

A Survey of Technology Licensing and Related Activity for Canadian Academic and Nonprofit Research Institutions





Table of Contents

A Message from AUTM's Chair	3	Licences	11
Executive Summary	4	New Products: Where It All Comes Together	13
Maximizing Wind Turbine Clean Energy	5	Breeding Healthier Herds	14
Research Funding	6	Start-Ups	15
Invention Disclosures	7	For Good Measure: Benchmarking	17
Giving Hope to Patients with Rare Adrenal Cancer	8	About the Survey	18
Patents: Safeguarding Ideas	9	About AUTM	18



A Message from AUTM's Chair

Federal Government Must Invest More in R&D

University research and development (R&D) is a major driver of Canadian innovation and economic growth. Universities conduct more than 40% of Canada's R&D, produce over \$55 billion annually in economic activity, and support 680,000 direct and indirect jobs.^{1,2}

Despite these impressive returns, the share of federal investment in Canadian research is stagnating, down from more than 55% when AUTM first published the licensing survey in 1991 to 39% in this year's report. Meanwhile, many other countries are outspending Canada in research and development as a percentage of gross domestic product.³ If Canada wants to maintain its global innovation leadership, the federal government must invest more in R&D.

Investment is essential for innovation, but it's not the only factor enabling it. We need our legislators and policymakers to continue providing a reliable framework of strong intellectual property laws — an infrastructure that efficiently moves ideas to the marketplace and gives investors the confidence to back entrepreneurs.

Technology transfer at Canadian universities transforms lives, strengthens communities and offers solutions to the most pressing challenges facing our world. The AUTM survey data illustrates how this enduring system encourages the risk taking that's driving a globally competitive economy, creating better jobs and improving quality of life. Let's not lose our edge.

Richard Chylla, PhD, CLP, RTTP
AUTM Chair

¹ The Conference Board of Canada, The Economic Case for Investing in Education.

² Statistics Canada, Gross Domestic Expenditures on Research and Development in Canada.

³ "How Much Does Your Country Invest in R&D?," UNESCO Institute for Statistics.



Executive Summary

How Does Your TTO Stack Up?

This year, AUTM's Licensing Survey drills deeper into the data. We know that survey contributors already use the historical data to see how their institutions stack up. So, this year, using research expenditures to level the playing field, we're taking a closer look at how tech transfer operations tick for different peer groups.

The survey data, collected from 32 institutions, illustrates the evolving role of tech transfer offices (TTOs), which are doing more with less, and the changing risk appetites for licensing intellectual property.

LESS STAFF, MORE LICENSES

While the number of licensing full-time staff equivalents (FTEs) decreased 12.4% from 2018 — suggesting fewer people are available to perform core tech transfer tasks — data shows a 32.4% increase in the number of licences and options executed per licensing FTE. Office staffs managed 2.9 more active agreements per FTE, and the volume of work is not likely to slow as TTOs reported 1,788 invention disclosures.

BROADENING REACH WITH NON-EXCLUSIVES

The number of non-exclusive licenses and options grew to 402 in 2018, up 15.2% from the previous year. That's five times more non-exclusive licenses than two decades ago. Why? TTOs are getting more creative, branching into areas like data and software. This trend bears watching in light of legal changes that may weaken patents.

BUILDING ENTREPRENEURIAL ECOSYSTEMS

Canadian tech transfer institutions formed 119 start-ups based on university intellectual property. The record level of start-up formation underscores a continued focus on local entrepreneurial ecosystems with year-over-year growth of 7.2%, and continuing a decade of steady growth.

You can read more about emerging trends and see the expanded data in the pages of this report. If you'd like to go beyond the data provided in the survey, consider AUTM's STATT Database.



Olivia Novac
Committee Chair,
Canadian Licensing Survey Committee



Tech in Your Life

Maximizing Wind Turbine Clean Energy

École de technologie supérieure



It might not look like it to peer at the large blades of a wind turbine, but if one vane is misaligned by just five degrees, the resulting energy could blow away millions of dollars. This problem often makes the production of clean electricity still more expensive than producing fossil-fuel energy.

As the world faces an ecological crisis and unprecedented economic challenges, Montreal's Ecole de technologie superieure's (ETS's) Department of Mechanical Engineering agreed to adapt existing technology to solve this problem. Their research revealed that a wind turbine misaligned by five degrees can cause

a 1% energy loss, and the idea of an alignment process to calibrate wind turbine blades caught on.

After five years of effort, the researchers invented the first laser wind-vane aligner. This new technology enables wind turbines to be oriented as precisely as possible in the wind direction, enabling energy savings of 1 to 2%; for one 100-megawatt wind farm this powers an additional 200 to 250 homes.

For a 100-megawatt wind farm of 150 turbines, this could represent \$20 million in losses over 20 years," said Francis Pelletier, PhD in wind-energy production at Montréal's École de technologie supérieure (ETS).

The improved precision considerably reduces stress on mechanical components and extends their lifespan. In the future, Francis hopes that wind energy alone will be enough to power all major cities around the world.

2018 TECH TRANSFER BY THE NUMBERS



\$6.05 BILLION

Research Expenditures



50

New Products
Created

119

Start-Ups Formed

1,788

Invention Disclosures



314

US Patents Issued

980

Start-Ups Still
Operational



878

New US Patent Applications

795

Licences and
Options Executed



The Survey

Research Funding

Funding the work of researchers and scientists at colleges, universities and other research institutions is the first step in developing technologies that eventually improve our world. Funding comes from the federal government, industrial sponsors and other sources.

Total research funding in 2018 showed a modest decline of 1.5% compared to 2017. Data from 2018 continues the trend of finding more funding, but not in the usual places. The largest share of funding came from "Non-Classified" research dollars category, accounting for 50.5% of all funding. This category can include funding sources such as grants from nonprofit organizations or state and city grants. Over the past 5 years, the share of funding from federal sources has been declining while the share from industry sources has been on the rise. These trends indicate that institutions are successfully pursuing more non-traditional funding sources and partnerships.

KEY FINDINGS

- Total research expenditures decrease 1.5% to \$6.05 billion (CAD).
- Over the past five years, total research funding has risen 3.2%.
- Research funding is trending away from federal sources. Over the past five years, the share of funding from federal sources has declined from 39.7% in 2014 to 38.5%.
- Over the same time period, the share of funding from industry has increased the most, from 9.6% to 11.4% over the past five years.
- The largest share of funding is from non-classified sources such as nonprofit organizations and state and local governments. Non-classified funding accounted for half of all funding, \$3.03 billion (CAD), essentially flat from the prior year's \$3.02 billion (CAD).

Research Expenditures (\$ Millions CAD)

	2014	2015	2016	2017	2018
Federal	\$2,325	\$2,534	\$2,306	\$2,423	2,331
Industrial	\$564	\$667	\$652	\$700	\$691
Non-Classified	\$2,964	\$2,887	\$3,109	\$3,018	\$3,028
Total	\$5,858	\$6,087	\$6,066	\$6,142	\$6,050

	2014	2015	2016	2017	2018
% Federal	39.7%	41.6%	38.0%	39.5%	38.5%
% Industrial	9.6%	11.0%	10.7%	11.4%	11.4%
% Non-Classified	50.7%	47.4%	51.3%	49.1%	50.0%



The Survey

Invention Disclosures

The disclosure is the launching pad for evaluating new inventions, analyzing market potential and developing strategies for protecting the intellectual property.

The total number of disclosures in 2018 decreased 5.0% compared to 2017. Overall staffing levels were down 12.4% from the prior year. This may be an indicator of the headwinds that technology transfer offices (TTOs) are feeling regarding institutional research and TTO funding, inventor outreach and commercialization. It is unclear if disclosures have reached a plateau or if they will regain an upward trajectory.

KEY FINDINGS

- Overall disclosures were 1,788, a decrease of 4.9% from 2017.
- Over the past five years, the benchmark number for disclosures per \$10M total has remained near 3 disclosures.
- The average number of disclosures managed per office staff was 6.5 in 2018 compared to 6.0 in 2017. In 2014, disclosures managed by staff was 6.1
- Licensing staff declined 15.2% from the prior year, and overall staffing decreased 12.4%.

Invention Disclosures

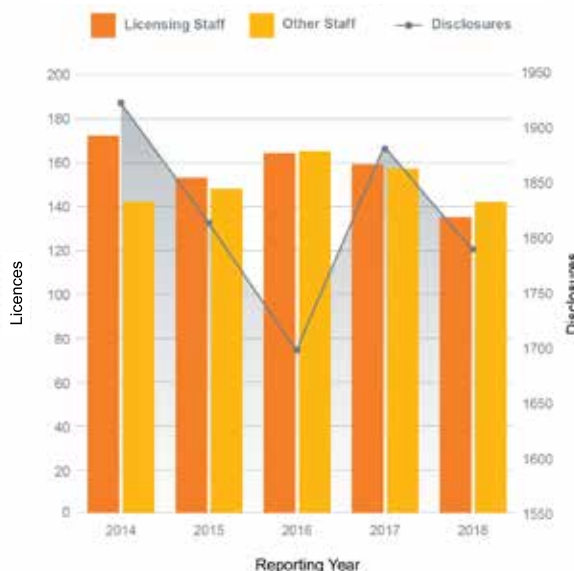
	2014	2015	2016	2017	2018
Invention Disclosures Received	1,922	1,813	1,697	1,882	1,788
Number of Responses to Survey Questions	39	36	35	33	32
Average Disclosures per Respondent	49	50	48	57	56

Total Research Expenditures (\$ Millions CAD)	\$5,858	\$6,087	\$6,066	\$6,142	\$6,050
Disclosures per \$10M Research Expenditures	3.28	2.98	2.80	3.06	2.96

Research Funding vs. Disclosures



Disclosures Handled by Staff



Tech in Your Life

Giving Hope to Patients with Rare Adrenal Cancer *University of Western Ontario*



Western University Chemistry Professor Emeritus Duncan Hunter gets a little choked up when it's noted the work he began more than three decades ago will now, finally, be applied to saving hundreds of lives in the form of the drug Azedra.

In 2018 the new compound, developed by Progenics Pharmaceuticals, became the first FDA-approved therapy for this use, offering hope to patients with rare adrenal gland tumors. It decreases the need for blood pressure medication and reduces the size of tumors in about one-quarter of patients – people who exhausted all other medical options.

Hunter developed the compound with his Western University lab team. The compound is highly radioactive and, once injected intravenously is specifically absorbed by, and then attacks the tumor, while the kidneys flush out the material it doesn't use. Key to Azedra's success in treating this rare disease is the

use of a radioactive pharmaceutical called metaiodobenzylguanidine (MIBG), a compound designed to target only the tumor.

"Essentially, every molecule of MIBG has a radioactive iodine (iodine-131) on it. It gets absorbed where you want it to, it irradiates where you want it to and then it decays," Hunter said.

Azedra is a "magic bullet" for rare adrenal tumors that can't be surgically removed and require systemic anti-cancer therapy.

WORLDdiscoveries, the technology transfer office for Western University, located in London, Ontario, helped Hunter apply for patents and coordinated license agreements with Molecular Insight and later Progenics Pharmaceuticals.



The Survey

Patents: Safeguarding Ideas

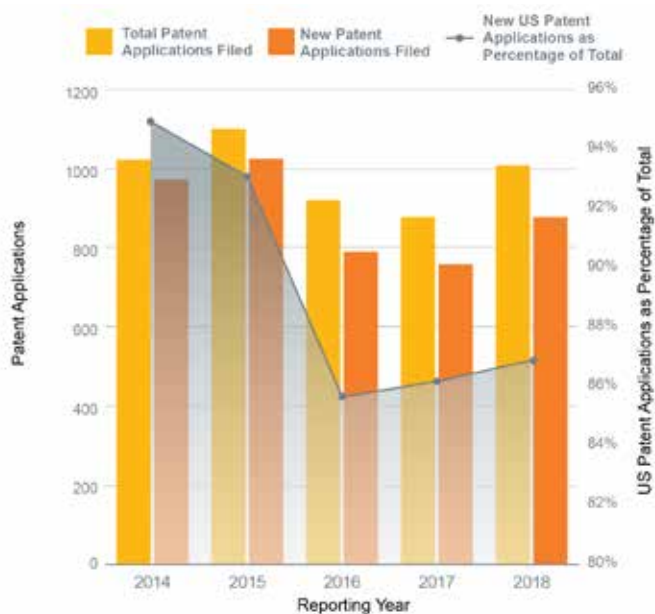
A key step in the transfer of technology is the protection of new inventions. Patent protection provides both economic opportunities for sponsoring research institutions and an incentive for entrepreneurs and companies to invest in new technologies.

Overall disclosure and patent activity — disclosures and provisional and issued patents — have steadily increased, but offices continue to demonstrate the same efficacy.

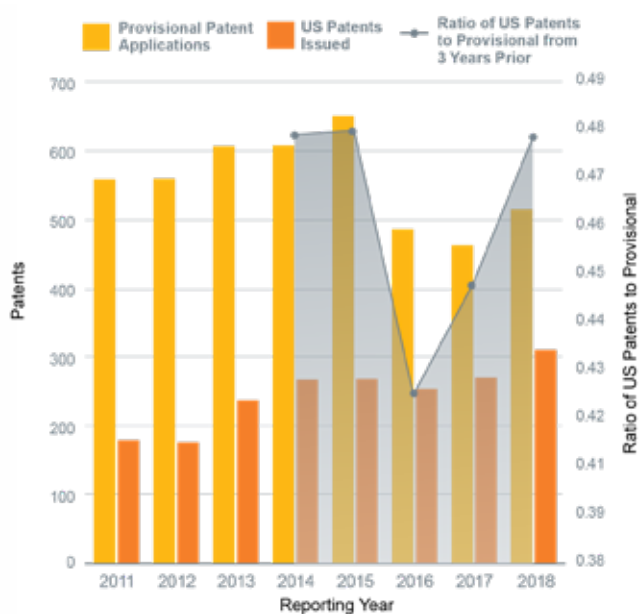
KEY FINDINGS

- While provisional patents, issued patents, gross patent expenses, and net patent expenses continue to rise, their rates of increase remain consistent. This implies that TTOs have implemented the same general patent strategy over the past five years.
- US Patent and Trademark Office data indicates a lead time of about three years from provisional patent to issued patent. Applying this timeline to the AUTM data indicates that TTOs have been fairly consistent over the past five years in how provisional patents are prosecuted to issued patents. Looking back from 2018's issued patents to the provisional patents from three years prior, we estimate the ratio of issued patents to provisional patents to be about 2-to-3. This implies a high level of patentability of inventions coming out of research institutions.
- The US continues to be the primary market in which Canadian research institutions focus, with US patent applications accounting for 87% of total filings.

Research Institutions Opt for US Patents



A High Level of Patentable Research



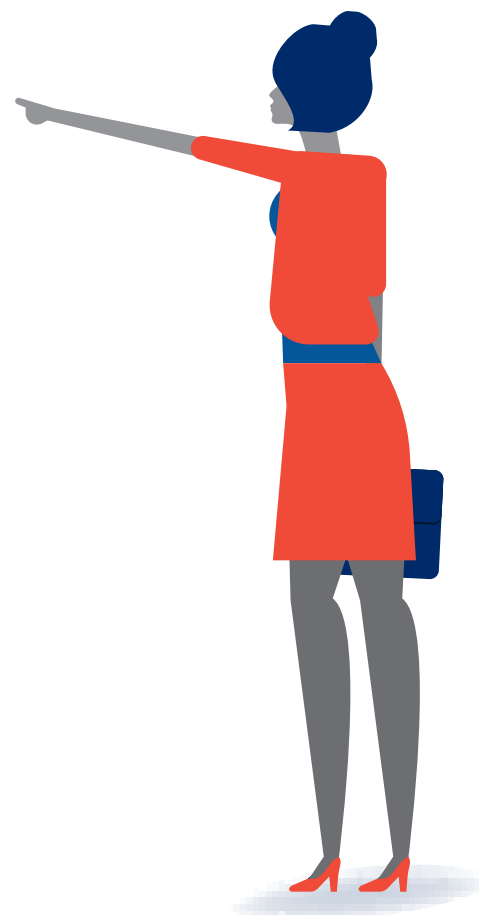
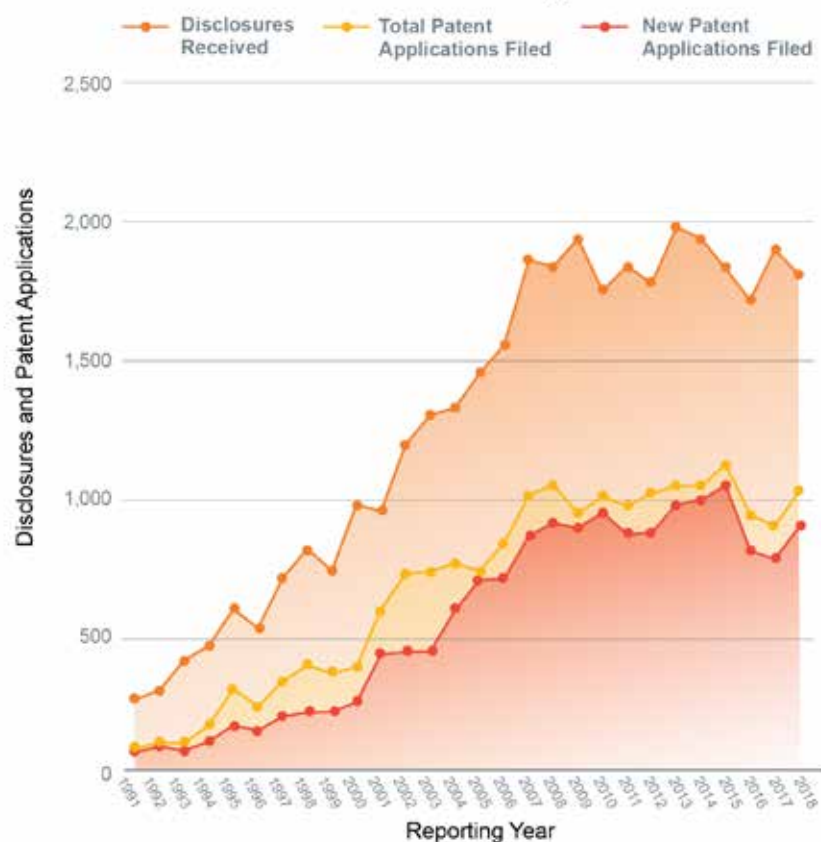
US Patent Applications Filed and Issued to US Institutions



	2014	2015	2016	2017	2018
Number of Survey Respondents	39	36	35	32	31
New Patent Applications	973	1,026	790	759	878
Total US Patent Applications	1,024	1,101	921	878	1,009
New US Provisional Patent Applications	614	657	491	467	520
New US Utility Applications	116	102	109	76	59
New Non-US Patent Applications	243	246	143	200	198
US Patents Issued	270	271	257	273	314

	2014	2015	2016	2017	2018
Total Research Expenditures (\$Millions CAD)	\$5,858	\$6,087	\$6,066	\$6,142	\$6,050
New Patent Applications per \$10M Research Expenditures	1.66	1.69	1.30	1.24	1.45

Disclosures vs. Patent Applications





The Survey

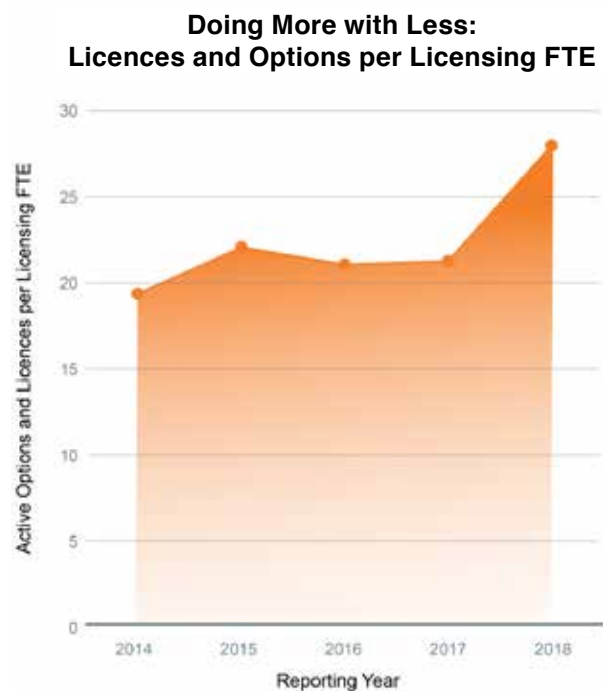
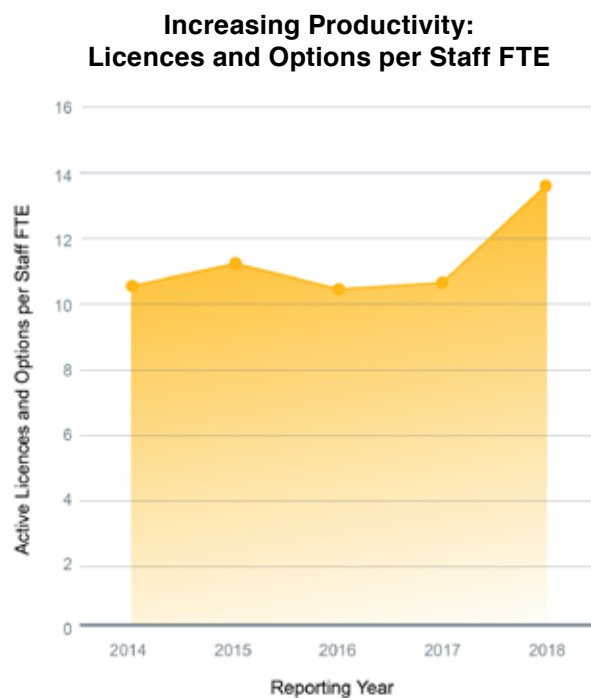
Licences

The next step in the commercialization process for protected intellectual property is licensing. The number of exclusive licenses executed is a leading indicator of licensing revenue and the commercial development of new products and services five to ten years later.

TTOs are doing more with less. The number of licensing full-time staff equivalents (FTEs) decreased 1.6% from 2017 — suggesting fewer people are available to perform core tech transfer tasks.

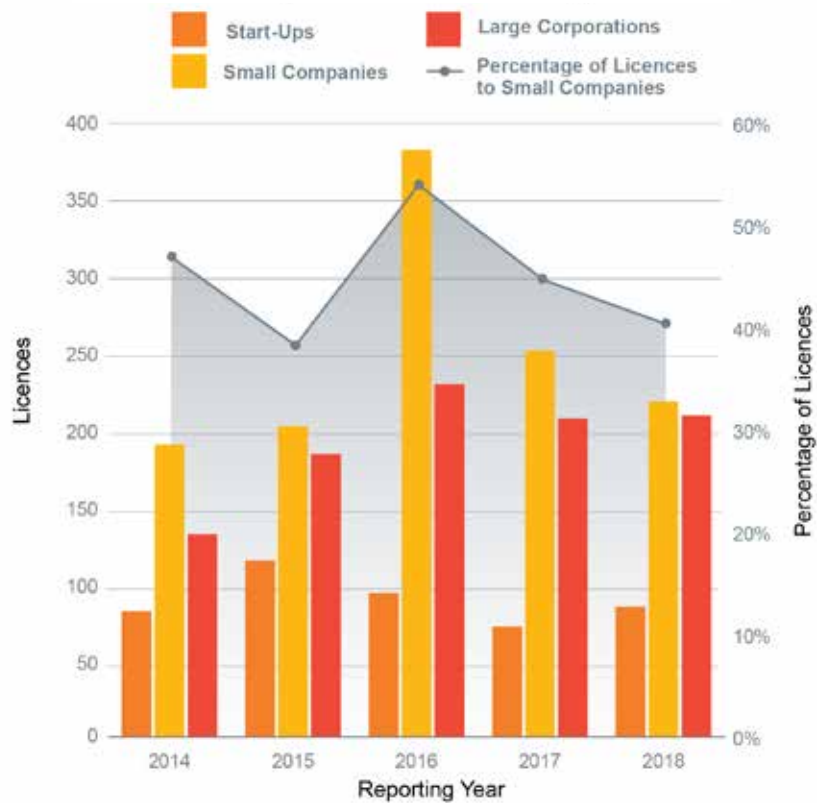
KEY FINDINGS

- While the number of licensing FTEs decreased 15.2% from 2017, the data shows a 32.4% increase in the number of licenses and options executed per licensing FTE.
- Office staffs managed 2.9 more active agreements per FTE in 2018 than in the prior year.
- Small companies accounted for 42.6% of licensing. Licensing to large companies accounted for 40.9%, and the share of licensing to start-ups was 16.5%.

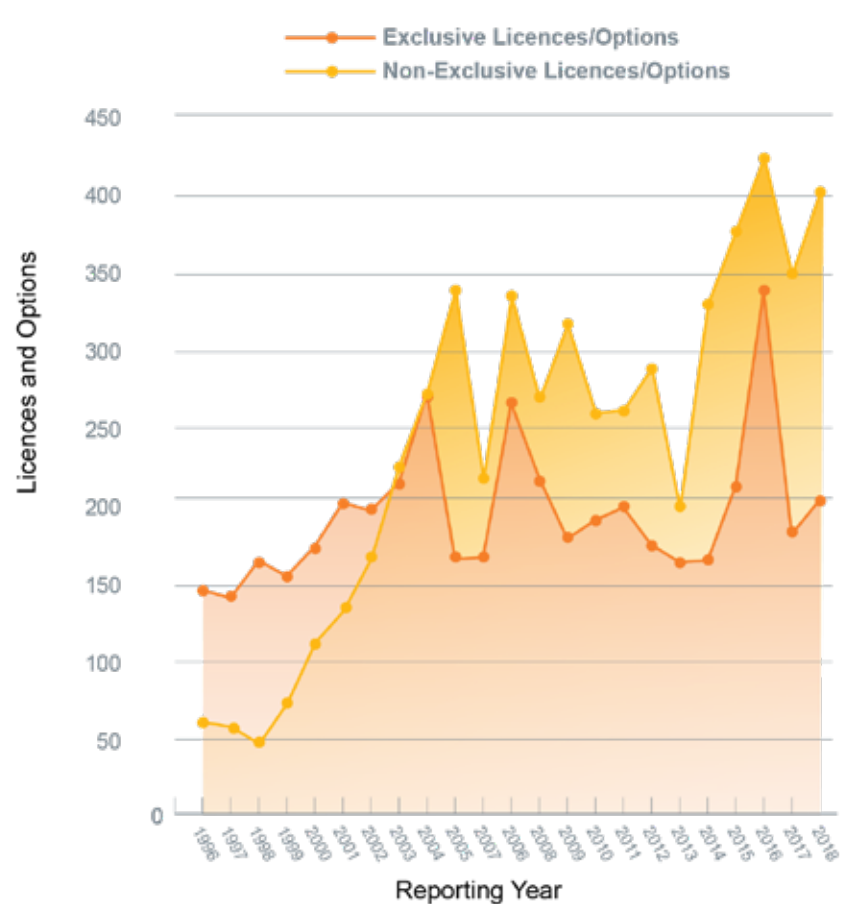


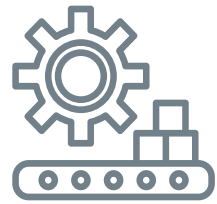


More Licensing to Small Companies



Increasing Preference for Non-Exclusive Licences and Options





The Survey

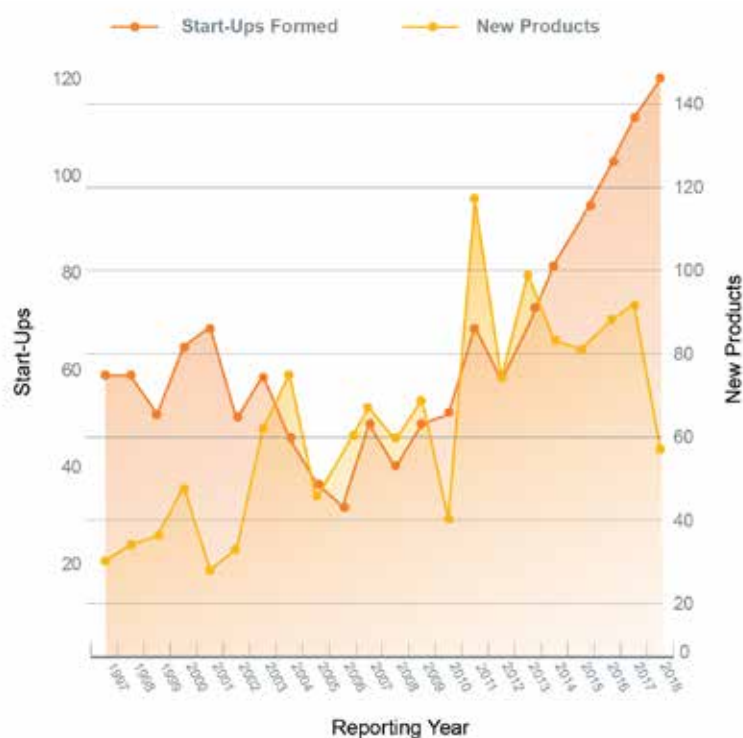
New Products: Where It All Comes Together

The arrival of new products in the marketplace is the culmination of successful tech transfer, from idea, research and development to intellectual property protection and licensing — a strategic, collaborative and often complicated process led by tech transfer professionals.

KEY FINDINGS

- The number of new products per TTO decreased slightly to 2.63 products per respondent to this question. In 2017, the average was 3.70 products per response to this survey question. In 2014, the average was 2.62 products per response to this survey question.
- There is no relationship between the number of start-ups formed and the number of new products created. There is no statistical evidence that universities may be shifting from creating new products to creating new start-ups.
- The number of new products reported in 2018 was 50; in 2017 there were 85 products reported.

Start-Ups vs. New Products



Tech in Your Life

Breeding Healthier Herds
University of Guelph



The rate of disease in the global dairy population has increased each year since 1996. The selection of low heritability traits, which does not directly measure an animal's ability to resist diseases, has not provided a significant change in the health of the dairy population.

Research showed reductions in every major disease and a 5 to 20% reduction specifically in animals bred by Immunity+ sires.

Following 20 years of research, Dr. Bonnie Mallard, of the Ontario Veterinary College at the University of Guelph, devised a test to identify cattle as high, average or low immune responders. By improving breeding selection, the tool allows farmers to raise healthier animals that need less treatment and antibiotic use. High immune responders have about half the disease incidence of their herd mates.

Semex Alliance, a cattle genomics company, partnered with Mallard and Guelph to introduce the high immune responder technology to dairy producers as Immunity+® sires. These animals have genetics that provide robust immune systems capable of dealing with a large variety of potential immune challenges, both viral and bacterial in nature, encompassing nearly all major diseases that have an economic impact on the farm.

Immunity+ sired animals also respond better to commercial vaccinations and produce higher quality colostrum — the milk produced in the first 24 hours after birth that contains immunoglobulins and, when absorbed by the calf's gut, helps protect the animal from common disease challenges — than animals sired by any other bull, according to Semex.

The technology was first licensed from the University's Research Innovation Office to Semex in 2012, and Immunity+ was launched the following year. The project has received funding from the Canadian federal and Ontario provincial governments.



The Survey

Start-Ups

Start-ups continue to be a core focus of university technology transfer offices, but after a decade of steady growth, there are signs that investors and TTOs may be becoming more selective. However, less research-intensive institutions are experiencing an increase in the mean of the start-ups formed.

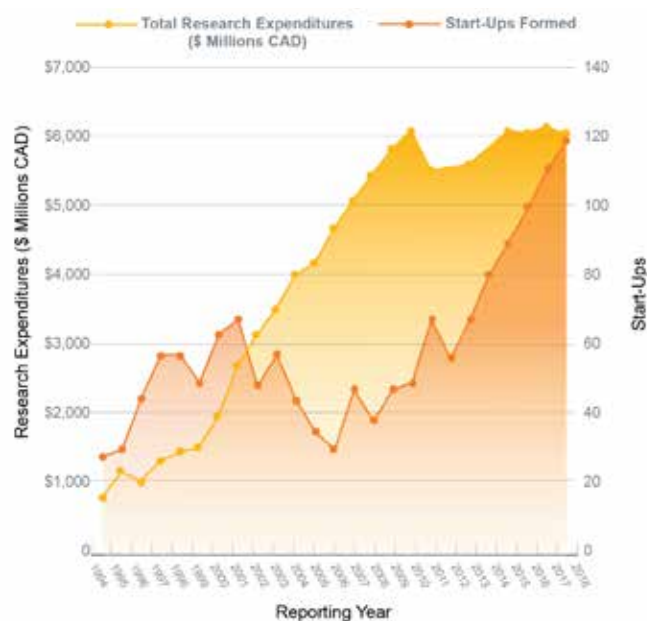
KEY FINDINGS

- In 2018, a record 119 start-ups based upon foundational university intellectual property were formed, an increase of 7.2% over the prior year, and a growth of 46.9% over the past five years.
- Of these start-ups, more than 92% were incorporated within the institution's home province.
- The number of start-ups has increased each year since 2012.
- Smaller TTOs may be increasing focus on forming start-ups as there is a substantial increase year-over-year in average start-ups formed.
- The number of start-ups formed per \$10M total research funding has generally increased over the past five years, from 0.14 start-ups in 2014 to 0.20 start-ups in 2018.

Start-Ups Continue Rapid Growth



Research Funding vs. Start-Ups

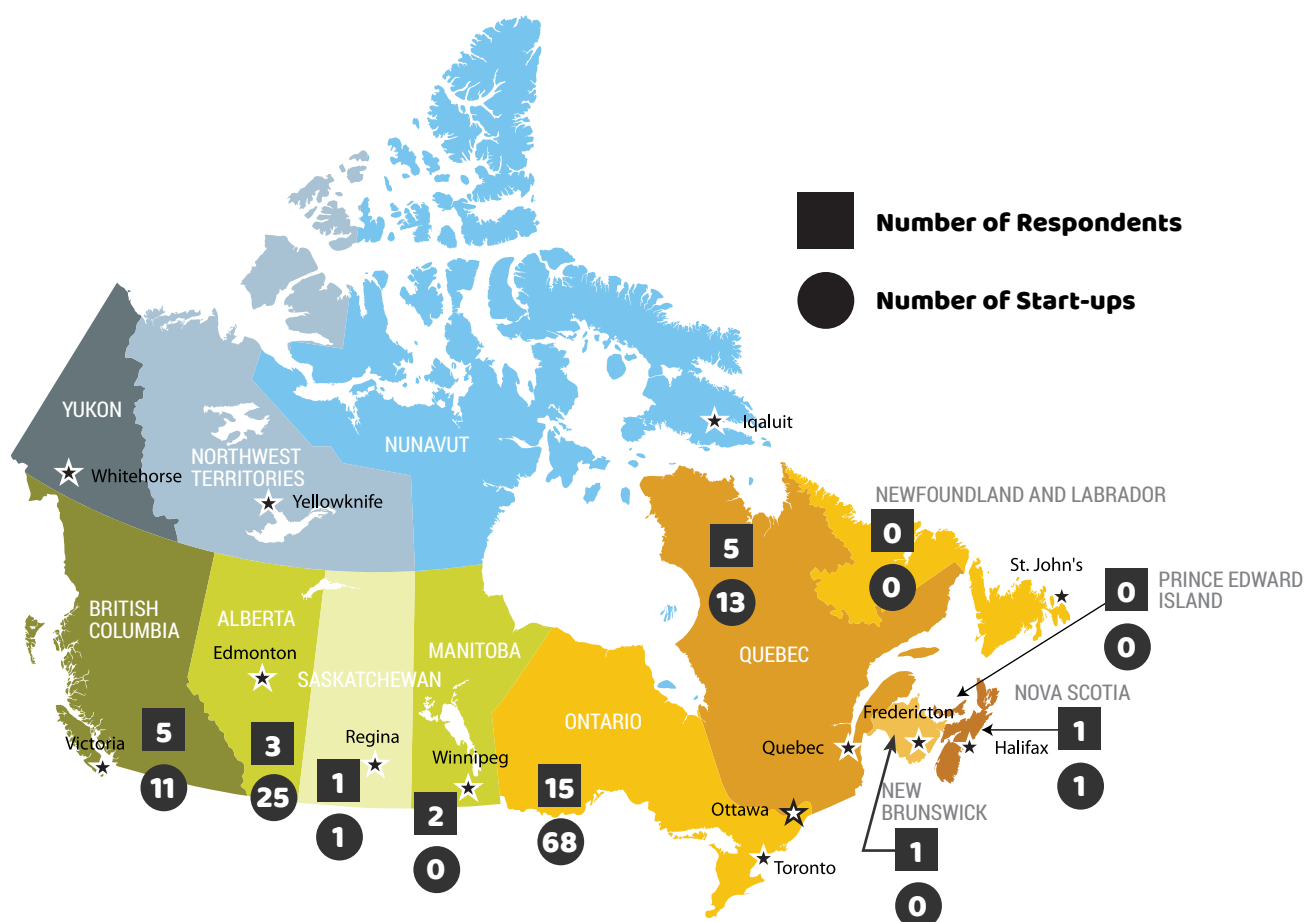


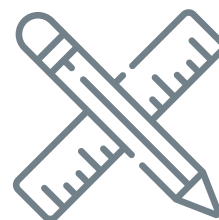


Forming Start-Ups

	2014	2015	2016	2017	2018
Start-Ups Formed	81	90	100	111	119
Start-Ups in Home Province	70	82	89	99	110
Start-Ups Still Operational at End of Year	481	521	564	907	980
Number of Responses to Survey Question	37	34	34	33	31
Average Start-Ups Formed per Respondent	2.2	2.6	2.9	3.4	3.8
Total Research Expenditures (\$ CAD Millions)	\$5,858	\$6,087	\$6,066	\$6,142	\$6,050
Start-Ups Formed per \$10M Research Expenditures	0.14	0.15	0.16	0.18	0.20

Start-Ups Formed per Province





For Good Measure Benchmarking

We know that survey contributors already use the historical data to see how their institutions stack up. So, this year, using research expenditures to level the playing field, we're taking a closer look at how tech transfer operations tick for different peer groups.

WHAT TO MEASURE

For this initial benchmarking report, we selected five of the most common measurements that broadly capture the overall performance of tech transfer offices. A sixth key measurement, research expenditures, was used to normalize the data.

- Invention Disclosures
- New Patent Applications
- Licenses and Options
- Gross Licensing Income
- Start-ups Formed

How Does Your Institution Measure Up?

	Average	Median	Per \$10 Million Research Expenditures (\$CAD)
Disclosures	59.5	50.0	2.96
New Patent Applications	30.3	23.5	1.45
Licences and Options	26.0	12.5	1.30
Gross Licensing Income	\$2,462,962	\$782,867	\$123,918
Start-Ups Formed	4.1	1.5	0.20





About the Survey

AUTM invited 70 Canadian institutions — universities and colleges, hospitals and research institutions, national laboratories and third-party technology investment firms — to participate in the AUTM 2018 Canadian Licensing Activity Survey. AUTM received 32 completed surveys, for a response rate of 46%. The numbers from these institutions reflect the significant role played by technology transfer in today's innovation economy.

Most of the data collected in this survey is also available in AUTM's Statistics Access for Technology Transfer (STATT) Database. To access this searchable database of more than 27 years of academic licensing data, visit www.autm.net/statt.

Suggested Citation

AUTM report titled AUTM Canadian Licensing Activity Survey: 2018, A Survey Report of Technology Licensing (and Related) Activity for US Academic and Nonprofit Institutions and Technology Investment Firms can also be referenced by its abbreviated title, AUTM US Licensing Activity Survey: 2018, editors Olivia Novac, Maya Collum and Nadine Weedmark.

About AUTM

AUTM is the non-profit leader in efforts to educate, promote and inspire professionals to support the development of academic research that changes the world and drives innovation forward. Our community comprises more than 3,000 members who work in more than 800 universities, research centers, hospitals, businesses and government organizations around the globe.



Transforming Ideas into Opportunities

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