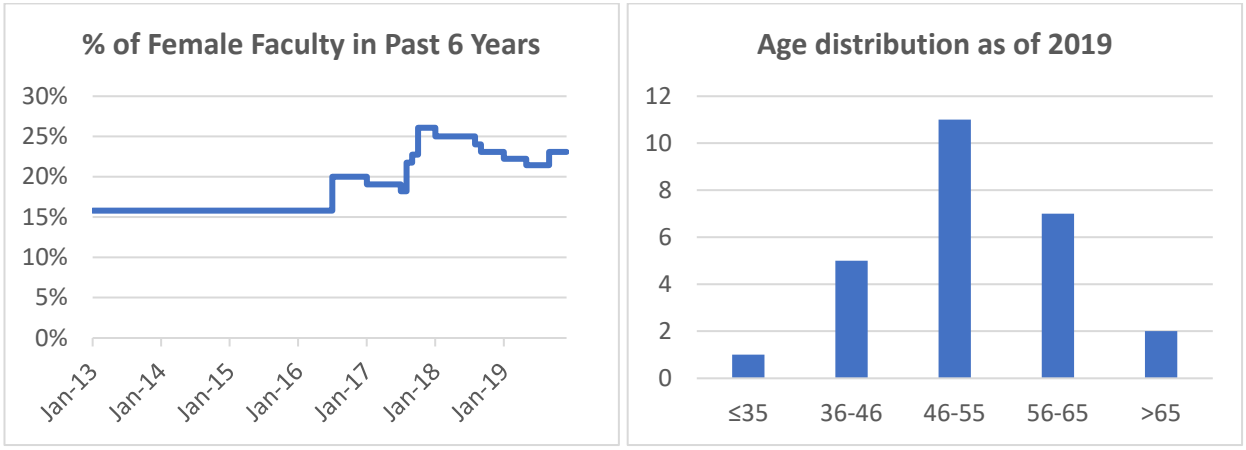

Figure 1: SoCS faculty demographics

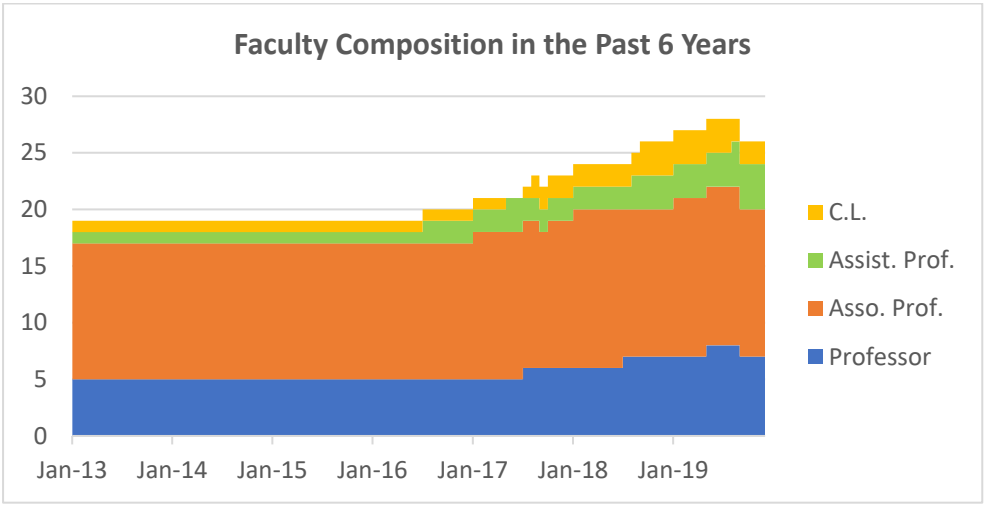

Figure 2: Faculty composition over the past 6 years

Figure 2 further plots the faculty composition in the past 6 years. It reveals that SoCS faculty didn't see any change (i.e. new hires or promotions) during the 3.5 years between January 2013 and July 2016. Compounded with the rapid increase in undergraduate student population (more on this in Section B.3), SoCS faculty members at the time felt overloaded and stressed. This trend was broken in the 2016/17 academic year, when 2 new faculty members joined and 2 existing faculty members successfully promoted to Associate Professor and Professor, respectively. In the year after, SoCS welcomed 2 new regular faculty positions and 2 teaching-focused CL positions. In the 2018/19 academic year, 2 more faculty positions were added to support the new Master in Cybersecurity and Threat Intelligence (MCTI) program and a new position for the School Director was also created. On the other hand, 3 faculty members were retired during this 3-year period. One of their positions were lost due to budget cut, one is filled by a new faculty member, and one was used for converting an existing CL appointment into a tenure-track position.

While SoCS enjoys the addition of 7 new faculty positions (a 39% increase) when compared to year 2013, whether the current faculty complement level is enough is still debatable. This is because: 1) the number of undergraduate students was more than doubled during the same time period and 2) 3 of the new faculty members are heavily involved in the new MCTI program and hence have very limited teaching capacity for supporting SoCS undergraduate programs. It is therefore important to reach an agreement with university administrators on the proper faculty complement level (Action Plan E.1.2).

A.2. Staff

SoCS also hosts 8.6 staff members as of October 2019, including an Administrative Officer, an Undergraduate Program Counsellor, an Instructional Support Coordinator, a Recruitment and Outreach Officer, 2 IT Analyst III, 2 Program Assistants for undergraduate and graduate programs respectively, and a part-time Administrative Support Clerk.

To support the rapid growing undergraduate programs, SoCS has been hiring Teaching Assistants (TAs) for many instructional related tasks, including grading assignments/exams, tutoring students in labs, and administrating academic integrity. Using TAs for these tasks has the benefits of low budget requirement, job opportunities for our students, and ability to quickly adapt to enrolment changes. However, it also brings high administrative overhead for planning, advertising, interviewing, and filling TA positions. The Academic Staff Hiring Committee that is responsible for these tasks is considered the most demanding SoCS committee. Other challenges include training TAs to better prepare them for the job, managing multiple TAs in a single course, maintaining consistency among multiple offering of the same courses, evaluating TA performances, and avoiding conflict of interests (especially for handling academic misconduct cases). These issues are partially addressed with the hiring of an Instructional Support Coordinator (O. Adesina) in the 2018/19 academic year. He took charge of academic integrity responsibility, which consumes 50% of his time and hence his contribution to TA management is limited.

Besides the issue of TA management, the increase in the number of undergraduate students also adds heavy workload to our Program Counsellor (G. Klotz). With 776 full-time-equivalent (FTE)

undergraduate students in 2018/19 academic year, the ratio of students-to-counsellor at SoCS is much higher than the average in CEPS.

With SoCS overshot its first-year enrolment target by ~45% and O. Adesina's resignation in July 2019, an additional staff position was created in Summer 2019 for undergraduate program counselling and administrating academic integrity. This not only addresses the issue of high students-to-counsellor ratio, but also allows the revised Instructional Support Coordinator role to take on more TA management responsibilities, which include planning, advertising, interviewing, and filling TA positions, as well as training, managing, and evaluating individual TAs. The Instructional Support Coordinator role can serve as an interface between students, TAs, and faculty members. Hence, securing enough staff capacity for both programming counselling and instructional supports in long term is important (Action Plan E.1.1).

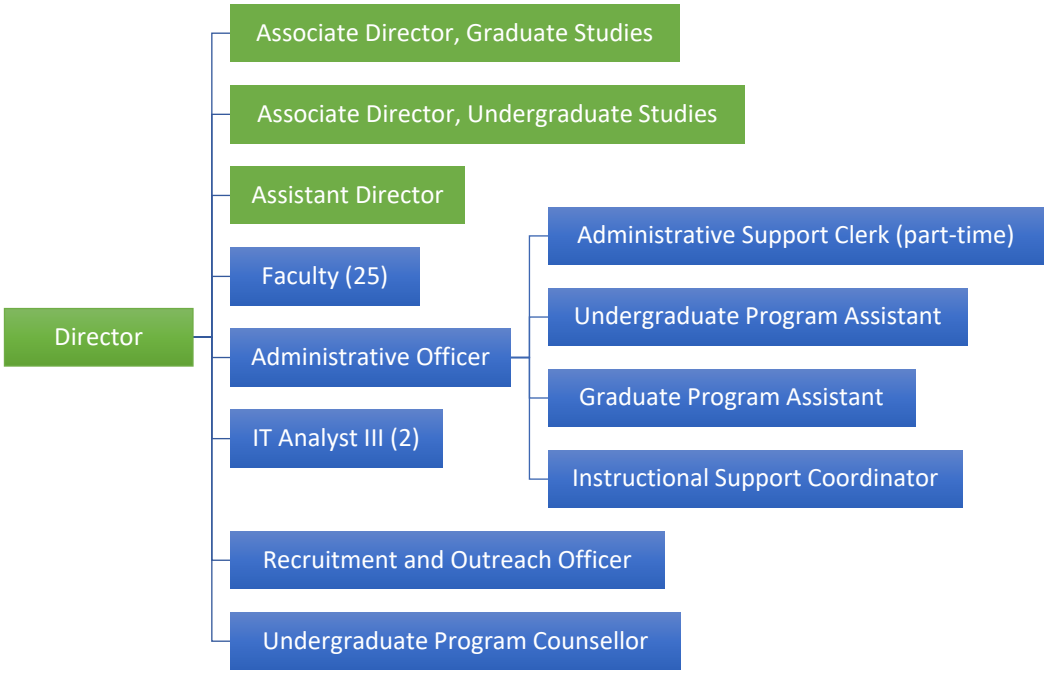

Figure 3: SoCS Organization Chart

A.3. Organization Structure

The organization structure of SoCS is shown in Figure 3. The administrative team consists of a Director (M. Gong), an Associate Director Graduate Studies (J. Sawada), an Associate Director Undergraduate Studies (D. Calvert), and an Assistant Director (M. Wirth). There are currently 19 standing committees in SoCS under the responsibility of the Director, Associate, and Assistant Directors; see Figure 4. Feedback collected from faculty members regarding committee services includes:

- The number of committees is high for an academic unit of our size, resulting each faculty member sitting on 2~4 committees. Each Associate Director sits on 6~7 committees and chairs 3 of them.

- The workloads for different committees are unevenly distributes, e.g. the Academic Staff Hiring Committee is considered much busier than others.
- The responsibilities of some committees overlap, e.g. the Graduate Admissions Committee and the Academic Staff Hiring Committee both evaluate applicants to our graduate programs.
- No committee oversees external activities, such as outreach and marketing.

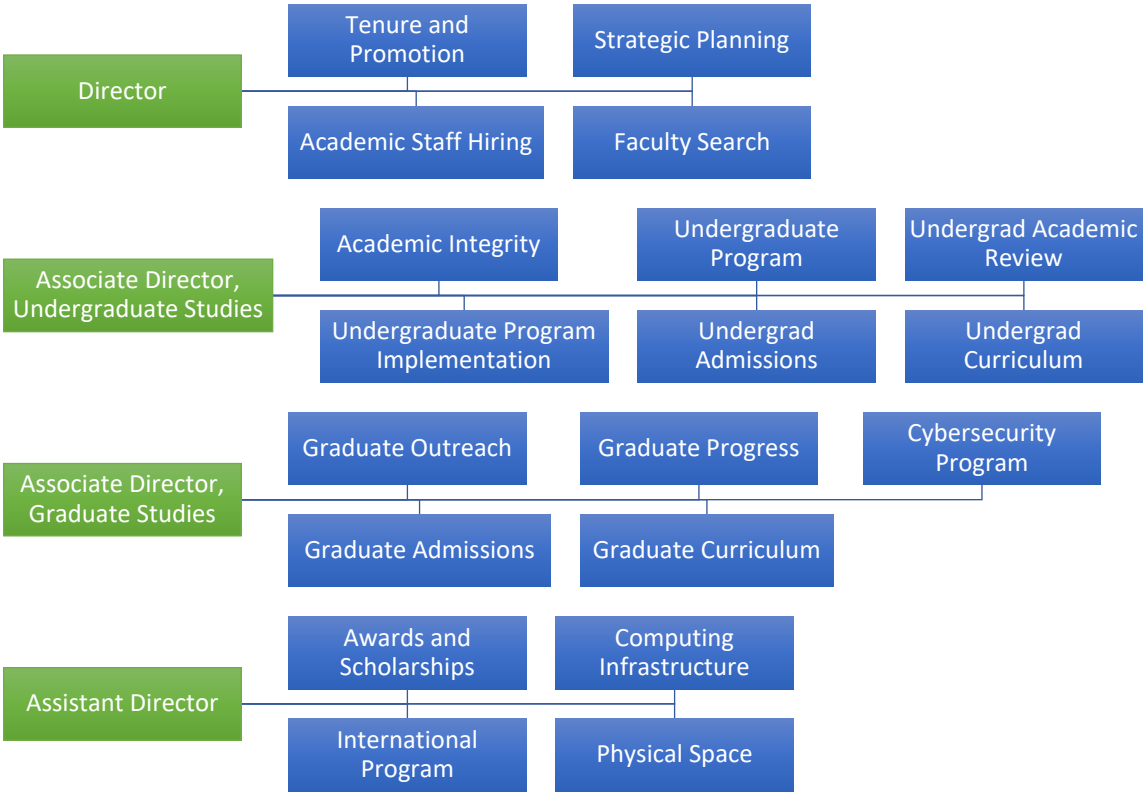

Figure 4: Organization of SoCS committees

Discussions on how to reorganize SoCS committee structure for streamlining the decision-making process and balancing the service workload are therefore needed (Action Plan E.1.4).

A.4. Faculty Workload Assignment

As shown in Figure 5, the majority of the faculty members in SoCS follow the default Distribution of Effort (DOE), which is 40% teaching, 40% scholarship, and 20% service. The exceptions include the teaching-focused CL positions, which have a DOE of 70%/15%/15%, and members taking on administrative roles both within and outside of SoCS.

Faculty members with 40% teaching load are expected to teach 3 courses per year, whereas 70% teaching load translates to 5 courses per year. Currently the workload differences between offering different courses are not considered. This approach, while is easy to implement, raises equitable issues for the following reasons:

- While the majority of SoCS undergraduate lecture courses have credit weighting of 0.5 credits, there are a few courses (i.e., CIS*2170, CIS*2750, CIS*3750, and CIS*3760) have 0.75 credits for recognizing the heavier project or group work component in these courses. Added work is required for managing such a course, which is not recognized.
- In some courses, faculty are required to actively participate in many labs, whereas in others there is no lab component for the course.
- The efforts for developing and teaching a new course is not formally recognized. The Director at the time normally provides teaching credit for such efforts, but there is no policy to enforce this.
- Preparatory work for offering an existing course for the first time is not recognized. In comparison, the Collective Agreement between CUPE 3913 and the University of Guelph clearly defines the supplemental payment for such preparatory work from sessional lecturers.
- Class size differences are not considered. Due to rapid enrolment increase, SoCS faculty members were forced to offer extra-large courses. The problem was alleviated by P. Matsakis, Interim Director at the time, who split most of the courses with >200 students into multiple sessions.

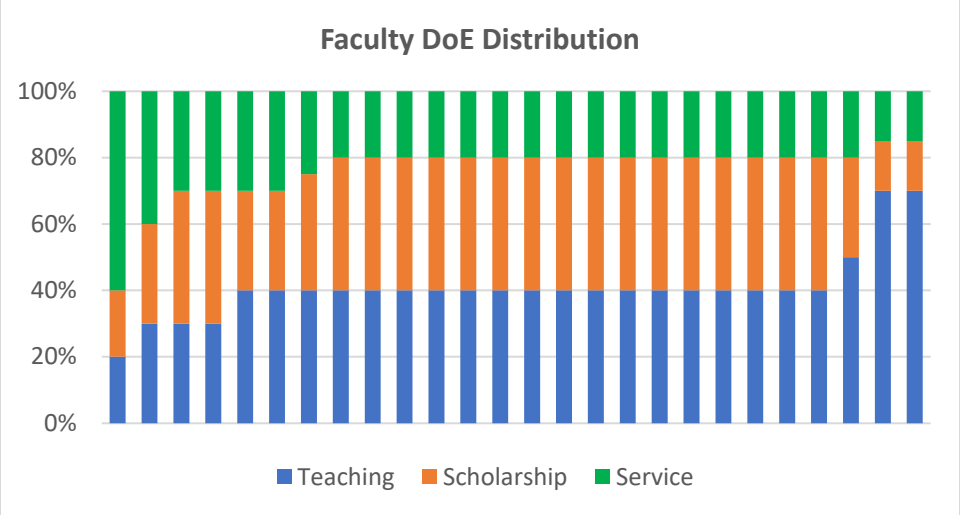

Figure 5: The Distribution of Effort (DOE) of different faculty members

During the public presentation of M. Gong's interview for School Director, he mentioned the teaching equivalency document at Memorial University of Newfoundland, which defines the additional teaching credits for offering new courses, courses with labs/large sizes, etc. There is interest for SoCS to set up a similar practice to ensure equity among faculty members' teaching workload (Action Plan E.1.3).

A.5. Physical Infrastructure

SoCS mainly resides in the Reynolds Building, which was initially built in 1915. This historical building was extensively renovated between November 2017 and August 2018. Currently, the

building has 38 offices, which host all SoCS faculty and staff members. The usage of other rooms in the Reynolds Building is listed in Table 1.

In terms of undergraduate teaching space, besides a lab in Reynolds 0002, SoCS also uses 4 other teaching labs: THRN 2418, THRN 2420, THRN 3401, and SSC 1303/1305. These labs are currently being used at close to capacity; see Appendix for booking schedules. In addition, the room Reynolds 3321 is reserved as a teaching lab for graduate students in the new MCTI program.

In terms of research space, our self-study activities have revealed the needs for dedicated research facilities. There are 3 rooms (Reynolds 2207/3307/2221) set up as "graduate pods" in the newly renovated Reynolds building, which accommodate 54 students in total. Two other double-office-sized rooms (Reynolds 2206/3306) are reserved as research labs: one as HCI Lab for conducting user studies and is shared by S. Scott, D. Flatla, and A. Hamilton-Wright; the other as Cyber Science Lab for supporting A. Dehghantanha's CRC Tier II nomination and hosting his computer servers. The graduate pods are currently at capacity with our current graduate students, and thus, there is no available room for additional graduate students, nor for any undergraduate students hired for either part-time or full-time research position (e.g. summer URA/USRA students).

Table 1: Space usage in Reynolds building

Room location	Room function	# of seats
Reynolds 0002	General teaching lab	48
Reynolds 0001	Shared TA office	23
Reynolds 0003	Shared TA office	20
Reynolds 0004	Postdoc and sessional office	20
Reynolds 1101	Classroom	48
Reynolds 1103	Boardroom	8
Reynolds 2224/3324	Boardroom (2)	12 each
Reynolds 2206/3306	Research lab (2)	6 each
Reynolds 2207/3307	Graduate student office (2)	15 each
Reynolds 2221	Graduate student office	24
Reynolds 3321	Cybersecurity teaching lab	36

Due to the space constraint, existing undergraduate research students (and future graduate students) are forced to work at home, at library, or occasionally at one of the meeting rooms. This is not a sustainable arrangement and does not offer these students a high-quality research experience, which they could get when work closely with more senior graduate students and faculty members. They cannot receive mentorship on conducting research, technical problems, or general professional development in a timely manner. The lack of high-quality research experience in turn makes it hard to motivate these students to pursue further graduate studies.

Action is therefore needed to seek for additional high-quality space on campus for SoCS to support both teaching and research activities (Action Plan E.1.5).

A.6. Financial Resources

As shown in Figure 6, the annual budget of SoCS has seen an increase of 48% from <$4 million in the 2014/15 financial year to $5.6 million in the 2018/19 financial year, largely due to the added faculty positions. On the other hand, the School has been carrying a debt, which started at $560K in the 2014/15 financial year and peaked at >$600K in the 2016/17 financial year. Under the pressure of recovering from the debt, SoCS adopted cost-saving measures such as using less costly Undergraduate Teaching Assistants (UTAs) instead of Graduate Teaching Assistants (GTAs) in 1st and 2nd year courses. The debt has since reduced to about $250,000 in the 2018/19 financial year.

Besides the budget, the only other revenue source for SoCS in the past 5 years is through offering Distance Education (DE) courses. This revenue was >$270K in the 2014/15 academic year but has since declined to <$170K in the 2018/19 academic year, due to the reduction on the number of DE courses that SoCS offers. Starting from the 2019/20 academic year, the new MCTI program is expected to be another revenue source.

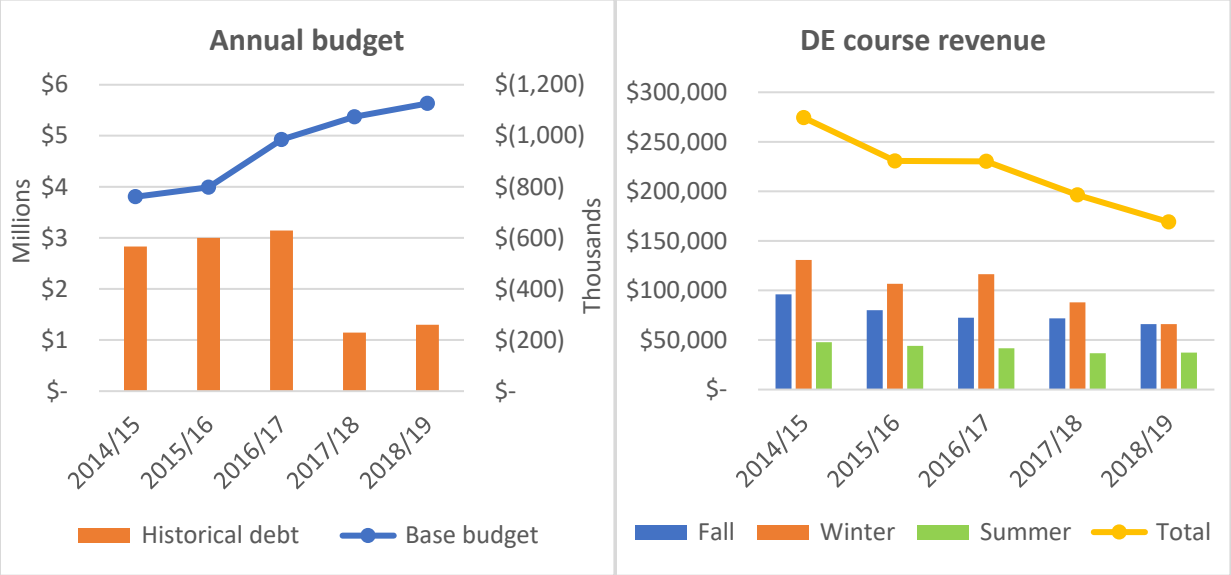

Figure 6: SoCS budget and revenue from offering Distance Education (DE) courses

Figure 7 shows how the budget was spent every year. As expected, the majority was used on personnel, which consistently accounts for ~95% of the total budget. The operating-related spending accounts for another 3~3.6%. It is worth noting that the fellowships for GTAs and UTAs are coded under operating, which account for 50~65% of total operating cost.

Figure 7 also plots the personnel expenses for different types of positions. Due to increases in the number of faculty, the expense has increased 43% from $2.4M in 2014/15 to $3.4M in 2018/19. Expense on staff also seen an increase of 79% from $260K to $470K in the past 5 years. The cost for GTA, on the other hand, peaked at $475K in the 2017/18 financial year, which means roughly 80 full GTAs were used between Summer 2017 and Winter 2018 terms.

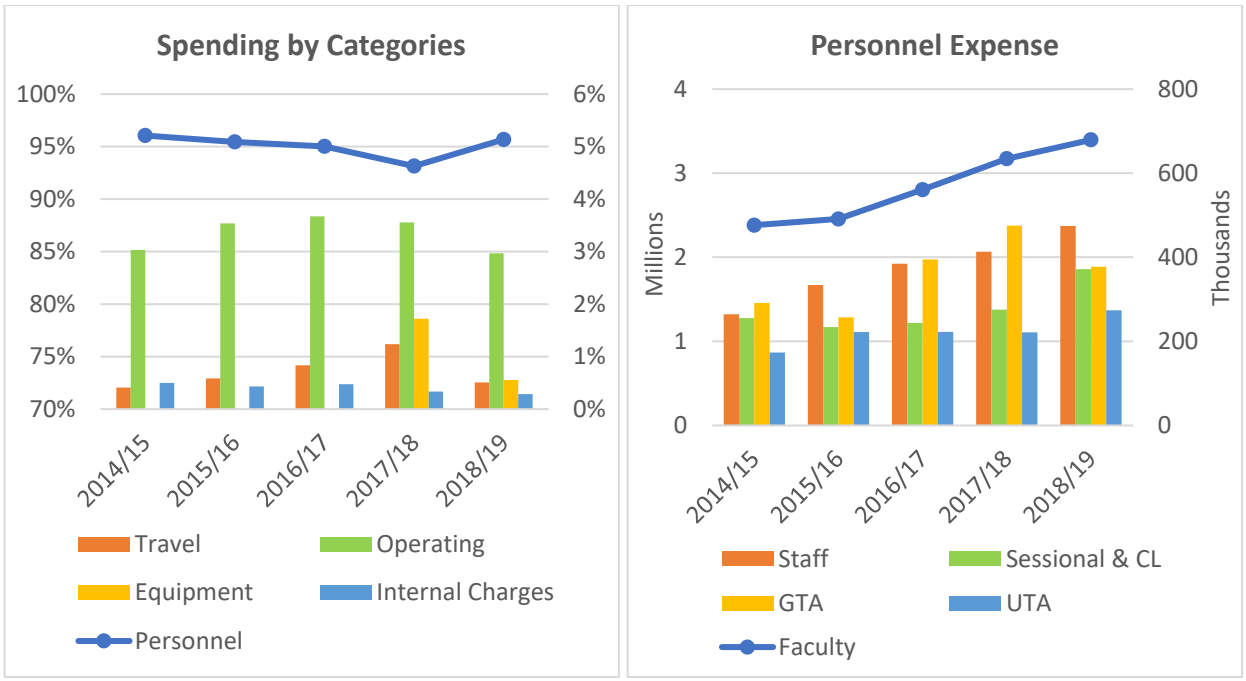

Figure 7: Distribution of the budget among different spending categories (left) and the personnel expenses for different type of positions (right)

B. UNDERGRADUATE EDUCATION

SoCS offers 2 main 4-year Bachelor of Computing (BComp) degree programs: one in a Computer Science (CS) and the other in Software Engineering (SE). Both programs offer 5-year co-operative education (co-op) degree program options for eligible students (70% or higher average). SoCS also offers a 3-year BComp General degree program.

B.1. High Overall Demand for SoCS Programs

Figure 8 plots first-year student recruitment data for the past 4 years, which show a strong and increasing demand for SoCS undergraduate programs. From 2016 to 2019, the number of applications, excluding transfers, more than doubled (from 1,384 to 2,897 applications). The rapid increase in the number of applicants has led to a decrease in acceptance ratios. SoCS used to accept >1/2 of its applicants in Fall 2016, but only took <1/3 in Fall 2019.

To address this rapid growth with limited additional faculty hires, SoCS had set an enrolment target of 200 incoming students under the leadership of P. Matsakis, Interim Director at the time. However, this target has been consistently overshot. There were 291 students confirmed to join SoCS in Fall 2019, exceeding the target by ~45%. As a result, SoCS was left scrambling to find larger classrooms and sectional lectures to accommodate the additional students within a short period. Discussions with the Registrar's Office on how to effectively enforce this target is therefore of high priority (Action Plan E.2.1).

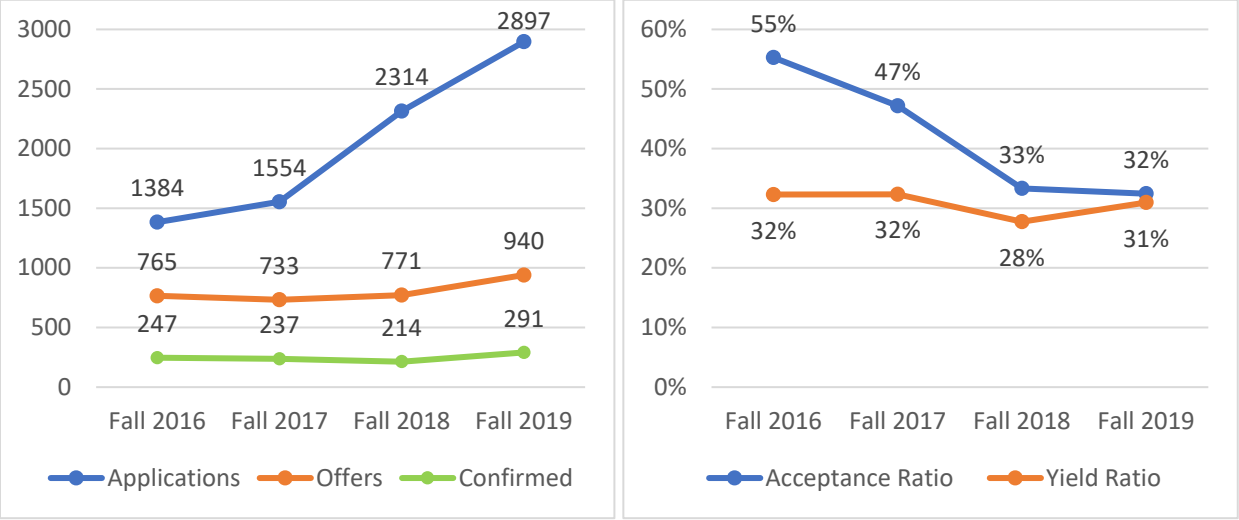

Figure 8: Growth in demand for SoCS programs. Left: number of students applied for, received offer from, and confirmed to attend SoCS; Right: the corresponding acceptance and yield (confirmed/offers) ratios

Given the global trend toward digitization across many different industry sectors, the industry need for software developers will continue to grow. The current interest and expected growth of artificial intelligence integration into a wide variety of application areas also call for more CS graduates. Hence, we anticipate this high demand to continue for the short- to mid-term future. Long-term demand is less certain, however. University of Guelph is situated within hours of

several top, internationally recognized Computer Science schools/departments, and competition for the top students is fierce. Providing a quality education and student experience will play a key factor for SoCS to maintain and grow its local, Canadian, and international reputation. Initiatives for fueling the long-term demand for SoCS programs includes providing more experiential learning opportunities (Action Plan E.2.2) and opportunities to learn in-depth knowledge in selected areas (Action Plan E.2.3).

B.2. Demands for Different SoCS Programs

We further compare the demands for the 3 SoCS degree programs and the 2 co-op options. Figure 9 shows that the 2 co-op options attracted the highest number of applicants throughout the past 4 years. The cutoff averages for the 2 co-op options are in general higher as well. This indicates that students value the experiential learning experience that SoCS offers through co-op.

Experiential learning is listed as one of the 10 metrics in the Ontario's new performance-based funding model for colleges and universities. Hence, further enhancing SoCS co-op programs has multiple benefits. On the other hand, the number of co-op placement positions is limited, especially during the summer terms. CEPS Associate Dean Undergraduate Studies, K. Gordon, is leading the efforts on introducing summer academic term for SoCS and School of Engineering (SoE). SoCS fully supports this initiative (Action Plan E.2.2).

Figure 9 also shows that the 3-year BComp General degree is the least attractive program in SoCS. There were only 21 applicants in Fall 2016 and 53 in Fall 2019, accounts for <2% of the total applicants. While not being a popular option, this program can be restructured to serve as a graceful exit route for students in other SoCS programs who run into insurmountable difficulty in completion. Given that graduation rate is another evaluation metrics in the new provincial performance-based funding model, this initiative, led by D. Calvert, Associate Director Undergraduate Study, should be supported (Action Plan E.2.4).

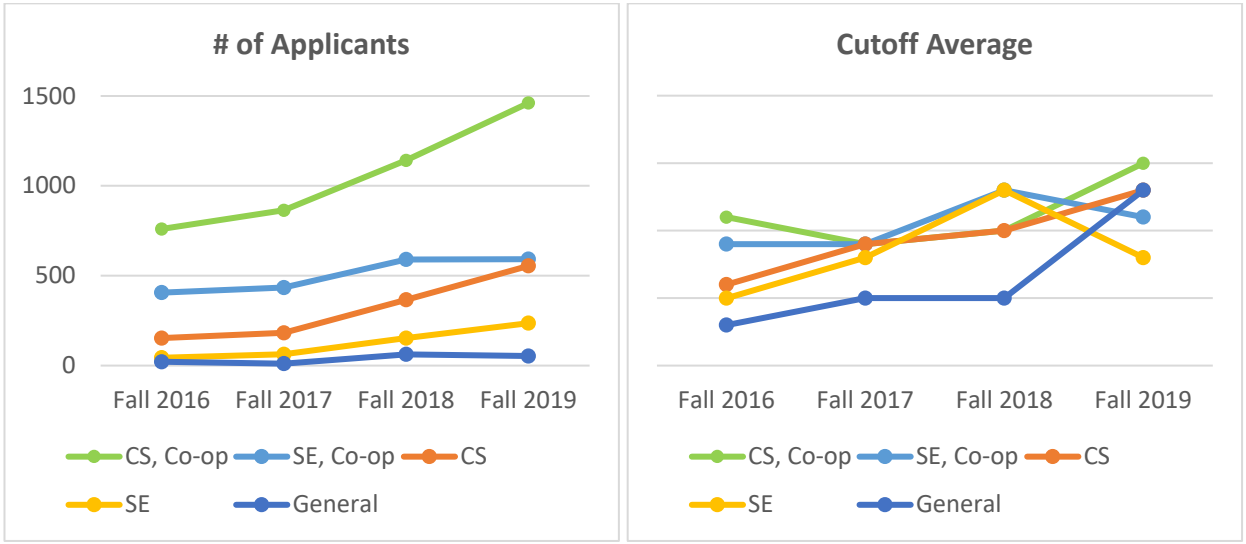

Figure 9: Comparison among different SoCS programs on the number of applications (left) and cutoff average (right). The Y axis on the right plot is intentionally unlabeled

B.3. Undergraduate Student to faculty ratio

Official enrolment data retrieved from the University Data Portal show that the number of students in SoCS programs has increased substantially over the past 9 years. As shown in Figure 10, there were 206 full-time and 27 part-time students in 2010/11 academic year, whereas the latest numbers have closed to quadrupled to 807 full-time and 117 part-time. The percentage of part-time students has been relatively stable at ~15% in recent 3 years.

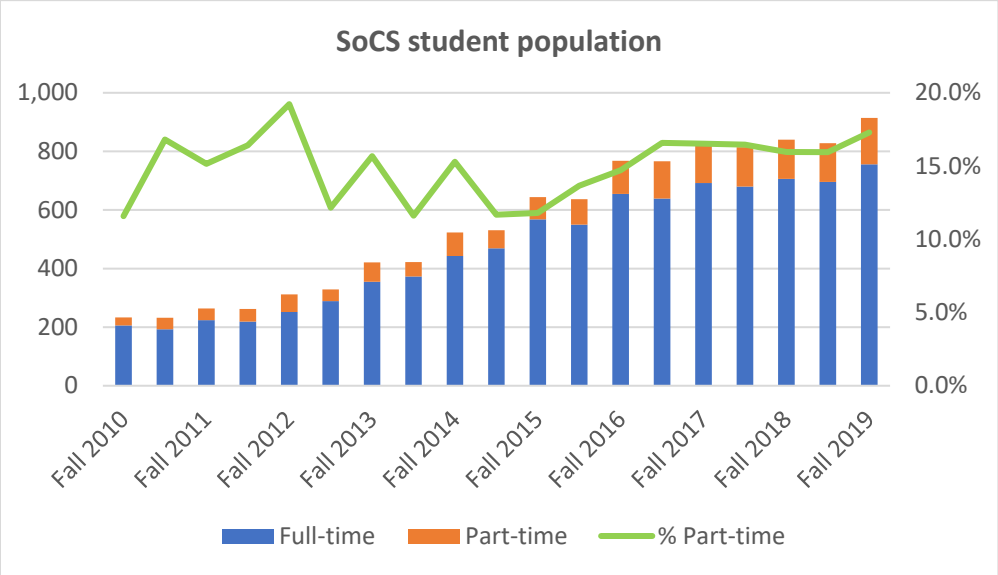

Figure 10: SoCS student headcount and part-time vs full-time student ratios

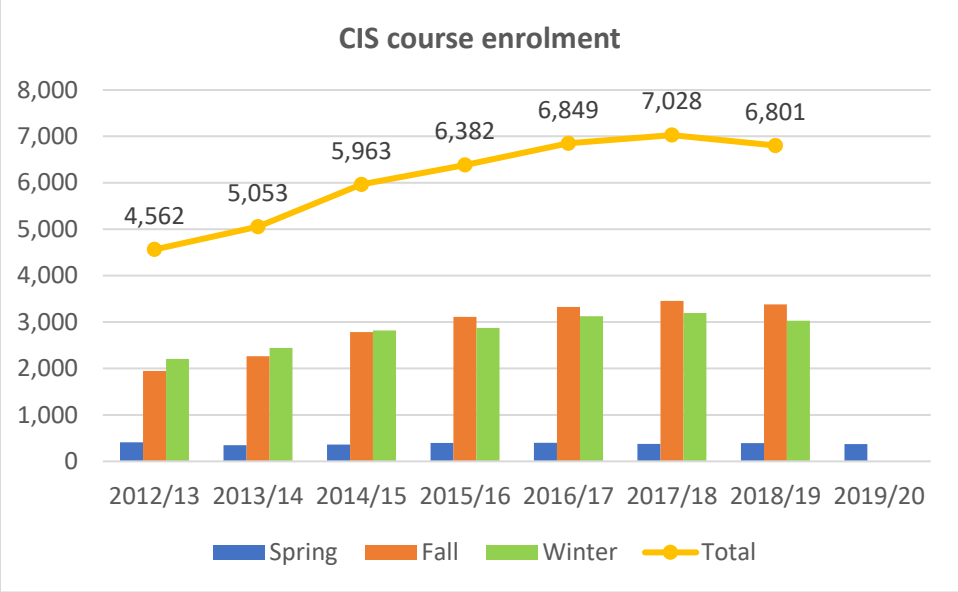

Figure 11: CIS course enrolment in different terms

SoCS also conducts significant service teaching both within CEPS and for the broader university community, with ~1,000 students enrolled in our introduction to computer applications,

computing, and programming courses in recent years. As shows in Figure 11, the total number of course enrolment increased from ~4,500 in 2012/13 to ~6,800 in 2018/19.

On the other hand, as mentioned in Section A.1, the number of SoCS faculty members didn't catch up until 2017/18 academic year. As a result, the full-time equivalent (FTE) undergraduate student to faculty ratio dramatically increased from 16:1 in January 2013 to peak of ~38:1 in both September 2016 and September 2017; see Figure 12. The new positions created in the past 2 academic years helped to reduce this ratio to ~30:1, but the high incoming student enrolment in Fall 2019 pushed it up to >35:1 again. If we consider service courses provided by SoCS, the ratio is even higher.

In addition, since some of the new hires were dedicated for supporting the new course-based MCTI program and hence cannot contribute to undergraduate teaching, the overall undergraduate student to faculty ratio does not show an accurate picture. If we remove the faculty members needed for offering the 7 courses for the MCTI program, the ratio only saw a modest drop to ~35:1 in the past 2 years and has now been pushed up to >38:1 again in Fall 2019; see Figure 12.

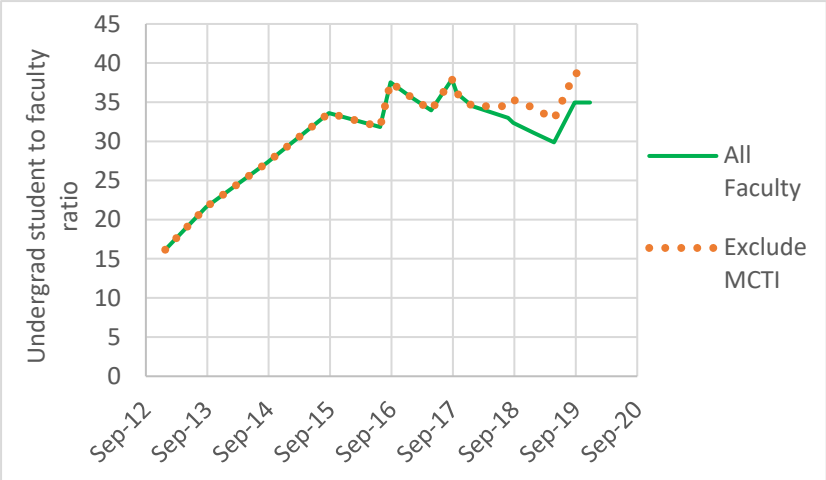

Figure 12 Undergraduate student (FTE) to faculty ratio

Feedback collected during our self-study consultation activities found that many faculty and staff feel unable to provide a high-quality teaching experience or enough support for all students in their classes, as the size of their classes have grown. A specific concern was the impact on the SE program, which was intentionally designed as a "boutique" program that offers students intensive team-based, project focused learning. This type of course design demands significantly more hands-on management from faculty than more theory-based courses. Another concern, valid for both the CS and SE programs, is the impact on the student experience in upper year technical electives that teach in-depth, advanced technical skills and knowledge. Providing meaningful, quality experiences in large classroom contexts for these demanding courses is extremely difficult and time-intensive. To address this issue, it is imperative that SoCS work together with the College and University to resolve the currently inadequate staffing levels (faculty and staff) to appropriately support our high enrolment levels (Action Plans E.1.1 and

E.1.2). As discussed above, providing students with a high-quality learning experience is critical for maintaining the reputation and long-term demands of our programs.

B.4. Increases in International and Female Student Ratios

Besides the increases in the total number of students, SoCS undergraduate programs are also becoming increasingly diversified. As shown in Figure 13, there were a total of 14 international students in SoCS programs in Fall 2013, which accounts for 3.3% of student population at the time. Today this number increased by 7 times to 100. In addition, 49 of these international students joined in Fall 2019, which is the largest cohort in the School's history and accounts for 17.6% of all incoming students. This trend aligns well with both the College's and University's strategic mandate towards internationalization.

This increase in international students brings opportunity to help grow the global reputation of SoCS degree programs and to generate additional tuition income for the University. It also introduces new challenges as we welcome these new students to SoCS, Guelph, and Canada. Sufficient resources and supports are needed to ensure a successful acclimation and integration into our programs. To address this issue, one of our initiatives will be to secure resources for actively recruiting and better supporting international students (Action PlanE.5.3).

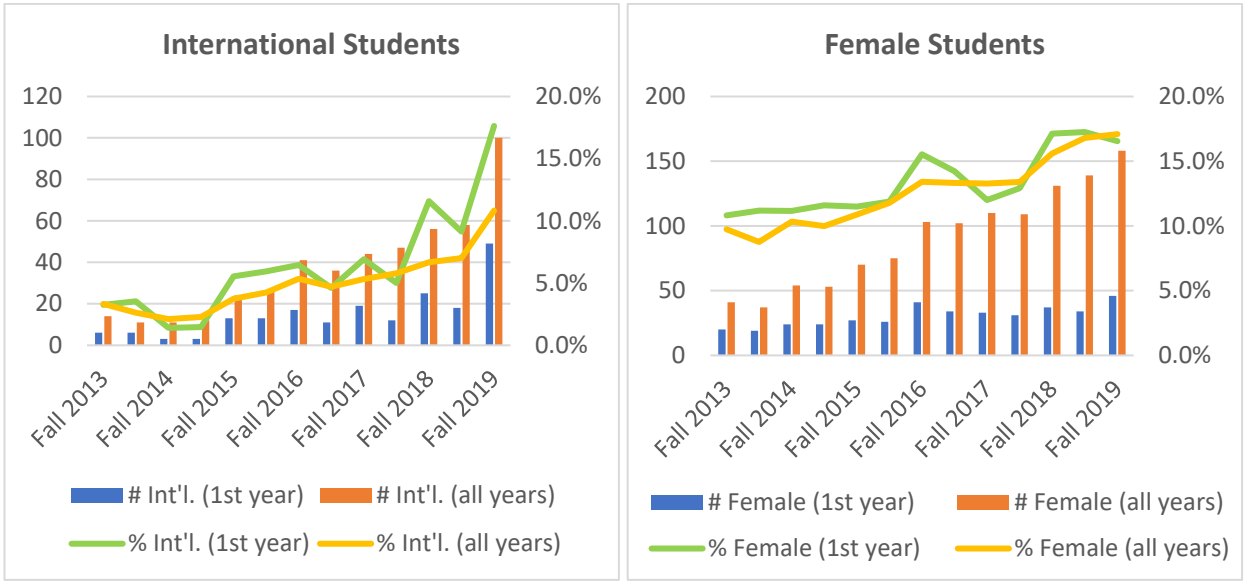

Figure 13: Composition of SoCS students in terms of international (left) and female (right) students

Figure 13 also shows the number and percentage of female students over the past 6 years. There were a total number of 41 female students across all our BComp degree programs in Fall 2013. Today, there are 158 female students in SoCS, 46 of which joined in Fall 2019. The percentage of female students enrolled also increased slowly but steadily, from <10% in Fall 2013 to >17% in Fall 2019.

As the College has stated an overall target of reaching 20% female enrolment in all programs by 2022, SoCS clearly has some work to do to meet this goal. To address this issue, one of our initiatives will be targeted recruitment and retention for female students (Action Plan E.5.4).

C. GRADUATE EDUCATION

SoCS currently offers 3 graduate degree programs, a Master of Science (MSc) degree in CS, a Doctor of Philosophy (PhD) in Computational Sciences, and a professional Master in Cybersecurity and Threat Intelligence (MCTI). The MSc is a 2-year program that requires completion of 5 graduate courses (1 core, 4 elective), a public seminar, and a thesis. The PhD degree program is a 3-year interdisciplinary program that requires one supervisor in SoCS and one supervisor in a relevant Application Discipline (AD) outside of SoCS. Students must complete a core course, a qualifying exam, 2 public seminars, and a dissertation. The Computational Sciences PhD program is fairly new and began admitting students in 2015/16. Prior to that, SoCS offered a traditional PhD in CS, which was discontinued in 2014/15. The MCTI program is newly launched in Fall 2019 as SoCS's first course-based Master program. It is a one-year (3 semester) program that requires completion of 6 courses (5 required, 1 elective) and a project with an industry partner.

C.1. Strong Demand for SoCS Graduate Programs

Like our undergraduate programs, the number of applicants for SoCS graduate programs has increased dramatically in the past 4 years as well; see Figure 14. The total number of applicants jumped from <50 during the 2015/16 academic year to >250 in 2018/19 academic year. The figure also shows that the percentage of international applicants varied from 40% to 70% in the past 4 years. The percentage of international students that received offers has increased from <45% to 60%.

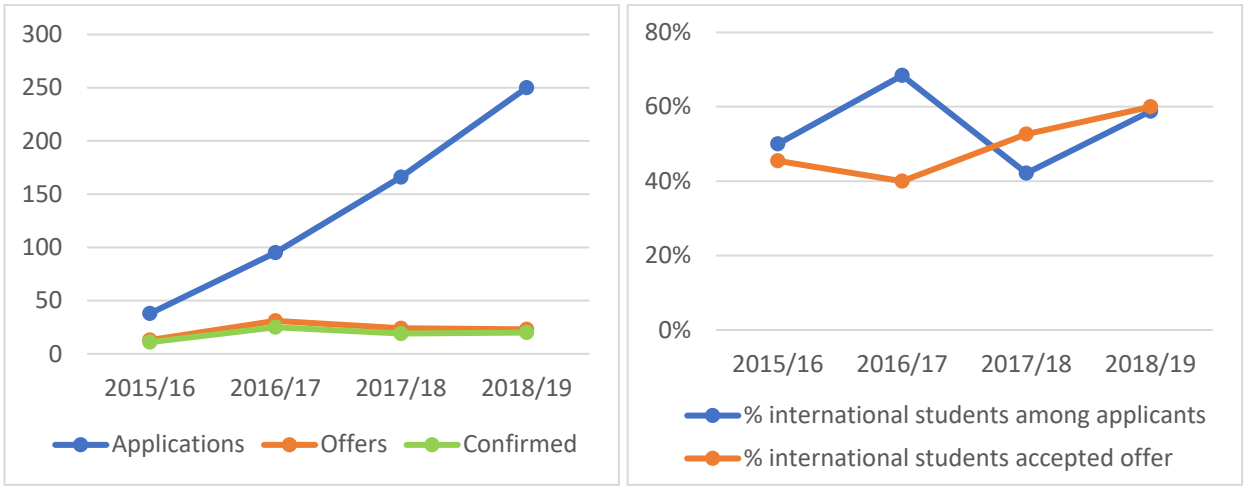

Figure 14: Demand for SoCS graduate programs. Left: the number of students applied, received offer from, and confirmed to join SoCS graduate programs. Right: the immigration status of applicants.

The high international student percentage presents both opportunities and challenges for SoCS to grow our graduate programs in the future. The current reality in Canada is that undergraduates from technical fields (computing, engineering, etc.) are in extremely high demand. These students can obtain well-paying jobs directly out of their bachelor's degrees. Thus, it is difficult,

even for top computing and engineering schools in Canada, to recruit domestic students into graduate studies. Exceptions include certain areas such as Artificial Intelligence, Cybersecurity, and Bioengineering, where such topics are currently largely taught at the graduate level. Thus, we believe that our newly introduced MCTI program will help attract both domestic and international graduate students.

The large number of applicants introduces high workload for screening them. SoCS only has one Graduate Program Assistant, who oversees the progress of ~70 existing graduate students on top of processing the applications. Hence, she does not have the capacity to provide detailed evaluation on the large number of applicants. Only those whom faculty members express interest to recruit are carefully reviewed and hence some high-quality applicants could be rejected without being known to faculty members. Discussion on how to better screen graduate applicants is therefore needed, especially for applicants of the course-based MCTI as they do not have supporting faculty members (Action Plan E.3.5).

C.2. Graduate Student to Faculty Ratio

Despite the rapid increase in the number of applicants, the graduate programs at SoCS remain relatively small. Figure 15 plots the number of graduate students in the 3 existing SoCS programs, as well as the discontinued PhD in CS program. Since the new Computational Sciences interdisciplinary PhD program coming online in 2016, it has seen a healthy growth to 19 full-time students this year. Part of it can be attributed to the recent hire of several new faculty members with ongoing or emerging research programs. The new MCTI program introduced in Fall 2019 also attracted 13 students. The number of MSc students, on the other hand, has been stable at ~35 in the past 4 years.

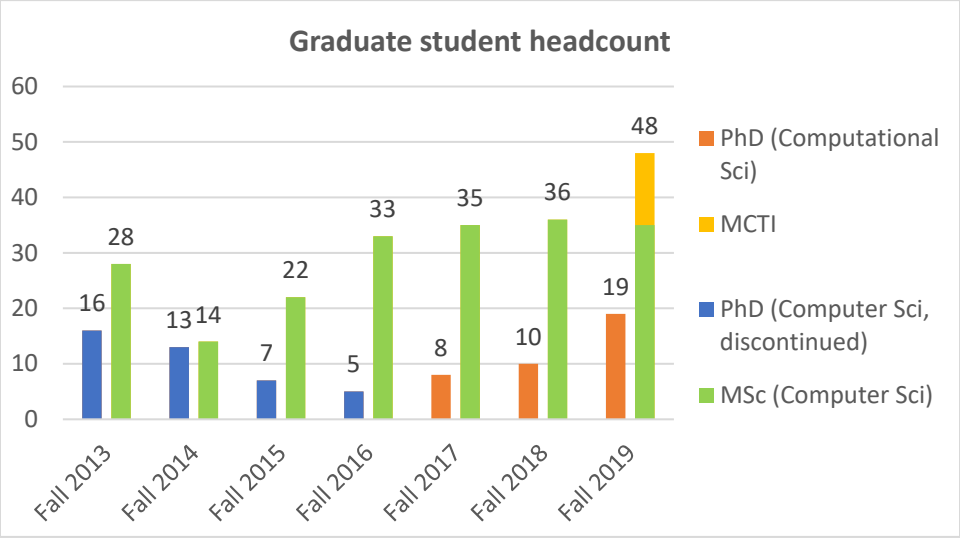

Figure 15: Number of graduate students in SoCS programs

Excluding the course-based MCTI program, SoCS currently has 54 research-focused graduate students. Given our current complement of 24 regular faculty members (excluding teaching-focused), this provides an average of 2.25 graduate students per faculty member. This ratio is

relatively low for a computer science department in a research-intensive university. The current PhD student per faculty ratio is 0.8, which is also lower than the CEPS average at 1.08. Data gathered during this self-study process revealed that the relatively low student to faculty ratios are the result of the following factors:

A significant factor was found to be the substantial growth of the undergraduate program in the past 6 years. Rapidly growing enrolments demand faculty's immediate attention from multiple aspects, including more out-of-class student consultations, more time mentoring and managing larger numbers of TAs, and developing new course content delivery and assessment strategies to accommodate large (including team-based and project-focused) classes. These additional efforts have substantial impact on the amount of time and energy faculty members have for maintaining active research programs that support thesis-based graduate students (e.g., conducting research, recruiting high-quality students, writing grants to obtain research funding, supervising graduate students, writing papers to demonstrate productivity for grant reviewers, and attending conferences to promote and raise the visibility of research outcomes).

To some extent, the initiatives discussed above for addressing our inadequately resourced undergraduate program should help to free up some faculty member time and energy to focus on their research programs. These include ensuring a proper faculty complement level (Action Plan E.1.2), creating equitable workloads for faculty members (Action Plan E.1.3), and increasing the capacity of Instructional Support Staff (Action Plan E.1.1).

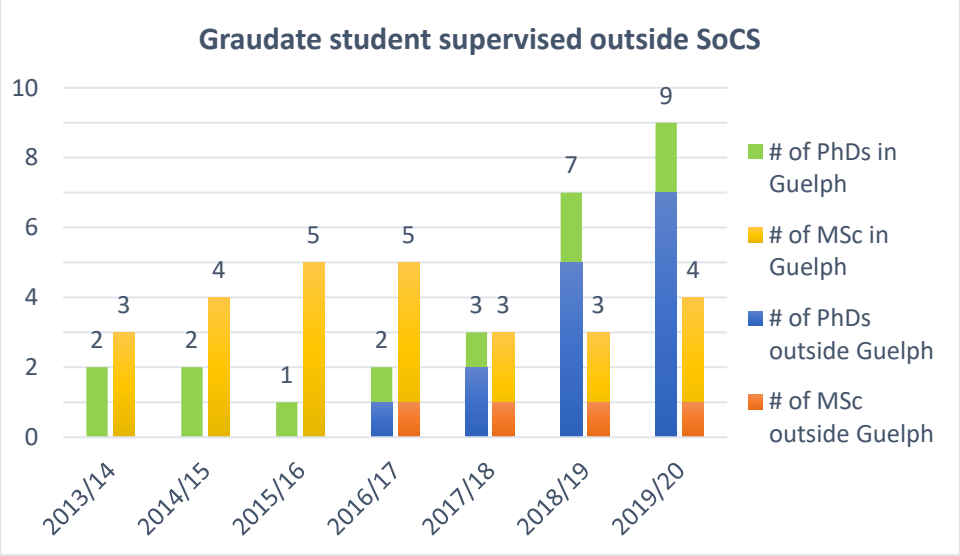

Figure 16: Number of graduate students SoCS faculty members supervised outside of SoCS

Another factor revealed through the self-study is that SoCS faculty members have made notable efforts for supervising or co-supervising graduate students outside of SoCS. Figure 16 plots the numbers of students that SoCS members directed at other academic units in Guelph or at other universities. On average, there are 5 MSc students per year, which accounts for ~14% of MSc student population in SoCS. There are also 9 PhD students currently being supervised or co-supervised. If these PhD students were counted, SoCS PhD student per faculty ratio would rise to 1.16, which is higher than CEPS average.

There are two main reasons for SoCS faculty members to supervise graduate students outside. First, Computer Science is nowadays highly integrated with other disciplines, leading to many interdisciplinary collaboration opportunities. As a result, SoCS faculty members often co-supervise students in areas such as Biology and Business, which should be strongly encouraged. Secondly, the lack of a traditional PhD in CS program also pushes SoCS faculty members to supervise PhD students in other universities. While the Computational Sciences PhD program has attracted many high-quality students since it began 3 years ago, prospective PhD students interested in pursuing an academic position in CS departments may feel that it could be underappreciated by the hiring committees. The lack of freedom for independently supervising PhD students is also a driving factor. There are currently 7 PhD students being supervised or co-supervised outside of University of Guelph, which accounts for ~37% PhD student population in SoCS. Creating an attractive environment for faculty members to supervise PhD students in SoCS is therefore important.

As recently as 2014, SoCS offered a PhD in CS program, but was forced to terminate it due to various challenges in program management. However, since then SoCS successfully recruited both senior faculty members who have extensive experience in PhD supervision in their previous institutes and junior faculty members who have strong research records and funding supports. This makes it feasible to reintroduce the PhD in CS program alongside with the existing Computational Sciences version (Action Plan E.3.1). Once SoCS successfully reintroduces its own PhD program, we expect to see a boost in the number of PhD students at SoCS.

Overall, we currently have a modest graduate program that has tremendous potential to grow and strengthen. However, this growth requires dedicated attention and commitment from the School, in balance with its much larger and demanding undergraduate program.

C.3. Limited Graduate Course Offerings

The self-study activities also revealed that SoCS is currently struggling to offer an adequate number of graduate courses on a regular basis. Moreover, the courses listed in the graduate calendar are outdated and do not reflect the research focus of current faculty and the research training that these faculty members need their students to have. In order to complete their course requirements in a timely manner, students are often forced to take courses outside of SoCS due to insufficient course offerings of interest or relevance. Faculty members frequently offer special topics or reading courses to help students access relevant courses. For example, during the 2017/18 academic year, only 3 regular courses from the current graduate calendar were offered, together with 5 special topics and 3 reading courses. Furthermore, among the 3 regular courses, 2 were core or introductory level courses and only 1 was advanced level course.

From a marketing perspective, this does not communicate well to our existing and prospective graduate students what courses they could take when they are in our program. The lack of regularly offered graduate courses is essentially a resource issue, as large undergraduate courses need to be staffed before small graduate courses. Introducing a course-based MSc route (to be discussed in Section C.5) could help address this problem. Another issue is that the topics of interest to faculty and their graduate students are not currently reflected in the existing graduate

calendar. To address this discrepancy, efforts to review and modernize our graduate course offerings are needed (Action Plan E.3.2).

C.4. Limited Funding Support for Graduate Programs

The level of funding support plays an extremely strong role in attracting and retaining high-quality research-based graduate students. This funding can come in the form of scholarships, GTAs, Graduate Research Assistantships (GRAs), and paid internships, such as research-based industry partnerships through Mitacs Accelerate grants. A challenge for SoCS faculty is that very few scholarships are available to international students, which are the main source of our graduate program due to reasons mentioned above. The number of GTAs and GRAs that SoCS can offer is also limited due to the pressure for reducing deficit in SoCS annual budget (Section A.6) and the lack of research funding (more on this in Section D.3).

There are 2 recent changes in funding requirement for graduate students. First, the Office of Graduate and Postdoctoral Studies (OGPS) introduced the International Doctoral Tuition Scholarships (IDTS) in Fall 2018, which is valued at $12,500/year. IDTS is available for international students with admission average of A^- or higher. It bridges the difference between international and domestic student tuitions (currently at $6,560 and $2,330 per term respectively) and hence makes supporting international PhD students easier. Secondly, a new graduate funding policy will come into effect in Winter 2020 within CEPS and from OGPS. This policy mandates the minimum funding levels to be $16,500 for research-based MSc students and $21,500 for PhD students. According to the data presented by L. Brown, Associate Dean of Research and Graduate Studies, only 3 of the 16 MSc students currently in SoCS MSc program are being funded at $16,500 or higher. Hence, this policy is expected to have significant impact on future MSc student enrolment.

To maintain and increase the number of MSc students under the new CEPS funding policy, securing adequate funding supports is the key. Faculty members are encouraged to seek industry partnerships such as Mitacs Accelerate grants, which generally have high success rates. Once SoCS operates under better financial conditions (debt cleared and additional revenue generated), we can provide more GTAs to support faculty members without external funding to supervise graduate students (Action Plan E.3.3), as well as offering departmental scholarships to high quality candidates and allowing them to choose supervisors based on mutual agreement.

C.5. Opportunity for Course-based MSc Option

Even though we cannot accept more thesis-based MSc and PhD students due to limited funding support, the large number of MSc applicants still offer a good opportunity for growing our graduate program through introducing a course-based MSc route (Action PlanE.3.4). During the 2018/19 academic year, SoCS accepted only 9.3% (9 out of 97) domestics MSc applicants and 5.9% (8 out of 136) international MSc applicants. Recent research on the internationalization of Canadian graduate studies programs also indicates that a key goal of many foreign students to is supplement their existing educational background and, sometimes their industrial experience,

with Canadian academic credentials[1]. Hence, such a course-based MSc option is expected to be popular among international students.

The initial design for the course-based MSc is a 2-year program with 4- or 8-month co-op term. This differentiates it from the existing 1-year MCTI program and offers international students with opportunities to access the Canadian job market. Students in course-based MSc can transfer to the thesis route if they can find supporting supervisors. The program is expected to be funded by a tuition revenue share model like the MCTI program. The anticipated benefits to SoCS include:

- Bring tuition revenue to the School so that we can offer more graduate courses, as well as courses in summer terms.
- Provide faculty members with opportunities to teach graduate courses in their area of interests, which helps them to reduce workload on teaching.
- Faculty members who supervise projects for course-based MSc students receive both credits for HQP training and funding support to their general-purpose accounts.
- Have a large pool of graduate students available on campus, from which faculty members can identify strong candidates for recruiting into the thesis-based MSc program, reducing the needs for evaluating international candidates on papers only.
- By allowing thesis-based MSc students to transfer to course-based route as well, we provide a graceful exit route for thesis-based MSc students who have difficulty with their research program.

On the other hand, several questions need to be carefully addressed before we move forward. These include how many graduate courses SoCS can support with its current faculty complement level, how to ensure the quality of the undergraduate courses not being affected, and how to avoid the new course-based MSc program undermining the MCTI program.

C.6. Interdisciplinary Graduate Programs

With many different disciplines embracing digitization and artificial intelligence, CS research becomes increasing interdisciplinary. SoCS has participated in the Collaborative Specialization in Artificial Intelligence (CSAI). The CSAI is a joint program with SoE and Department of Mathematics and Statistics. To complete the CSAI program, students must be enrolled in the MSc program in CS, Engineering, Mathematics and Statistics, or Bioinformatics, and complete additional, program-specific courses (for a total of 5.5 courses instead of 5 courses). SoCS also plans to join the new Collaborative Specialization in One Health, which is being led by the Department of Population Medicine, Ontario Veterinary College. These interdisciplinary graduate programs help boost collaborations between SoCS and other disciplines on campus.

We are also active collaborating with other academic units for developing new graduate programs. For example, SoCS is working with the Department of Mathematics and Statistics to develop a professional master's program in Data Science. Discussions with the Gordon S. Lang

[1] Kyra Garson, 2018, "Internationalization, Inclusion, and Intercultural Understanding? What are Students Learning?" Keynote talk at the 31st Annual Teaching and Learning Conference, University of Guelph, May 1-2, 2018.

School of Business and Economics is also underway for a professional MBA stream in Cybersecurity.

D. RESEARCH

SoCS faculty actively engage in research in several theoretical and applied research areas. The main topic areas include: Artificial Intelligence and Machine Learning, Cybersecurity, Data Science, Human-Computer Interaction, Bioinformatics, Applied Modeling and Theory, Visual Computing, and Hardware and Distributed Systems. SoCS also has a long history of conducting interdisciplinary and applied computing research, as reflected in the emphasis of our Computational Sciences PhD program discussed above.

D.1. Relatively Low Research Profile and Activities

SoCS does not yet have a strong research reputation among CS departments in Canadian universities and the amount of research activities in School is also low. However, most faculty members agree that we are already doing high-quality research in exciting and relevant research areas (e.g. Cybersecurity, HCI, fundamental computing theory, etc.). For example, in recent years the research excellence of our faculty members was evidenced by NSERC Discovery Accelerator Supplements (DAS) award, multi-million-dollar research funding, appointment on NSERC Computer Science Evaluation Group, nomination for NSERC Canada Research Chair (CRC) Tier II position, and multiple best-paper awards in top conferences.

One problem we have is that we are not doing an adequate job of communicating the outcomes and values of our research both internally across campus and externally. To address this issue, one of our initiatives will be to create a strategy for promoting and celebrating our research activities and successes to key stakeholders, such as university administrators, funding agencies, and potential students (Action Plan E.4.3).

Another direction for improving our research profile is to host regular seminars for both our own faculty members and external researchers to showcase their work (Action Plan E.4.4). University of Guelph is surrounded by several internationally recognized Computer Science schools/departments, which is a disadvantage for us in terms of attracting and retaining top students. However, we can also take advantage of this by bringing in nearby strong researchers to SoCS. Such research seminars will help boost collaborations both within and outside of the School, as well as to broaden the knowledge of our graduate students. If budget allows, we would also like to fund a SoCS Distinguished Lecture Series to attract high profile researchers. This will help put SoCS in the spotlight of respective research communities.

Besides promoting research of faculty members, we would also like to showcase research outcomes from students, both graduate and undergraduate. A possible direction is to create an annual Research Forum (Action Plan E.4.5). Both graduate students and undergraduate students registered for CIS*4910 (Computer Science Thesis) would be required to present their work.

D.2. Improvements on Overall Research Citations

Most SoCS faculty members publish regularly at reputable venues, including refereed journals and conference proceedings. Since the research methodology used can vary dramatically, it is hard to evaluate and compare the research productivities and impacts across different fields in

CS. Nevertheless, the Google Scholar citation counts and the corresponding h-index numbers are reported here, as researchers nowadays often include them in grant applications.

Figure 17 plots the data for all SoCS faculty members who have Google Scholar user profiles set up. To fairly compare faculty members in different stages of their academic career, the number of years passed since they gained their PhD are used as the X-axis[2]. As expected, more senior faculty members generally have higher research citations and h-index numbers.

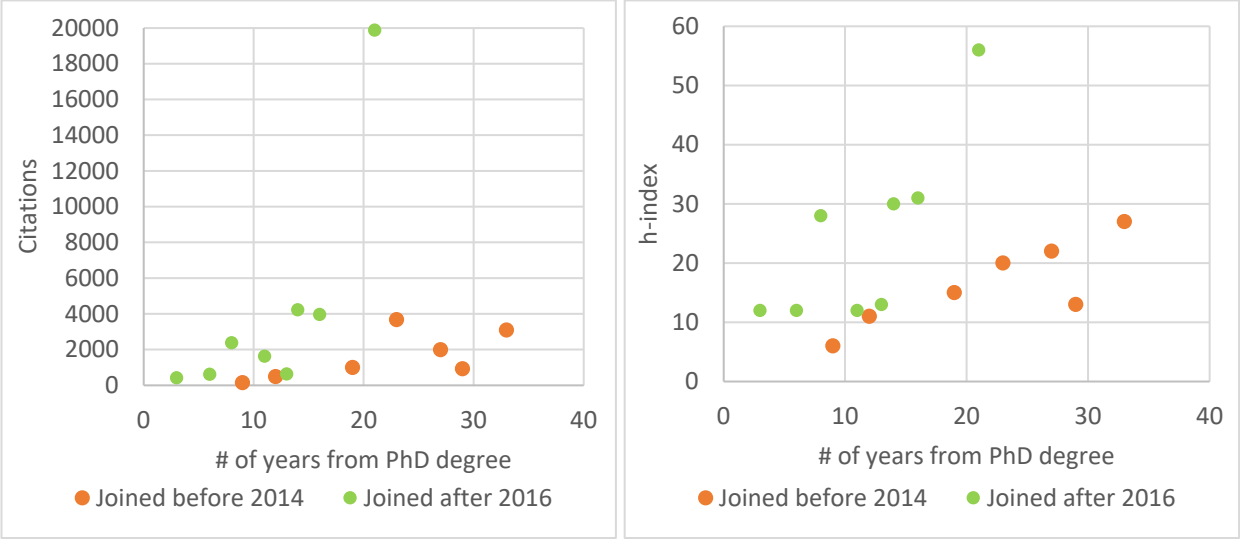

Figure 17: Faculty research impact in terms of total citation count (left) and h-index number (right). Note that some data are missing as not all faculty members have Google Scholar user profiles set up.

Another trend can be observed from the figure is that faculty members hired in the past 3.5 years have higher citations than their peers who joined earlier. This is related to the fact that SoCS faculty members were overwhelmed by undergraduate teaching before 2016, as discussed previously in Section C.2. Some faculty members lost their research momentum due to the lack of time for research, leading to slower progress on building up research impacts. In comparison, faculty members who worked at other institutes first and joined SoCS in recent years were able to devote more time on research.

This observation suggests that SoCS is currently at a crossroads. Because SoCS welcomes strong researchers and is also attractive to them, its research profile can be improved quickly through investments on new and replacement faculty positions, and through providing senior faculty members time and resources to rebuild their research programs. On the other hand, if student-faculty-ratio continue to rise and faculty members become overloaded with undergraduate teaching again, recently hired faculty members will experience the same difficulties as senior faculty members faced before 2016. The School will also lose its attraction to strong researchers. Hence, prioritizing research time for faculty members is of high importance. (Action Plan E.4.1).

[2] Date of 1st PhD is used for researchers with more than one PhD degrees. Potential interruptions in the academic career, such as parental leaves or industry experiences, are not considered for simplicity.

D.3. Limited but Increasing Research Funding

Figure 18 plots the amount of available research funding over the past 5 years. It shows that the total funding dropped from >$350K to <$200K between 2014 and 2015 fiscal years and has since bounced back to >$350K per year. With our 24 regular faculty members (excluding teaching-focused), the funding amount per faculty member is $14.6K. This is quite low for a research focused computer science school.

Besides the total funding dollars, the amount of support secured from the TriCouncil is also an important metrics, since this amount is used by both the TriCouncil and internally at Guelph to enable additional funding allocations and quotas for research support funding such as NSERC USRAs, CFI infrastructure grants, etc. As shown in Figure 18, the total amount of TriCouncil funding was $125K in 2014 fiscal year and has seen a steady increase to $218K in 2018 fiscal year. The complete data for the 2019 fiscal year is not yet available, but SoCS faculty members have already secured over $334K for the NSERC Discovery Grants alone, which represents an 82% jump over the amount of Discovery Grants in the previous year. New faculty members who succeed in their applications or transferred their existing Discovery Grants to Guelph contributed significantly to this huge increase.

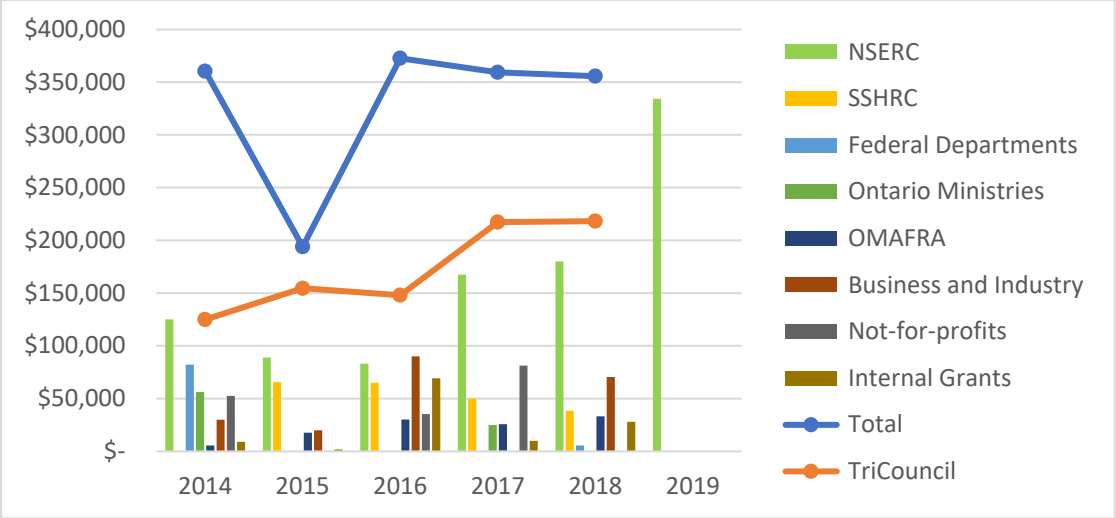

Figure 18 The amount of research funding in the past 5 years. The data for 2019 is incomplete and include the NSERC Discovery Grants only.

While the data show very positive trends, to achieve the College's goal of increasing research funding by 50% still requires substantial efforts. Strategies on how to improve grant application success will be developed and implemented (Action Plan E.4.2).

E. ACTION PLANS

Here, we discuss the planned actions for SoCS in the next 5 years, as well as how these actions support the goals listed in the Strategic Plan for CEPS — "Inspiring Excellence (2018-2023)". These actions are grouped into 5 areas: resources and organization, undergraduate education, graduate education, research, and outreach and fundraising. The planned actions under each category are ordered by their priorities.

E.1. Resources and Organization

E.1.1. Ensure Sufficient Academic, Administrative, & Instructional Staff Support

The rapidly increased undergraduate body also calls for additional staff capacity for academic, administrative, and instructional support. An Instructional Support Coordinator position was created in Summer 2018 and a second position on Undergraduate Program Counsellor and Academic Misconduct Officer was created in Summer 2019. However, both positions are temporary. Demonstrating that both positions are important for supporting SoCS undergraduate programs and adding them to SoCS base budget are therefore needed.

The goal of this action is to lower the amount of work needed by the Academic Hiring Committee, as well as to bring SoCS student-to-counsellor ratio closer to the average ratio in CEPS.

E.1.2. Lobby for the Proper Faculty Complement Level

Given the high undergraduate student to faculty ratio and rising demands for SoCS undergraduate programs, SoCS needs to secure the teaching capacity of the 2 CL positions by converting them into tenure-track positions. We will also proactively determine the proper faculty complement level for supporting different enrolment targets (e.g. 200 vs. 250 vs. 300). The number of additional courses/sessions needed for supporting more students will be investigated by the Undergraduate Curriculum Committee and then consulted at the SoCS School Council. Efforts will be made to secure the resources needed before agreeing to increase the enrolment target.

The action plan aligns well with College GOAL A.1 (strategic additions to the faculty complement) in the CEPS Strategic Plan. Progress of this action plan will be measured using the undergraduate student to faculty ratio, with the goal of lowering the ratio to <30:1 from the current 35:1 by year 2023.

E.1.3. Create Equitable Workloads for Faculty Members

Currently there is no formal policy at SoCS for recognizing the workload difference in teaching new vs. existing courses, courses with different sizes and credits, and courses with vs. without lab components. Efforts will be made to create a teaching equivalency document that recognizes the additional workloads. The Undergraduate Curriculum Committee led by D. Calvert has already investigated this issue and drafted a document. However, more work is needed to develop a sustainable solution.

E.1.4. Review and Potentially Reorganize SoCS Committees

SoCS currently has 19 standing committees. The workload among these committees are considered as unevenly distributed and the responsibilities of some committees are considered overlapping. On the other hand, there is no committee overseeing outreach and marketing activities. Hence, it is worth to revisit SoCS committee structures and their mandates.

The plan is to have the Strategic Planning Committee, together with Associate and Assistant Directors, to review the committee structures, starting in Winter 2020. The goal is to have a reduced set of committees in place by Fall 2020.

E.1.5. Acquire or Build Additional Space

The Reynolds Building, home of SoCS, is being used at its capacity. Should the university decide to increase the enrolment number of incoming undergraduate students, additional teaching labs are needed. Research labs are also needed for conducting research, as well as for facilitating interactions among postdoctoral researchers, PhD and MSc students, and undergraduate research assistants who work in the same field. When the Reynolds Building was renovated, there was plan for building an extension. It is unfortunate that the plan wasn't carried through.

SoCS recognizes that building new infrastructure is a major investment and requires long term planning. Hence, in the short term, we will also explore the possibility of creating additional office spaces within Reynolds through minor renovation.

E.2. Undergraduate Education

E.2.1. Enforce Enrolment Target for Incoming Students

SoCS has previously set the enrolment target for incoming students as 200 under the leadership of P. Matsakis, Interim Director at the time. However, this target was overshot by ~45% in Fall 2019, forced SoCS to find ad hoc solutions to accommodate the additional students. Discussion and agreement with the Registrar's Office on how to enforce enrolment target for incoming students is therefore needed.

Progress of this action plan will be measured by how well the enrolment targets are met in the future.

E.2.2. Introduce Flexibility in Co-Op Placement Terms

An important goal in CEPS Strategic Plan is to enhance the experiential learning experience (GOAL B.3). An action plan on this front is to introduce summer academic term, which is led by K. Gordon, Associate Dean Undergraduate studies. D. Calvert and his Undergraduate Curriculum Committee have already started investigating on the additional resources needed for supporting a summer academic term.

Progress related to this goal will be measured by the number of SoCS co-op students who receive co-op placement each year.

E.2.3. Offer Area of Specialization within SoCS

Currently SoCS students can broaden their skills and knowledge by studying a secondary area of their interests. The Area of Application is a set of 8 courses from another discipline, such as Psychology, Business Administration, and Biology. With SoCS building up its strength on areas such as Cybersecurity, AI, Data Science, etc., it makes sense to offer our undergraduate students the opportunity to study in-depth knowledge in these areas as well. Their efforts will be recognized through degree designation in form of either minor, stream, or area of specialization.

Implementing this action is resource demanding because more senior courses in selected fields need to be developed and offered regularly. If implemented, progress related to this goal will be measured by the number of students enrolled in these programs.

E.2.4. Provide Alternative Routes for Graduation

Graduation rate is an important evaluation metrics in the new provincial performance-based funding model. For students who are admitted to our 4-year CS or SE programs but run into insurmountable difficulty for completion, the 3-year BComp General degree can be restructured to serve as a graceful exit route. D. Calvert proposed this initiative and will lead the curriculum restructuring process.

This planned action directly supports GOAL B.4 (improve the retention and completion time of our undergraduate students) in CEPS Strategic Plan. Progress related to this goal will be measured by the retention and graduation rates for SoCS students each year.

E.3. Graduate Education

E.3.1. Reintroduce PhD in Computer Science

While the PhD in Computational Sciences program is highly valuable for interdisciplinary research, the requirement of AD advisors adds extra hurdle in the student recruitment process. In some cases, the students conduct research on fundamental CS problems and their interactions with their AD advisors are very limited. This is a concern from the quality assurance point of view as the original design of this interdisciplinary PhD program is not being followed. Hence, it is time for SoCS to reintroduce our own PhD in CS program.

Supports from OGPS is already in place. The application process could start soon after we have the support from the School Council. The goal is to have the PhD in CS program approved during the 2020/21 academic year. Progress related to this goal will be measured by the number of PhD in CS students enrolled each year. Successful implementation of this initiative directly supports the GOAL C.2 (increase our PhD student enrolment) in CEPS Strategic Plan.

E.3.2. Review and Modernize Graduate Course Offerings

With 8 new faculty (excluding teaching-focused) joined SoCS in the past 3.5 years, which accounts for 30% of SoCS faculty, the area of research expertise in SoCS has changed. Hence, reviewing and modernizing our graduate course offerings is needed. There are needs for offering more graduate courses every year and at least one graduate course during the summer. In addition,

we also need to consider the breadth of graduate courses being offered, so that students doing research in different areas can all find suitable courses.

The Graduate Curriculum Committee is expected to lead the implementation of this action plan. The goal is to have a revamped set of graduate courses for our SoCS programs by Fall 2021.

E.3.3. Increase GTA Budget and Supports

In the past few years, SoCS has cut the number of GTA positions, which has effectively cut GTA budget, it limits the ability for SoCS faculty members to recruit graduate students, especially under the new CEPS minimum funding policy. In addition, requiring the Academic Hiring Committee to interview all graduate applicants to determine individual GTA funding level adds administrative workload and delays the admission process. Since SoCS is gradually recovering from its historical debt and the MCTI program is expected to bring in revenue, it is time to revisit this cost saving practice.

This planned action is to gradually increase the level of GTA supports and to reduce the needs for interviewing graduate applicants. How to use the additional GTA resource to support faculty members without external funding to supervise graduate students will also be investigated. Progress toward this goal will be measured by the number of GTA assignments each year and the time saved for the Academic Staff Hiring Committee.

E.3.4. Introduce Course-based MSc Route

Given that SoCS only accepted only <6% of international MSc applicants, there is a good opportunity for us to offer a course-based MSc option. Through discussions with B. Bradshaw, Assistant Vice-President Graduate Studies, we learned that such a program can be introduced as a major modification to our existing MSc program, i.e., adding a course-based route for completion. Only internal approval is needed, which can be done relatively quickly. However, we will proceed with caution to ensure that 1) the course-based route option will be well funded through a tuition revenue share model; 2) the new option will not compete and undermine our 1-year MCTI program; and 3) it won't unduly increase faculty workload.

This planned action directly supports the GOAL C.1 (offer new masters programs) in CEPS Strategic Plan. Progress related to this goal will be measured by the success in establishing the course-based MSc route and how the revenue generated helps other SoCS graduate programs.

E.3.5. Develop a Better Screening Procedure for Graduate Applicants

SoCS now receives >250 applicants for our graduate program each academic year, for which our Graduate Program Assistant does not have capacity to carefully evaluate. If the new MCTI program gains popularity or if SoCS decides to introduce a course-based MSc route, we need to screen all applications to these professional Master programs. This workload can be carried out by either the Graduate Admission Committee or an additional Graduate Program Assistant.

What the best strategy for graduate applicant screening is will be discussed. Implementation of the new screening procedure will be led by J. Sawada, Associate Director Graduate Studies.

E.4. Research

E.4.1. Prioritizing Research Time for Faculty Members

The overwhelming undergraduate teaching and administrative responsibilities during 2014 to 2018 academic years have already resulted in some SoCS faculty members losing their research momentum. It is therefore important to prevent this from happening again through protecting faculty members' time for research. The aforementioned action plans on ensuring proper faculty complement level (E.1.2), increasing the capacity of Instructional Support Staff (E.1.1), reducing administrative responsibilities (E.1.4), and enforcing undergraduate enrollment target (E.2.1) all help to achieve this goal. Additional initiatives that can help to achieve this goal will also be carefully considered.

E.4.2. Increase Research Funding

The CEPS Strategic Plan GOAL D.1 aims to increase our research funding by ~50% by 2023. To support this goal, SoCS will encourage and facilitate faculty members to seek funding from various sources and programs. SoCS has established policy for assigning each grant proposal a second reader, who provides valuable comments and helps to identify what the grant applicant(s) may have missed. We will continue this practice, as well as encouraging our faculty members to utilize the internal review system at the College level. Collaborative efforts for applying large group grants will be encouraged and supported. In addition, to help faculty members without funding to rebuild their research programs and to brace the impact of the new graduate funding policy, strategies for engaging all faculty members in graduate supervision will be investigated.

Progress towards this goal will be measured by the amount of overall research funding and Tri-council funding.

E.4.3. Celebrate Research Excellence

Some of the important research activities and achievements in SoCS are not made aware to our stakeholders, such as university administrator, funding agencies, and potential students. Hence, new strategy is needed for making SoCS research more visible. When reorganizing SoCS committees (Action Plan E.1.4), we can explore possible approaches. For example, the Awards and Scholarships Committee should have access to the CVs of faculty members and nominating them for internal and external awards. Promoting research excellence should also be part of the outreach and marketing efforts (to be discussed in Action Plan E.5.2 below).

E.4.4. Host Research Seminars Regularly

Research discussions and collaborations are important both for exploring potential topics and for promoting outcomes. To facilitate collaborations and boost research activities in the School, SoCS will set up regular seminars for both our own faculty members and external researchers to present their work. Policy for engaging graduate students will be discussed and implemented. Feasibility for funding and hosting a SoCS Distinguished Lecture Series to attract high profile researchers will also be explored.

Progress related to this goal will be measured by the following annual performance indicators: 1) the number of seminars hosted at SoCS; and 2) the attendance rate of graduate students and faculty members.

E.4.5. Create an Annual Student Research Forum

Right now, both MSc and PhD students in SoCS are required to give seminars on their research. However, these seminars are scheduled scattered throughout the academic year and are not well-attended. Undergraduate students working on their undergraduate projects (CIS*4900) or thesis (CIS*4910) are not required to present their work. Creating an annual Research Forum and requesting all these students to present together in a mini conference format can help them to learn from each other on different research topics and presentation skills. It can also help to engage undergraduate students in various research opportunities.

This planned action directly support the GOAL B.6 (enhance the research experiences of our undergraduate students) in CEPS Strategic Plan. Progress will be evaluated by the number of students participated in the Research Forum.

E.5. Outreach and Fundraising

E.5.1. Develop Fundraising Priorities and Strategies

SoCS needs to work with Alumni Affairs and Development (AA&D) on developing fundraising priorities and strategies. The upcoming 50th anniversary is a great opportunity for SoCS to gain funding support from its alumni. Areas that can benefit from fundraising campaigns include:

- Scholarship support for targeted student groups, e.g. female students or students from specific geographical regions.
- Funding for supporting a SoCS Distinguished Lecture Series, which invites world-class researchers to Guelph.
- Funding for additional space to host SoCS.

This planned action supports the CEPS Strategic Plan GOAL E.6 (work with AA&D to steward existing partnerships). Progress toward this goal will be measured by the amount of fund raised each year.

E.5.2. Revisit Outreach and Team Building Strategy

The rapid increases in number of undergraduate applicants for SoCS programs is a strong indication of our success on outreach, for which L. Salmon and D. Gillis deserve a significant amount of credit. On the other hand, the self-study activity suggested that we need to get more faculty members to engage in outreach activities. In addition, the outreach effort for our graduate programs is somewhat lacking.

Creating an Outreach and Marketing Committee (part of Action Plan E.1.4) can help to achieve this goal. In addition, we will also explore the possibility of adding outreach to the mandates of Assistant Director to facilitate the communication with the office of Associate Dean External Relations. The Assistant Director and the Outreach and Marketing Committee can then develop

focused outreach activities and market SoCS programs at both undergraduate and graduate levels. They can also help to plan activities to make SoCS a strong and engaged community.

E.5.3. Secure Resources for Recruiting and Supporting International Students

The CEPS Strategic Plan GOAL B.2 aims to increase international student enrolment in all CEPS programs to a minimum of 15% by 2022. International students, however, generally requires more resources and support to ensure a successful acclimation and integration into our program. Plans for increasing resources for international students are being investigated and implemented at both University and College levels. SoCS will work with the higher administration to secure resources for actively recruiting and better supporting international students.

Progress toward this goal will be measured by the percentage of international students in undergraduate SoCS programs, as well as the additional resources secured for supporting these students.

E.5.4. Actively Recruit and Retain Female Students

The CEPS Strategic Plan states the goal of having a minimum of 20% women enrolled in first year for all CEPS programs by 2023. SoCS does not currently meet the expectation and hence, active and targeted recruitment for female students is needed. The Action Plan E.5.2, if successfully implemented, can help toward this goal. In addition, SoCS will also encourage and support our existing female students to attend the annual Canadian Celebration of Women in Computing (CAN-CWiC) conference. This conference helps to connect our local students with the broader female student community, encouraging them to retain in SoCS programs.

Progress toward this goal will be measured by the percentage of female students in undergraduate SoCS programs, as well as the female student retention ratio.