

Mitacs: Mathematical Roots for Innovation in Canada

Mathematics Foundation Underpins 20-Year Evolution of Success and Growth at Mitacs

Alejandro Adem

ABSTRACT. In this article we describe the 20-year history of Mitacs, which is a unique Canadian organization promoting innovation through the deployment of highly qualified talent—namely, graduate students—in companies and not-for-profit organizations. What began as a research hub connecting mathematics to industry has evolved into a national organization providing a bridge from all disciplines to the private sector across Canada and creating mobility opportunities between Canada and the rest of the world. Mitacs is an important legacy arising from the creativity and enterprising spirit of the Canadian mathematical sciences community.

MITACS—A Proposal from the Mathematics Community

In 1989 the government of Canada created a program called Networks of Centres of Excellence (NCE). The motivation was the recognition that in order to compete in the global landscape, the country needed to create more impactful connections between university-based researchers and companies to further the national innovation strategy. The significant gap in productivity between Canada and countries such as the USA indicated the need to spur research and development spending by industry, to further develop technological transfer mechanisms, and to build significant university-industry projects.

From the point of view of universities, it had become apparent that far more PhDs were being produced than the academic job market required. Thus creating pathways to nonacademic employment in Canada became an import-

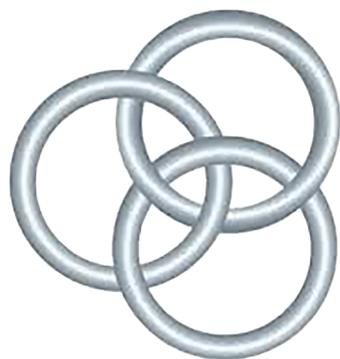
ant objective. In 1998 a group of research mathematicians realized that the mathematical sciences could serve as a unifying network to fill the articulated needs arising from the challenges outlined by the call for NCE proposals. The radical idea for a Network of Centres of Excellence in mathematical sciences germinated in the minds of Steve Halperin from the University of Toronto and the directors of the three mathematics research institutes in Canada (at the time): Luc Vinet (Centre de recherches mathématiques), Don Dawson (Fields Institute), and Nassif Ghoussoub (Pacific Institute for the Mathematical Sciences).

Considering that few mathematicians at the time had industry connections, their idea was met with skepticism by both academia and industry—few thought that a proposed network in mathematical sciences would receive the necessary government support. Despite doubts from the mathematics community and university administrators at the time, Ghoussoub, Dawson, Halperin, and Vinet submitted a proposal to the NCE program for the creation of MITACS—The Mathematics of Information Technology and Complex Systems. The MITACS acronym reflected the organization's original goal of bringing together researchers in the mathematical sciences to focus on the problems of mathematical modeling and management of large-scale

Alejandro Adem is CEO and scientific director of Mitacs. He is also a professor of mathematics at the University of British Columbia. On October 1 he will become president of Canada's Natural Sciences and Engineering Research Council (NSERC). His email address is adem@math.ubc.ca.

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MITACS

Figure 1. The original MITACS logo: the Borromean rings represent the foundational support of the three mathematics institutes.

complex systems and the mathematics of information technology.

MITACS: The Early Years—Basic Formula for Success

The proposal received glowing reviews, and MITACS was launched in 1999 with the mandate to connect mathematics researchers to industry and provide professional development opportunities for graduate students. The goal of MITACS was to fund industry and academic research, encourage the commercializa-

tion of the project results, and communicate the impact of these results to the government and to the public.

Under the early leadership of Arvind Gupta, professor in the School of Computing Science at Simon Fraser University, MITACS benefited tremendously from his extraordinary vision, entrepreneurial skills, and natural talent for building relationships between academia and industry. He was the driving force behind MITACS for fifteen years. He assembled a stellar group of highly motivated staff members and imbued the organization with an unbreakable “can-do” mentality that persists to this day.

MITACS was the first NCE to be discipline-based and the only one concentrated strictly on mathematical sciences, which was broadly construed to include pure and applied mathematics, statistics, and quantitative aspects of social and natural sciences. MITACS was able to overcome initial doubts and attract a wide variety of industrial partners for its research projects. One of the key goals of MITACS was to bring highly qualified talent into companies for the purposes of research and development. The primary vehicles for this were to be graduate students working on peer-reviewed research projects that could lead to commercialization. The key vehicle that accomplished this was developed by Gupta and his team: a unique internship program, Accelerate, co-funded by industry, which embeds graduate students in companies for renewable four-month intervals, providing crucial talent for the enterprise and invaluable experiential learning for the student, while connecting the student’s advisor to the company.

This program was first piloted at Alcatel in 2002, and the full internship program was launched in 2003. In the program’s first year, eighteen research internships were co-funded by the private sector. After gradual growth of the program, in 2007 the government of British Columbia granted

\$10 million¹ in funding for the MITACS Accelerate internship program, tripling the size of the existing program and expanding it to include all disciplines. Combined with additional funding from the government of Canada and other provinces, this allowed MITACS to offer 240 internships in 2007. In that same year, a professional training component was launched in order to provide the interns and other students the basic knowledge expected by businesses for prospective employees.

Another key MITACS program was introduced in 2009: Globalink, which began as a mechanism for bringing outstanding undergraduate students to Canada for short-term research projects. The program launched with seventeen interns traveling from India to British Columbia for three-month summer research internships and the opportunity to return to Canada on a fellowship for graduate school. This global mobility program was destined to grow considerably over the next ten years.



Figure 2. Donald Dawson and Arvind Gupta in the early days of MITACS.

Letting Go: The Evolution from MITACS to Mitacs

The two MITACS programs Accelerate and Globalink attracted a lot of demand from the private sector as well as financial support from government. However, once the restriction to mathematical sciences had been breached, there was no turning back. It became clear that the mathematicians had created a platform for innovation and global mobility that could not be constrained by specific discipline dynamics; in particular, the small size of the math community in Canada was an obstacle to its natural evolution. Moreover, the NCE funding could last for only fourteen years plus a ramp-down period.

An ingenious solution was found. MITACS was divided into two separate entities in 2011: Mitacs, Inc., a not-for-profit organization focused on innovation broadly construed, having the research universities of Canada as its founding members, and Mprime, which became the

¹All currency figures are in Canadian dollars.



Figure 3. The 2017 Mitacs Awards Ceremony in Ottawa, Ontario. official successor of the mathematical sciences NCE, which continued in existence until the original funding stream ended in 2014.

The success of MITACS/Mprime played an important role in revitalizing aspects of the mathematical sciences in Canada. Quoting from the final NCE report [1]: “By 2011, Mprime had 377 academic scientists from 32 different disciplines (52% from outside of mathematics and statistics) and 739 students working with over 650 partners in sectors as diverse as health, medicine, information technology, manufacturing, the environment, finance, communication, and security. The majority of Mprime partners—some 80%—hail from industry, from small and mid-sized firms to large corporations. Collectively, they contributed \$1.5 million annually to the network.”

The farewell for MITACS as a math organization took place through its highly successful role as the host organization for the 2011 International Congress for Industrial and Applied Mathematics in Vancouver, with nearly 3,000 mathematicians attending. The new Mitacs now focused on its internship, training, and global mobility programs and was able to tap into increasing market demand for the R&D capacity provided by this talent. The matchmaking skills of the Mitacs business development team played a key role in enabling its consolidation as the preeminent graduate industrial internship organization in North America.

In February 2015, I was appointed CEO and scientific director of Mitacs, which is headquartered at the University of British Columbia in Vancouver. Over the past four years Mitacs has grown enormously. In 2017 the government of Canada awarded Mitacs \$221 million over five years, and the budget for the current fiscal year is approximately \$175 million, with over \$50 million from industry. Mitacs has offices in Vancouver, Toronto, Montreal, and Ottawa and employs more than 200 staff members. The Accelerate program has expanded considerably over the years and now offers more than 6,500 internship units per year. Funding is supplied by the government of Canada, all ten provincial governments, university partners, and industry, which must pay half of the internship. The introduction of a national business development team to implement the partnership between academia and industry has allowed Mitacs to become a ubiquitous platform for research and innovation across the country, working closely with numerous partner organizations such as NSERC, SSHRC, and provincial innovation and research agencies.

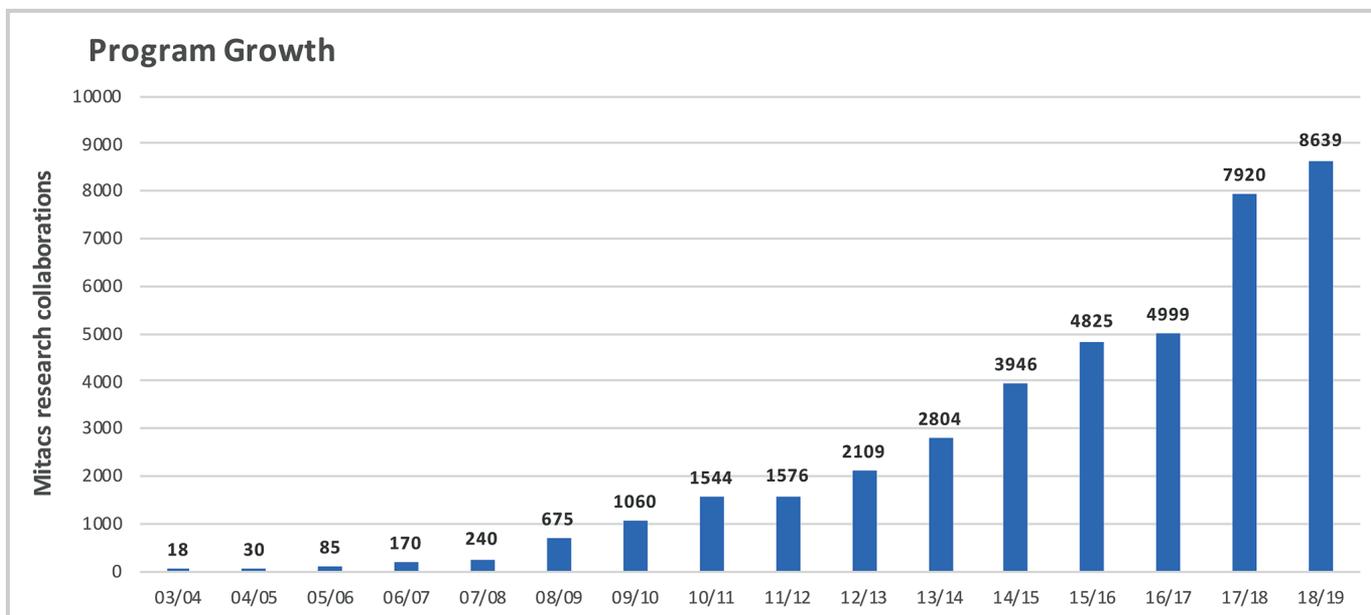


Figure 4. Research numbers above cover Mitacs Accelerate, Globalink, Elevate, Enterprise/Converge, and Science Policy Fellows programs from 2003–04 to 2018–19. *Results for 2018–19 delivery are preliminary and subject to confirmation by audited financial statement.

Likewise, the Globalink program has grown significantly: in the summer of 2019 Mitacs brought 1,250 talented international students to Canadian universities as research interns, and they will be offered fellowships if they choose to return to Canada for their graduate studies. Mitacs also provides extensive opportunities for bilateral mobility, funding research, and industrial stays by thousands of graduate students coming to and from Canada, thus reinforcing connections with international research teams. Mitacs works closely with a number of partner countries (including Germany, France, Brazil, Mexico, China, India, UK, and USA) with shared funding arrangements.

Mitacs is on track to deliver 10,000 yearly student internships by 2020 (as outlined in its 2016–21 Strategic Plan; see [2]), but that is considered another intermediate milestone. In fact, the ultimate goal would be to offer every Canadian graduate student who wants one the opportunity of an internship, as well as an international research experience. Moreover, it makes sense to expand these programs to talented, advanced undergraduate students so that they may connect earlier with research that may lead to a potential career outside academia. In fact, close to 20 percent of current Mitacs interns are from social sciences and humanities, disciplines that are now being incorporated into interdisciplinary projects. The research themes covered by Mitacs interns cut across most academic disciplines. The Mitacs website <https://www.mitacs.ca/en/projects> describes close to 7,500 projects, out of which 15 percent are in the mathematical sciences.

Another notable achievement was the establishment by Mitacs of the Canadian Science Policy Fellows program, started in 2016, which places university faculty and post-docs in government departments for a year to work on key science policy issues. This program includes placements both in Ottawa (federal) and in Victoria (BC government), and it is expected to expand to other jurisdictions. The fellows receive training by science policy experts and opportunities to participate in public events. This program has become the Canadian version of the AAAS Science & Technology Policy Fellowships (STPF) in the USA. Other new programs include an international entrepreneurship program to connect incubators in Canada with foreign markets and an Indigenous engagement initiative to explore ways to increase the inclusion of this important underrepresented group in Mitacs programs.

Final Remarks

Mitacs began its journey as MITACS, motivated by the need to show the relevance of mathematics to other disciplines and its impact on society. Along the way it designed and delivered some highly successful programs for creating research-based work-integrated learning opportunities for graduate students through a flexible and scalable format that can be offered broadly across sectors and in a variety

of geographic locations. More recently its international programs have supported bilateral flows of talent and ideas combining research, innovation, and entrepreneurship. These are important objectives for Canada, which understands the highly competitive nature of talent attraction and the immense value of having a rich and diverse supply of talent for its economy. The fact that a small group of visionary mathematicians launched this journey should be a source of pride for our community: we can rightfully own the original vision that spawned Mitacs, an organization that will continue to innovate and reinvent itself due to its irrepressible mathematical genes.

References

- [1] NETWORK LEGACY: MPRIME NETWORK INC. www.nce-rce.gc.ca/ReportsPublications-RapportsPublications/ExcellenceNewsletter-BulletinExcellence/v4_i3/MPrime_eng.asp
- [2] Target 10,000: Talent, Ideas, Networks, Mitacs Five-Year Strategic Plan, Fall 2016. <https://www.mitacs.ca/en/about/strategic-plan>

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Alejandro Adem

Credits

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