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Impact and opportunities:
Canada's AI ecosystem - 2023

**Report produced by Deloitte on behalf of
CIFAR, Amii, Mila and the Vector Institute**

"Canada has become the springboard to advance AI-fuelled enterprises around the globe. Our openness to newcomers, our highly skilled workforce, our banking stability with access to global markets, and our commitment to a standard of living that is second to none has allowed us to translate our ideas and curiosity into tangible solutions that address real-world challenges and opportunities.

Our future success depends on embracing an entrepreneurial, inclusive, and responsible culture that generates—and delivers on—these ideas for good.

As we strive for success, we must be mindful of the challenges that exist across the AI ecosystem, including responsible and ethical AI deployment, targeted investments to scale AI-fuelled enterprises, talent acquisition, and AI fluency. By addressing these hurdles, we can move toward an environment that encourages innovation and provides a platform for AI-driven initiatives to thrive. Our collective efforts today will determine our position on the world stage tomorrow. This is how we shape the future of ethical AI and use of data to make an impact that matters for our communities, our country, and our planet."

Anthony Viel
Chief Executive Officer
Deloitte Canada

"As public interest and experimentation with AI and generative AI solutions are at an all-time high, we as a nation are seeing the evolution of unique opportunities to embrace an AI ecosystem that inspires and differentiates Canada on a global stage.

Jas Jaaj
Managing Partner, Generative AI
Global Business Innovation Leader
Deloitte Canada

Now, more than ever, we can capitalize on how we show up—from highlighting our growing pool of world-class talent and researchers, to encouraging a strong investment landscape, to supporting an entrepreneurial culture that brings our ideas and knowledge to life. As an annual reflection on what lies ahead, this report will map out how we collectively shape emergent ideas and key market plays. Navigating this exciting era of AI innovation can be challenging, which is why adopting responsible and trustworthy AI practices is crucial. I believe that AI fluency can help demystify these technologies for the broader public as we continue to explore solutions that meet the needs of our community."

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Executive summary

Today, Canada is undeniably one of the world's leading players in AI. Our combination of talent, investment, and entrepreneurial spirit has enabled us to stand proudly on the global AI stage, outperforming many of our Group of Seven (G7) peers (France, Germany, Italy, Japan, the United Kingdom, and the United States) and other nations. We have accomplished a lot. But we are fast approaching a pivotal point in our development as an AI power—and we face a crucial choice.

We can be bolder, move faster, and invest more to move beyond AI exploration and experimentation, embracing and integrating AI across the Canadian economy. We can continue to be an AI leader with the power, prestige, and influence to directly shape the future of AI. Or we can rest on our laurels, act with caution and moderation in our efforts to embrace AI's potential—and gradually cede leadership to countries more willing to move faster, more boldly, and more decisively to harness the power of AI.

Which is it going to be?

Impact and opportunities: Canada's AI ecosystem - 2023 is a collaborative effort between Deloitte, the Canadian Institute for Advanced Research (CIFAR), Amii, Mila, and the Vector Institute. This report provides a snapshot of the state of Canada's national AI ecosystem for the 2022–23 period (April 1, 2022 – March 31, 2023); it was created to help the broader market understand how an evolving Canadian AI landscape is reshaping our comprehension and adoption of AI technologies and affecting how the country is viewed on the global stage.

Key findings 2022-23

Talent and job market
Canada's cohort of AI talent rose an average of 38% annually in each of the preceding five years, outpacing the United States, United Kingdom, Germany, France, and Sweden; **the number of actively engaged AI professionals in Canada rose 29%** in 2022-23. Among surveyed organizations with AI roles, **roughly 50% of AI jobs were classified as "well-paying,"** with annual salaries in the range of $82,000 or more.

Research and development
In 2022-23, **$2.57 billion was invested in Canadian AI research and development**, outpacing several countries in the AI space such as Germany and Japan in AI research and Australia and France is AI-development funding. The number of **AI patents filed by Canadian inventors rose by 57% in 2022-23,** over the average growth seen in the previous year. In contrast, the average growth in AI patent filings in other G7 countries only rose 23% over the same period. Our strength in this realm reflects the AI research communities that have coalesced around the numerous Canada CIFAR AI Chair awards that have been established across Canada.

Toward an AI-ready society
There is considerable room for Canadian AI to grow and scale. **Forty-six new AI companies were founded** in the country in 2022-23, matching the previous year's new additions and in contrast to a 16.6% drop globally. While just **26% of surveyed organizations had launched one or more AI implementations**, compared with 34% globally, **42% had exploratory AI pilots in place**, on par with their global counterparts. Only 36% of surveyed organizations globally felt their data-management and data-governance process maturity was in the mid-to-high range.

Investment and economic indicators
Amid a global investment slowdown, **total venture capital (VC) AI investment in Canada reached $8.64 billion** , buoyed by a sharp rise in investment in Q4. Canada ranked third among G7 countries in per capita VC investment in AI, trailing only the United States and United Kingdom. Compared with numbers from five years prior, Canada saw a 3.6-fold growth in AI VC investments by the beginning of 2022. Overall, **domestic investment comprised 28% of total VC investment in Canadian AI** in 2022-23—higher than in Germany, the United Kingdom and Italy. **Incubator and accelerator investment totals increased by 76% across Canada** during the period April 1, 2022 – March 31, 2023 when compared to the preceding year (April 1, 2021 - March 31, 2022), demonstrating strong support for AI start-up companies. However, only 55% of surveyed organizations planned to increase AI investments in the following fiscal year, well below the global average.

Ethical AI and diversity
Eighty-six percent of surveyed companies in Canada had concerns regarding AI's ethical risks, with 51% of respondents citing the potential for bias in AI algorithms and/or about the potential for low-quality results. When it comes to adopting responsible AI principles, there is also room to improve: **52% of surveyed organizations "always" or "sometimes" adhered to AI cybersecurity risk-management and human-centred design principles**, while just 35% of respondents said the same with respect to AI model life cycle documentation principles. Encouragingly, **68% of survey respondents reported that diversity, equity, and inclusion (DE&I) values were an important or very important consideration** in hiring, training, and retaining AI talent.

Decision time:
Are we ready to be more than AI experimenters and explorers?

Canada's national AI ecosystem is healthy and growing. But we can't rest on our laurels. To realize our potential and ensure Canada remains a powerful player in the global AI landscape for years to come, we need to decide as a nation to think and act differently. We must work together to capitalize on our incredible pool of highly qualified AI talent, our strong investment landscape, and our network of world-class National AI Institutes – Amii in Edmonton, Mila in Montréal, and the Vector Institute in Toronto and globally recognized researchers, and blaze a uniquely Canadian approach to AI—one that maximizes the best of who we are and champions the responsible, ethical, and safe rollout and use of AI. The following outlines our recommendations on where and how to begin.

- **Strengthen Canada's AI fluency.** To encourage AI adoption, Canadian leaders, influencers, and decision-makers at all levels need to better understand what AI is—and what it isn't—and how they can use it to achieve their own goals.

- **Invest in scalable AI opportunities.** Investors should look for and fund AI ventures that have potential to allow them to differentiate themselves in a crowded AI market and scale up into thriving, growing businesses at an international level.

- **Make use of CIFAR and Canada's AI institutes.** Canadian AI companies should seek to better harness the knowledge, expertise, and networks available courtesy of CIFAR and our three National AI Institutes in order to connect with investors and other members of the AI community, and grow beyond experiments and pilots. This **wide-ranging network of collaborators could be used at scale to drive responsible AI development** ensuring

new measures are effective without stifling innovation and growth. Teaming with organizations and researchers alike is essential.

- **Keep our AI talent in Canada.** For Canada to remain a leader in AI, it's imperative that the talent we attract and develop stays here. To do so, our AI employers should provide our AI talent with meaningful opportunities to build careers that are personally and professionally satisfying—and recognizing that such careers are enabled by making Canadian firms more globally competitive.

- **Establish and maintain a strong presence on the global stage.** Canada must assert itself with more than AI research alone. Leaders should take clear, visible roles in the ongoing conversations about AI regulation and do more to promote our national AI ecosystem. We should let the world know there's no better place than Canada for top-notch AI innovation and opportunities.

- **Identify use cases that drive value.** AI use cases typically fail to fully deliver value because they don't tackle business-critical challenges. Leaders should thus identify and prioritize use cases that support strategic AI priorities and solve specific business problems, such as improving customer service and automating labour-intensive work.

- **Continue our wide-ranging collaborations to drive responsible AI development and use.** Governments, regulators, and industry leaders worldwide are striving to keep up with the pace of AI development and evolving regulatory landscape establishing rules and principles to help ensure AI technologies are developed and used responsibly and ethically.

Figure 1: Survey respondents - locations

British Columbia (BC)
36

Alberta
53

Rest of Canada
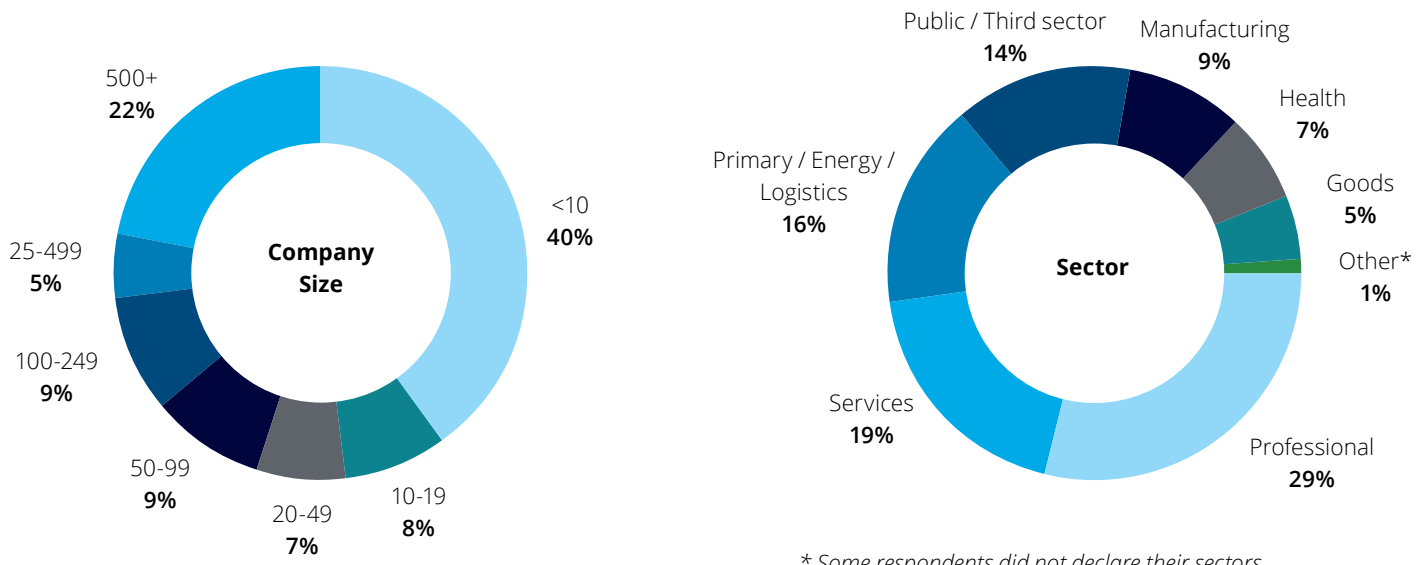(RoC) - **39**

Ontario
139

Québec
108
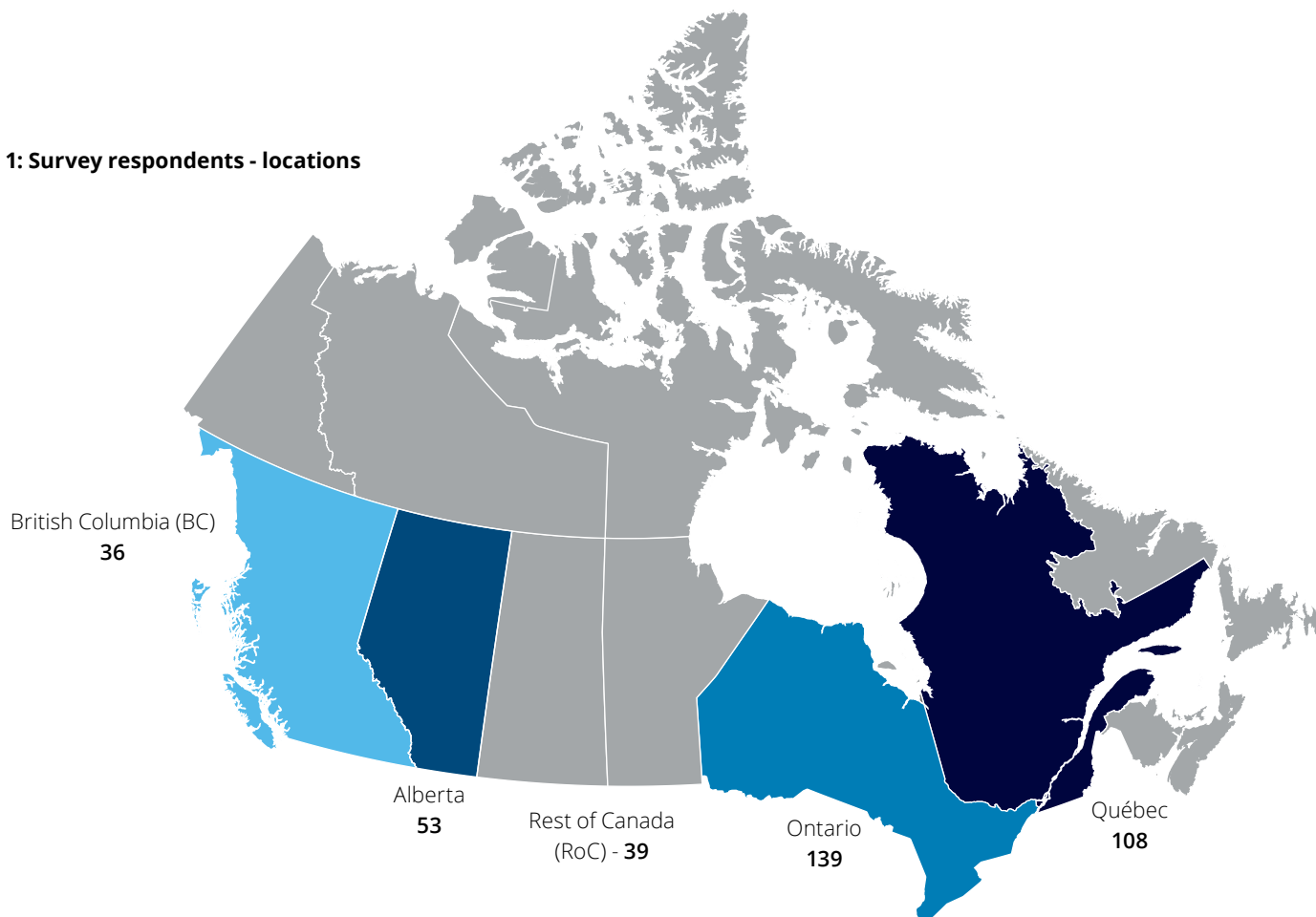
Introduction

Impact and opportunities: Canada's AI ecosystem - 2023 is a collaborative effort between Deloitte, CIFAR, and the three National AI Institutes - Amii, Mila, and the Vector Institute. This first-of-its-kind report provides a snapshot of the state of Canada's AI ecosystems in 2022–23 (April 1, 2022 – March 31, 2023), a period during which AI and generative AI applications showed the potential to play a critical role in our everyday lives. Our intent with this report is to help Canadians recognize how our nation's advancements as an AI leader will reshape our understanding and adoption of AI technologies and affect how Canada is viewed on the global stage. By prioritizing the development, launch, and adoption of AI technologies, we can strive to unlock AI's full potential, helping to ensure all Canadians have access to AI's benefits—safely and responsibly.

The report presents key Canadian AI ecosystem findings in five areas: talent and job market; research and development; views toward an AI-ready society; investment and economic indicators; and ethical AI and diversity. It also presents a view of our growth in generative AI, outlines the role of AI during the COVID-19 pandemic, and provides a summary of the impact of CIFAR and Canada's three National AI Institutes.

Participants and organizations across multiple sectors and company sizes were screened for their relevance to this research. All individual participants came from organizations that were AI developers, offered AI services, used AI to drive their services, or had plans to implement AI in their businesses within two years.

Figure 2: Survey respondents - company size, region, sector

Company Size

- 500+ **22%**
- <10 **40%**
- 25-499 **5%**
- 100-249 **9%**
- 50-99 **9%**
- 20-49 **7%**
- 10-19 **8%**

Sector

- Public / Third sector **14%**
- Manufacturing **9%**
- Health **7%**
- Goods **5%**
- Other* **1%**
- Professional **29%**
- Services **19%**
- Primary / Energy / Logistics **16%**

* Some respondents did not declare their sectors.

Region

- BC **10%**
- RoC **11%**
- Alberta **12%**
- Québec **28%**
- Ontario **39%**

Our methodology

CIFAR, Amii, Mila, and the Vector Institute, together with Deloitte, employed a three-part methodology to gather the data used for this report.
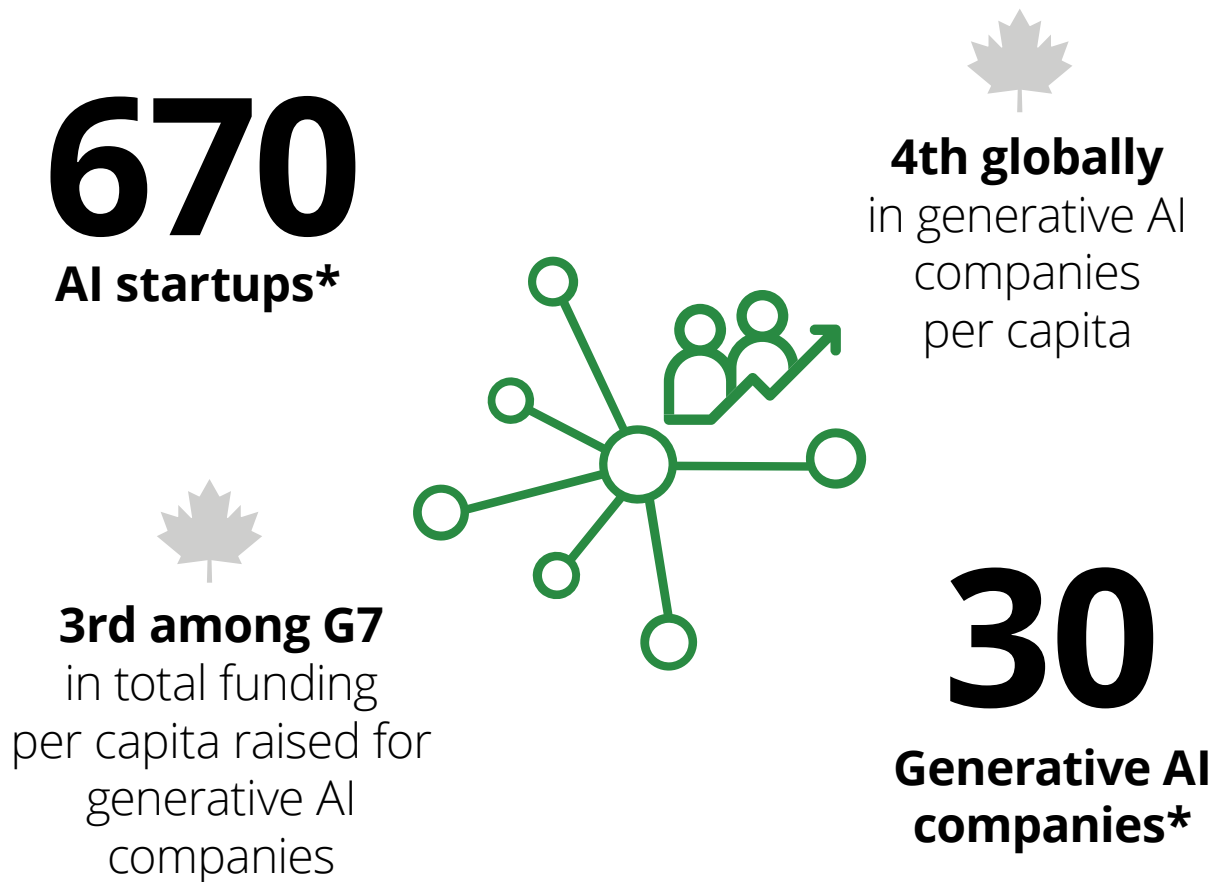
Together, we derived ecosystem-member metrics using data provided by CIFAR and the National AI Institutes. In addition, Deloitte conducted market research using government-patented databases, PitchBook, WIPO, and NetBase Quid market-research databases. The full group then validated and compared market-research findings with reports from the Canadian Venture Capital & Private Equity Association (CVCA), internal Deloitte teams, and media reports.

Lastly, we engaged Modus Research to conduct a survey of 375 business executives and senior managers of enterprises across Canada, carried out from March 11 to 23, 2023. The questionnaire was developed by an established executive business panel developed by Modus Research in collaboration with Deloitte.

Canada's AI ecosystem at a glance

Canada has a vibrant AI ecosystem made up of different actors, including AI start-ups and enterprises, generative AI vendors (see below), research labs, incubators, accelerators, venture capital (VC) firms, and regulators. Prominent National AI research Institutions—such as Amii, Mila, and the Vector Institute—along with CIFAR, a Canadian-based global research organization, also play a vital part in ensuring the success of Canadian AI research and development.

Government support for the AI sector is strong and consistent, as seen with the Pan-Canadian Artificial Intelligence Strategy at CIFAR and Canada's Global Innovation Clusters program, both launched in 2017. Investment has flowed into Canadian AI and generative AI companies, and Canada ranks third in the G7 in per capita VC investments.

670
AI startups*

4th globally
in generative AI companies per capita

3rd among G7
in total funding per capita raised for generative AI companies

30
Generative AI companies*

* (active in the last 5 years, have received at least one investment deal in the last 5 years that is more than $1M USD)

Canada's AI ecosystem:
Five key insights

Figure 3: HQPs enrolled or graduated from AI institute recognized programs 2022-23

4,078 Canada

1,156 Québec

2,553 Ontario

369 Alberta
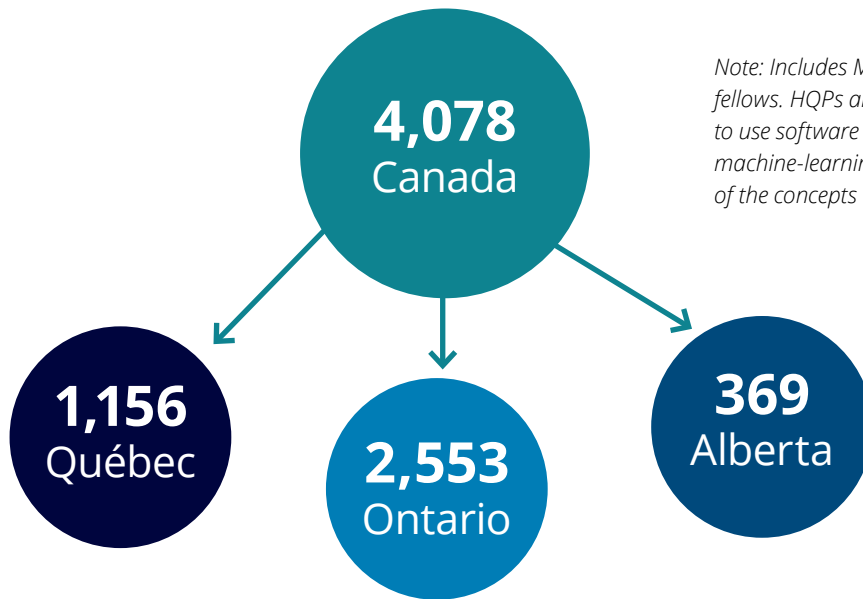
Note: Includes MSc and PhD students and post-doctoral fellows. HQPs are defined as people with both the ability to use software tools and techniques to solve AI or machine-learning (ML) problems and an understanding of the concepts to be researched.

Talent and job market

You can't build a successful AI ecosystem and a thriving, AI-powered economy without enough highly trained AI talent and fulfilling AI jobs; fortunately, Canada is among the world's best in both. Each year, the country trains an ever-expanding cadre of talent for a growing array of AI-dependent roles. If Canadian organizations continue to embrace AI and integrate it into their businesses at this pace, the need for AI talent will skyrocket.

Canada is a leading source of global AI talent
Of the world's most elite AI researchers (i.e., the top 0.5%), 6% call Canada home.[1] The country currently employs many top-tier AI researchers from graduate schools around the world, with 25% of currently employed top-tier researchers in Canada graduating from US institutions, 12.5% from UK and 12.5% from rest of Europe. Moreover, between 2017 and 2022-23, Canada ranked first in the five-year-average year-over-year (YoY) growth rate in AI talent concentration.[2] The country's cohort of AI talent rose an average of 38% YoY between 2017 and 2022-23, outpacing the United States (36% increase), the United Kingdom (34%), Germany (30%), France (29%), and Italy (28%).[3] Canada also leads the world in bringing more women into AI roles, achieving the highest YoY percentage change in female AI talent globally since 2019, including 67% in 2022-23 alone.[4]

AI is proving a powerful job creator across Canada
Employment in Canada's professional, scientific, and technical-services sector had a year-over-year growth rate of 11.06% in 2022-23—the fourth-largest growth seen in any sector in Canada that year.[5] There were 140,418 actively engaged AI professionals in 2022-23, an estimated 29% increase over the previous year.[6] In addition, the World Economic Forum projects an estimated 40% growth in global AI and machine-learning (ML) specialist jobs over the next five years, making it the top one growing profession among the 106 types of jobs evaluated by this study.[7]

Many of these AI and ML jobs are likely to pay well. Among organizations surveyed for this report that had AI roles, roughly 50% of the jobs were classified as "well-paying," with annual salaries in the range of $82,000, and held by highly qualified professionals (HQPs) who graduated from AI-related programs.[8] Despite this, many Canadian AI jobs continue to go unfilled. On average, survey results indicated that 7% of AI jobs at Canadian organizations—more than 2,300—had not been filled.[9]

Research and development

Canada's AI researchers are highly respected and valued members of the international AI research community. Whether alone or in collaboration with colleagues in Canada or around the world, our AI research community regularly makes waves through published papers and patent filings. Generative AI technologies wouldn't be where they are today without Canadian research underpinning them. But as other countries make consequential advances, are we willing to invest what's needed to maintain a leadership role?

As AI patent filings drop globally, Canadian AI patent filings rise significantly

Canadian AI innovators are making notable advances: The number of AI patents filed nationally rose by 25% in the 2021–22 period, with 158 new patents in that time, and 57% in the 2022–23 period, with 248 new patents.[10] This rate of increase put Canada second among G7 nations in 2022–23 behind Italy (63%), but ahead of the United Kingdom (32%) and Germany (14%).

The Pan-Canadian AI Strategy at CIFAR and Canada's Global Innovation Clusters program are key contributors to Canada's strong patent development, as they provide important funding and support for the country's AI researchers and developers.[11] Canada's National AI Institutes play a pivotal role in supporting AI innovation across the country in other ways, as well. In addition to training highly qualified talent through affiliated graduate programs and serving as launch pads for many AI start-ups, these institutes have made it
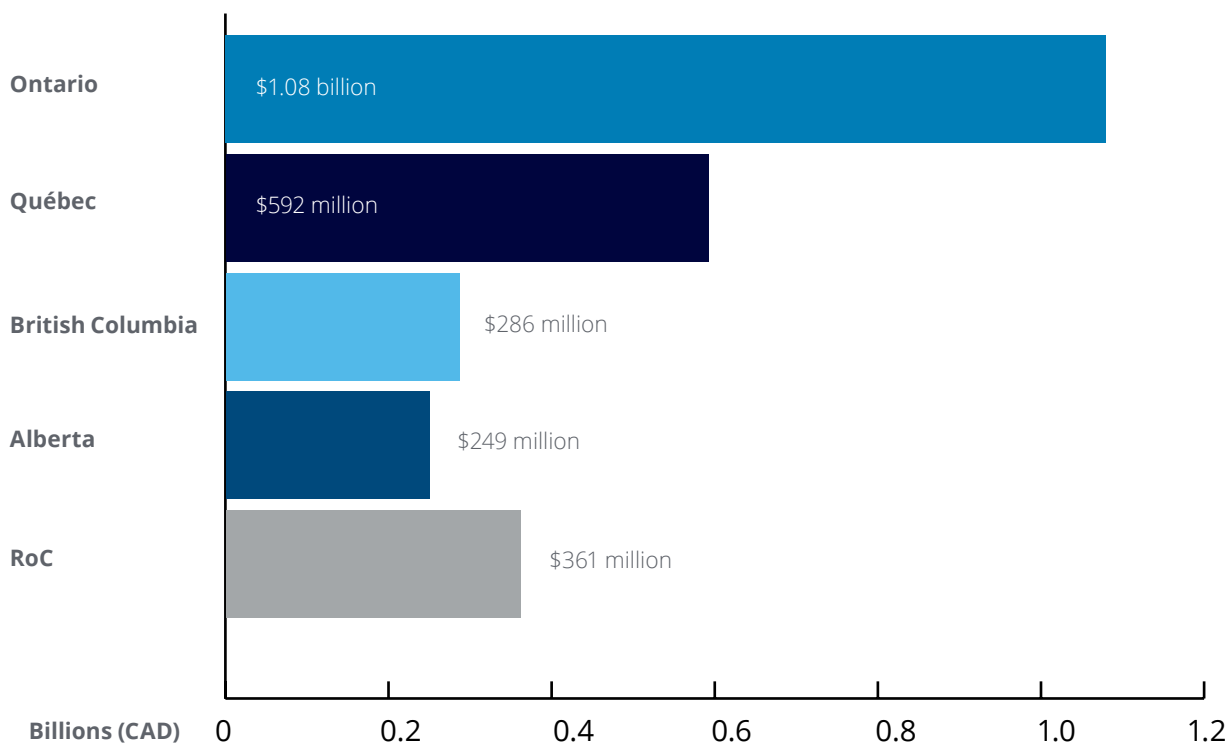
a priority to develop open-source software that AI innovators can use in their own work, thus fostering an environment of sharing and improvement that, in turn, supports increased innovation.

Since the Pan-Canadian AI Strategy launched in 2017, AI experts funded by Ottawa have earned 232 patents.[12] A report published by the Canadian Intellectual Property Office in 2021 estimated that corporations were responsible for 82% of patented AI innovations, with academic institutions accounting for 15% and government departments earning 3%.[13] This rise in successful private-sector patent filings points to early successes in the effect of the strategy's focus on increased awareness of intellectual property issues, which had otherwise lagged in years prior to 2017.

Canada is deeply integrated into the global research community

Canadian AI researchers co-authored roughly 83% of their 2022-23 AI-themed publications with colleagues across the world, with the majority (roughly 40%) co-written with colleagues from the United States, the EU, and China.[14] Canada was also first among the G7 nations in the number of AI research publications per capita in 2022-23. While countries included in the Organisation for Economic Co-operation and Development (OECD) have seen their share of high-impact AI publications fall since 2013, Canada has published high-impact AI research at an annual rate of 4% globally for the past decade.[15] Our strength in this realm hints at our expanding global

Figure 4: AI R&D funding, FY2022

Region	Funding
Ontario	$1.08 billion
Québec	$592 million
British Columbia	$286 million
Alberta	$249 million
RoC	$361 million

Billions (CAD): 0, 0.2, 0.4, 0.6, 0.8, 1.0, 1.2

influence. In addition, in 2017, researchers from the University of Toronto, in partnership with Google, published the landmark study on the Transformer network architecture,[16] the neural network that powers today's generative AI models.

Canada invests deeply in AI R&D

In 2022-23, external research funding and budgeted R&D expenditures amounted to a $2.57 billion investment in Canadian AI R&D.[17] Globally, Canada ranks fifth out of 62 countries for AI "capacity"—a measure of AI scale and intensity—outpacing Israel, Germany, Sweden, France, and Japan in AI research, and surpassing peer OECD countries such as France and Australia in AI-development funding.[18]

Phase 1 of the $125 million Pan-Canadian AI Strategy provided funding to CIFAR, Amii, Mila, and the Vector Institute to advance research, training, and innovation, including $86.5 million for Canada CIFAR AI chairs across the three AI institutes. Once Phase 2 of the Pan-Canadian AI Strategy is completed, as outlined in the federal government's 2021 Budget, a total of $448.5 million in funding will have flowed into the AI institutes, with $180 million earmarked to aid in commercialization efforts and programs such as the Global Innovation Clusters.

Figure 5: Unique investors in Canadian AI companies in FY2022, per province

Note: The number of unique investors may not match the total number of investments in AI companies across Canada, as some investors might fund multiple AI companies in multiple provinces.

Investment and economic indicators

Investors remain very attracted to Canada's dynamic AI ecosystem. While VC funding fell significantly worldwide in 2022-23, it continued to flow to Canadian AI companies, allowing them the opportunity to continue their research and establish and grow their businesses. Public funding for AI in Canada has grown, as well, as the federal and provincial governments seek to invest in the country's future.

However, judging by the numbers, many Canadian companies don't seem eager to increase their own AI funding. Overcoming this hurdle is likely to be essential for Canada to fully reap the benefits of AI.

Canada's AI investment landscape looks positive

A sizable, diverse, and well-balanced community of investors has been funding Canada's AI sector. In 2022-23, 528[19] unique parties invested in Canadian AI companies. Overall, domestic investment comprised 28% of total VC investment in AI in 2022-23—more than that seen in Germany (24%), the United Kingdom (20%), and Italy (22%).[20]

Canadian VC AI investments surge in Q4 2022 amid global investment slowdowns

In 2022-23, the global year-over-year VC investment in AI fell for the first time in a decade—from a record high of USD $211 billion in 2021 to USD $122 billion, a 42% drop.[21] This decrease was in all likelihood due to the economic slowdown and a cooling tech sector, which experienced falling demand, reduced valuations, sharply lower stock prices, and large-scale layoffs throughout 2022-23.
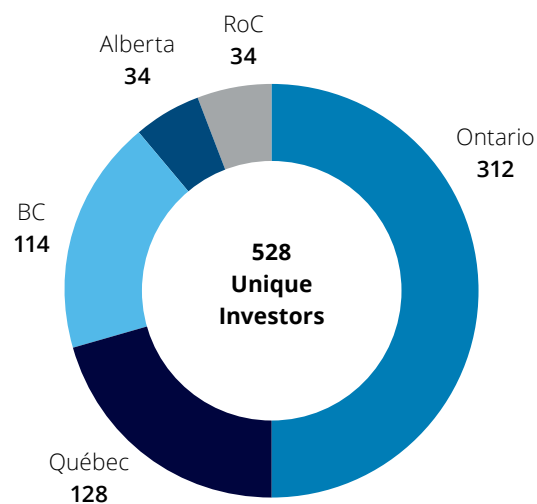
To better understand the shape of VC investment activity in Canada during this period, it is important to distinguish between enablers in the AI ecosystem, AI developers, and users outside the ecosystem:
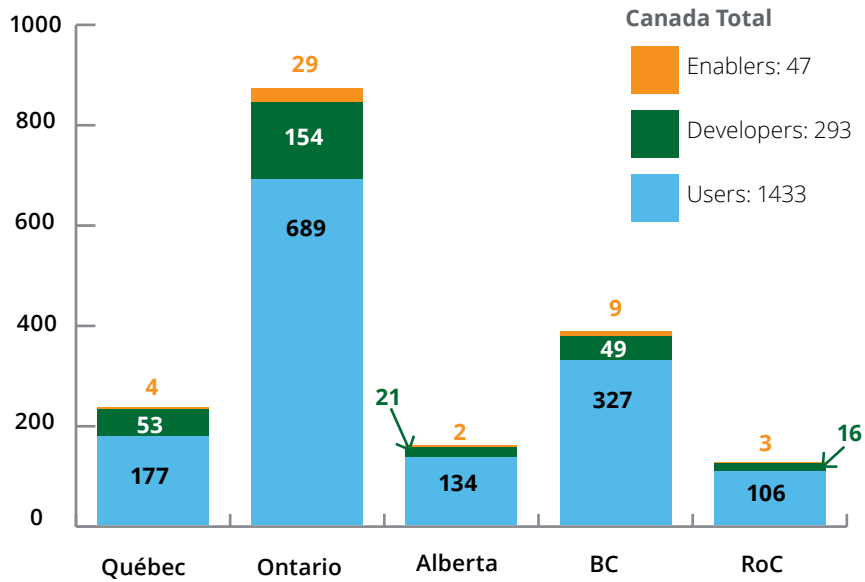
- **Enablers** are companies that provide services and solutions that support and facilitate AI development, from databases and cloud computing to data analytics.[22]

- **Developers** are companies whose core businesses involves developing AI- and ML-based services and solutions, such as AI-based service platforms, natural language processing (NLP) software, and autonomous robotics.[23]

- **Users** are companies in other industries—from fintech to digital health to supply chain and far beyond—that aim to enhance their businesses through AI-based technology.[24]

Ontario is home to the highest proportion of enablers (62%), developers (53%), and users (48%) in Canada.
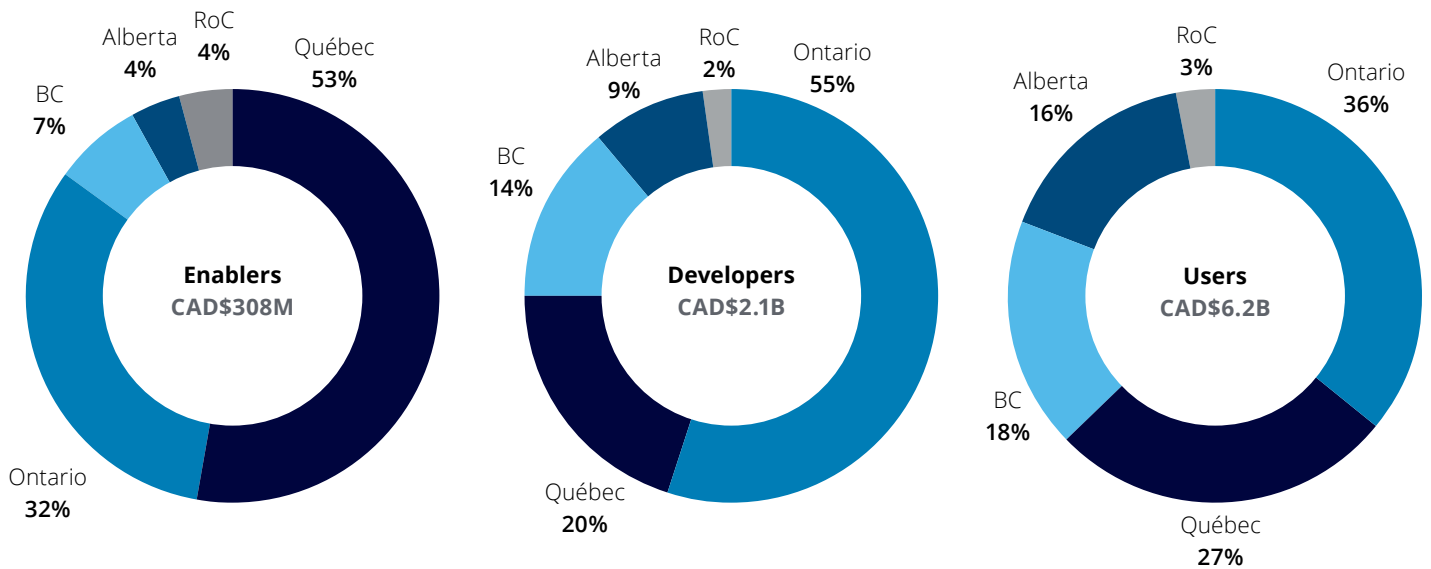
Nationally, total VC investments in AI reached $8.64 billion in 2022–23, with the vast majority ($6.23 billion) funding AI users who were distributed relatively evenly across the country.

Canada ranks third among G7 countries in per capita VC investments in AI enablers, developers, and users, trailing only the United States and United Kingdom.[25] Closer inspection reveals that, in terms of enablers, Canada is on a par with the United Kingdom, which

Figure 6: Number of enablers, developers and users that received VC investment in FY22 per province

Canada Total
- Enablers: 47
- Developers: 293
- Users: 1433

Province	Enablers	Developers	Users
Québec	4	53	177
Ontario	29	154	689
Alberta	2	21	134
BC	9	49	327
RoC	3	16	106

Figure 7: VC investment by type of AI organization

Enablers — CAD$308M
- Québec 53%
- RoC 4%
- Alberta 4%
- BC 7%
- Ontario 32%

Developers — CAD$2.1B
- Ontario 55%
- RoC 2%
- Alberta 9%
- BC 14%
- Québec 20%

Users — CAD$6.2B
- Ontario 36%
- RoC 3%
- Alberta 16%
- BC 18%
- Québec 27%

invests 1.09 times as much as Canada. There's room for improvement in our AI-developer VC investments, however: US per capita investment is 3.27 times that of Canada, and UK investment is 1.49 times as large. In terms of AI users, Canada has sizable investment ground to make up: US and UK per capita VC investments are both more than double that of Canada's contributions. If the nation is to remain competitive in an AI-driven world, much more substantial funding will be needed.

AI's business impact on Canada lags global average

With 55% of survey respondents in Canada reporting that they plan to increase their AI investments in the next fiscal year, Canadian organizations still lag behind the global average by about 21%.[26]

Pinpointing and operating with best practices are critical for project success. One-quarter of respondents reported slower recovery time than expected upon investing in AI applications. High-performing companies on average instituted/followed best practices for projects at rates that were higher than those of low-performing companies—15% higher, on average.

Table 1: G7 member states: VC investment in AI per capita, ranked

Country	Rank (Enablers)	Rank (Developers)	Rank (Users)
US	1	1	1
UK	2	2	2
Canada	**3**	**3**	**3**
France	4	4	5
Germany	5	5	4
Europe (excluding UK)	6	6	6
Japan	7	7	8
Italy	8	8	7

Reducing costs and/or increasing workflow efficiency were respondents' top focus for AI investments, while creating novel products or services received the lowest share of investments. Intelligent automation and prediction/optimization were the top-voted AI applications, and were cited as the most value-driving in the next five to 10 years. On the other hand, biometrics and simulation applications such as digital twin and virtual worlds did not appear to receive much confidence in their ability to yield a return on investment.

Table 2: Top Canadian AI Companies with Highest Capital Raised in FY2022

AI enablers	AI developers	AI users
Smile Digital Health, *Toronto* (medical record system, clinical database)	**Peak Power,** *Toronto* (energy services, clean tech)	**Ratio Labs Inc.,** *Toronto* (B2B payments, fintech)
Kaloom, *Montréal* (big data, SaaS, network management)	**Xanadu,** *Toronto* (cloud tech, quantum computing)	**Blockstream**, *Montréal* (cryptocurrency, blockchain, fintech)
Thentia Cloud, *Toronto* (govtech, legal tech, database, productivity software)	**Vention,** *Montréal* (multimedia, design software)	**Neo Financial,** *Calgary* (fintech, mobile)
Flare Systems, *Montréal* (cybersecurity, database, network management)	**Certn**, *Victoria* (HR tech, productivity software)	**LayerZero,** *Vancouver* (cryptocurrency, blockchain)
DrugBank, *Edmonton* (technology, media, and telecom (TMT), digital health)	**Nesto,** *Montréal* (financial software, real estate technology)	**Airex Energy,** *Laval* (climate tech, clean tech)
Jobber, *Alberta* (Cloud software, CRM and team management)		

Toward an AI-ready society

Canada is an AI start-up nation, with dozens of new ventures launched in the past two years and more than 600 AI businesses across Canada currently active.[27] Canada's three National AI institutes play an integral role in supplying the AI talent and fostering the collaborations that help these start-ups grow. However, once launched, AI companies face challenges familiar to other organizations seeking to grow their businesses:, such as financial costs, aggressive competition, additional investments, and the right mix of talent shortages. Tackling these hurdles is critical if Canada's promising AI start-ups are truly to soar.

But a larger factor might prove to be an even bigger challenge to the growth of Canada's AI economy: persuading the country's overall business community to more aggressively adopt AI. Corporate Canada is already falling behind its global peers when it comes to launching/using AI; many companies appear content to avoid taking risks with full AI applications, instead continuing to focus on AI pilot programs. Commercialization of Canadian AI products and services remains agonizingly slow. If Canadian businesses can't internalize a sense of boldness and adventure—and their willingness to take smart risks—we may squander our chance to build one of the world's first great AI-driven economies.

New AI companies continue to be established at a steady pace in Canada

All three National AI Institutes have established dedicated programs or teams to help Canada's AI researchers turn their ideas and expertise into start-up businesses. Forty-six new AI companies were founded in Canada in 2022-23—10.8% of all new businesses that year, and matching the number of new Canadian AI companies established the previous year.[28] More than half (27) were founded in Ontario, possibly due to the province's high rate of VC investment and significant growth in the available grant-related funding.

Canada's AI ecosystem is innovative and thriving, and the nation's AI business environment is both attractive and competitive: The steady pace of growth in new AI companies in Canada—there are more than 600 AI start-ups currently across the country—stands in contrast to the 16.6% drop seen globally in 2022-23.[29]

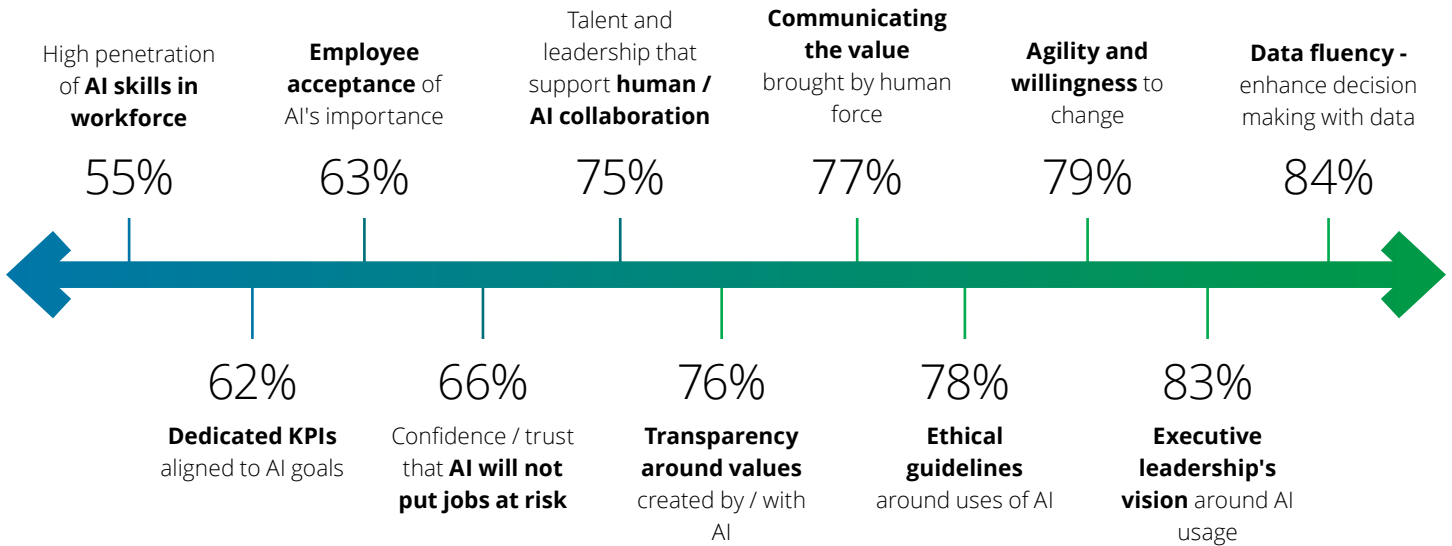**Collaborations continue to be a strength of Canada's AI ecosystem**

Canada is strong in the area of public and private AI partnerships, ranking second among G7 nations for government AI strategy.[30] The Pan-Canadian AI Strategy has been critical in bringing together AI ecosystem members across Canada.[31] From our National AI

Figure 8: AI-related partnerships* across the National AI Institutes
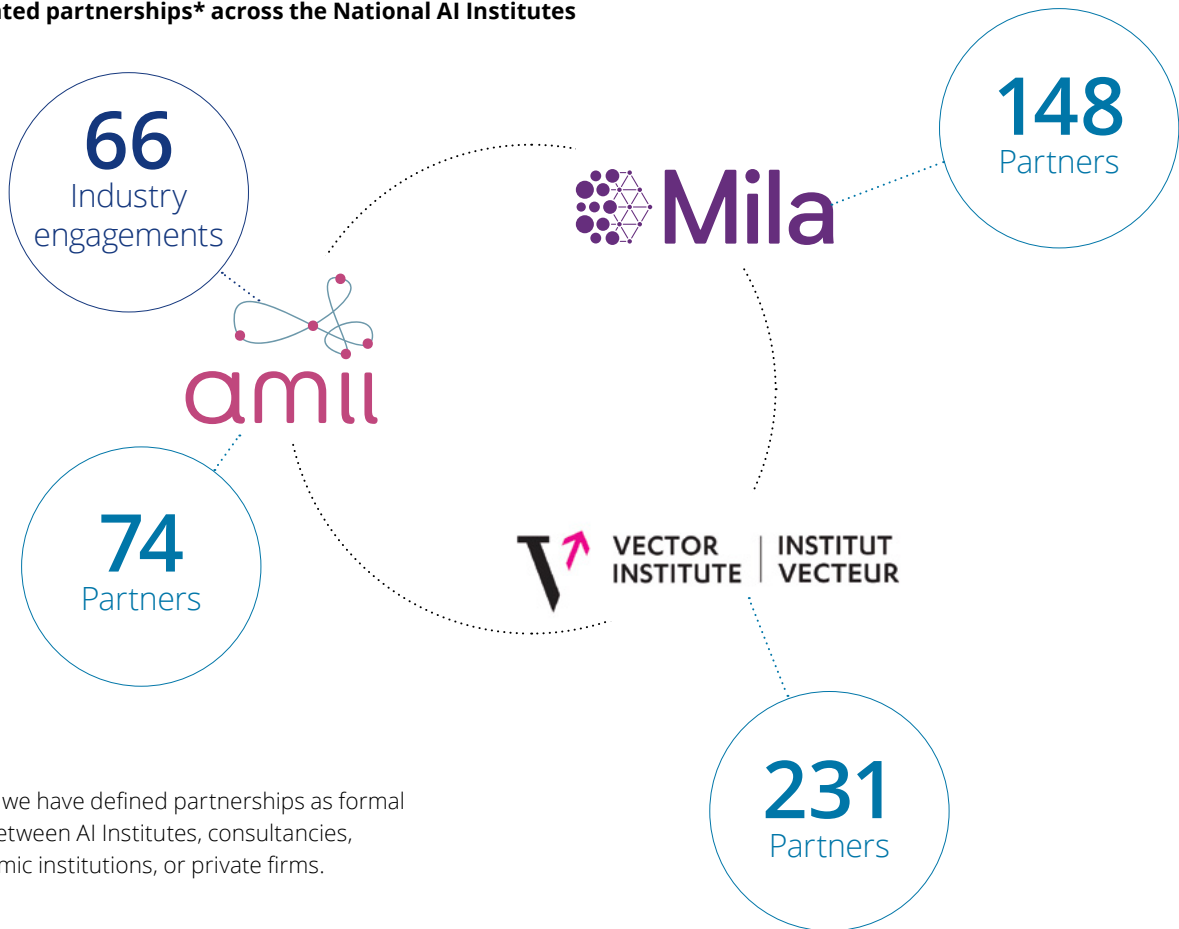
*For this report, we have defined partnerships as formal collaborations between AI Institutes, consultancies, start-ups, academic institutions, or private firms.

Figure 9: Importance of factors for the development of AI-ready culture

High penetration of **AI skills in workforce** — 55%

Employee acceptance of AI's importance — 63%

Talent and leadership that support **human / AI collaboration** — 75%

Communicating the value brought by human force — 77%

Agility and willingness to change — 79%

Data fluency - enhance decision making with data — 84%

62% — **Dedicated KPIs** aligned to AI goals

66% — Confidence / trust that **AI will not put jobs at risk**

76% — **Transparency around values** created by / with AI

78% — **Ethical guidelines** around uses of AI

83% — **Executive leadership's vision** around AI usage

Institutes to Canada's Global Innovation Clusters, the federal government has created an environment that supports AI adoption by businesses in key industries, public-sector organizations, and not-for-profit entities.

Internationally, Canada actively participates in intergovernmental working groups that bring together AI experts and policymakers with the aim of identifying and addressing our society's most urgent challenges in the face of continuing AI development and usage. Two key examples are the Global Partnership on Artificial Intelligence (GPAI) and the OECD Network of Experts on AI (ONE AI), which focus on responsible AI, data governance, AI policies, innovation, and commercialization.[32]

Canada has also established the Canadian Technology Accelerator (CTA) program for high-potential companies that have market-ready technology in sectors such as AI. The CTA program offers participants introductions to 1,400 potential partnerships across 12 global technology hubs. Since its inception, it has led to 3,100 new jobs, $818 million raised in capital, and $325 million generated in revenue, and has yielded more than 840 alumni so far.[33]

Cost is the most common growth hurdle for small and medium enterprises

Research and discussions led by Canada's National AI Institutes indicate that financial costs and investments are the most common challenges to the growth ambitions of small and medium-sized AI enterprises (AI SMEs). Other hurdles include gaining access to talent with the required skills, and identifying appropriate AI use cases. The fifth edition of the report *Deloitte's state of AI in the enterprise* cites insufficient funding for AI solutions, upskilling issues, concerns with choosing the right AI technologies, and difficulty articulating the business value of AI solutions as barriers to the growth of AI enterprises globally.

Addressing their growth challenges could enable AI enterprises to scale their operations more quickly. Services offered by Canada's National AI Institutes, such as coaching and mentoring, have been shown to help scale-ups and AI SMEs in this regard. Canada's rising concentration of AI talent and the surge in AI-related grant funding may also serve to help AI companies address any such hurdles.

Canada lags slightly in AI adoption and commercialization

Compared with global averages, Canada is slightly below for AI usage but on a par for exploration. Roughly one in four (26%) of the representatives surveyed for this report said their organizations have instituted one or more AI implementations, compared with 34% globally. However, 42% of the organizations involved in our survey had pilots in place to explore AI, matching the level of their global counterparts.[34]

Most Canadian organizations are in the preliminary phases of AI development and usage. Sixty-seven percent of respondents reported that their organizations have fewer than two years of experience developing and launching/using AI solutions. Similar findings were detailed in the report *Deloitte's state of AI in the enterprise, 5th edition*, which revealed that Canada has relatively more starter enterprises (characterized by low AI deployment and low-achieving for meaningful outcomes) than the global average.

Commercialization in the AI realm is moving slowly. Of those firms that have ventured forth, an average of two of their AI products or services have been adopted by other organizations.

One-third of Canadian organizations consider their data-management and governance processes to be relatively mature

The right data practices are vital. They're the foundation for using AI to gain valuable business insights, identify operational efficiencies, and transform a corporation into a truly AI-enabled enterprise. This essential first step begins with proper data management and data governance. However, Canadian businesses need to do more to raise awareness regarding data principles and strategies.

Just over one in three (36%) of the organizations surveyed reported data-management and data-governance processes in the mid-to-high maturity range. Roughly the same proportion responded that they were unsure about the current maturity level of these strategies at their organizations.

Factors prioritized while developing an AI-ready culture can be surprising

Capitalizing on the potential of AI requires an organization's workforce and culture to be AI-ready—that is, to have the knowledge and skills to understand what AI can do, and how to work with it.

Yet, while 84% of surveyed organizations ranked data fluency as the most important factor in developing an AI-ready culture, just 55% felt high penetration of AI skills in the workforce was important to achieving this data fluency.

Developing an AI-ready workforce and culture also requires organizations to help their workers understand that AI is a means to transform the work, not the workforce. Thus, in adopting AI, companies can let machines and humans perform the types of work

Figure 10: High data management / Governance maturity

Ontario **20%**
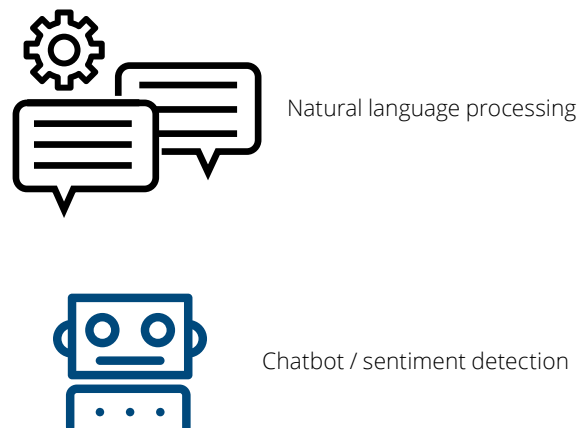Québec **24%**
BC **19%**
Alberta **19%**
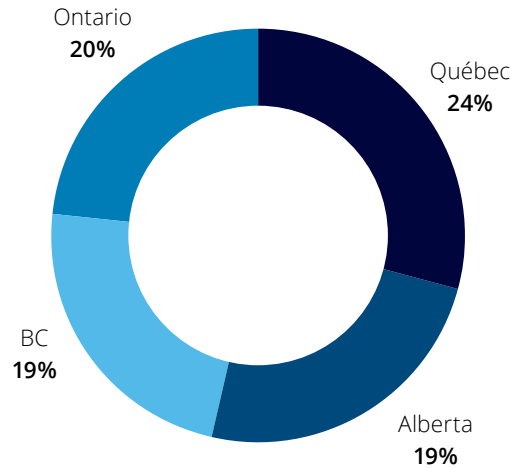
Note: Organizations across the rest of Canada had the highest self-reported levels of low data-management and governance maturity (43%). Data maturity percentages are calculated based on the number of companies surveyed in each province. The numbers in this chart will not add up to 100%.

they're most suited to, augmenting the capabilities of the other as needed. Tasks and assignments that require creativity, empathy, judgment, and emotional intelligence will still be done by humans—who will have more time to do so, since AI would free them from tasks such as data analysis, processing, image recognition, and sentiment analysis, at which AI would undoubtedly excel. The result will invariably be greater organizational efficiency and productivity overall.

Figure 11: Top 3 deployed AI applications

Intelligent automation

Pattern / anomaly detection

Cybersecurity
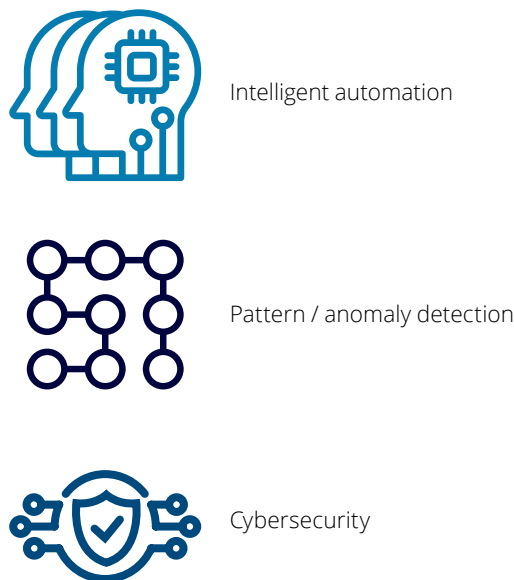
Figure 12: Top AI applications in development

Natural language processing

Chatbot / sentiment detection

Note: Given the current enthusiasm for generative AI and the large language models (LLMs) that underpin it, we expect the number of enterprises developing and deploying these two language-oriented AI applications to grow next year.

Ethical AI and diversity

As organizations continue to invest heavily in AI-related strategic priorities, it is crucial for them to balance value-creation opportunities with the related risks. AI tools continue to evolve—but so, too, does the regulatory landscape. When the federal government re-tables *Bill C-27: Digital Charter Implementation Act*—of which the *Artificial Intelligence and Data Act* is a key component—it's likely the text will contain additional provisions addressing the emergence of new technologies, as well as regulations regarding their use. The challenge, however, is that the exponential growth of these new technologies is outpacing regulators' efforts to guide their use.

By embracing trustworthy AI principles, organizations can take steps to support the ethical and responsible development and launch/use of their AI systems. This can allow companies not only to minimize risks—thereby upholding their reputations, the public trust, and confidence in the technology—but also to make use of the immense potential of AI and effectively monetize its capabilities. Given the ever-evolving AI landscape, it is thus imperative that responsible AI practices be interwoven in all steps of the product development lifecycle.

Organizations were most concerned about the risks of AI bias and poor results
Eighty-six percent of surveyed companies cited concerns regarding the ethical risks of AI. Just over half (51%) reported being concerned about the potential for bias or low-quality results in AI algorithms. Organizations were least apprehensive about AI eliminating jobs through automation, with just 27% of respondents citing this as an issue.

Small organizations (i.e., fewer than 10 employees) were more concerned about the potential for AI to be misused to manipulate thinking and behaviour (42%) than were large enterprises of 500 employees or more (21%).

AI organizations are adopting responsible AI practices
Canada is a global leader in responsible AI; this has been a central driver and value of our AI researchers for decades. The principles of human-rights-based, ethical, and responsible AI are being adopted and embraced by all sectors. In 2019, the Government of Canada established a list of 117 suppliers it could turn to for responsible and effective AI services (the list has since grown).[35]

So, how well do Canadian organizations adhere to these principles for ethical, responsible AI use? There's room for improvement across the board: While half (52%) of surveyed organizations said they were always or sometimes adherent to AI cybersecurity risk management and human-centred design principles, just 35% reported always or sometimes adhering to established principles for AI model life cycle documentation.

Canadian AI enterprises are taking steps to advance diverse representation
Encouragingly 68% reported that DE&I values were an important or very important consideration in hiring, training, and retaining AI talent.

Accordingly, CIFAR and its partners at the three National AI Institutes are committed to creating a more diverse, equitable, and inclusive environment through 30 DE&I programs nationally, as well as CIFAR's own strategic initiative, the Action Plan on Equity, Diversity, and Inclusion.

In addition, these organizations have committed to ensuring that a minimum of 25% of Canada CIFAR AI chairs identify as women or non-binary, and that over the next five years, at least 40% of new Canada CIFAR AI Chair recruits and 30% of trainees identify as "members of equity-deserving groups." [36]

Special feature

COVID-19's impact on Canada's AI ecosystem

In accelerating a transformation in the way Canadians live, work, and interact, the COVID-19 pandemic gave rise to several important new operational and regulatory opportunities for the use of AI.

AI has been used to help alleviate some of the added pressures imposed by the pandemic on health care systems. In Canada, for example, AI helped create predictive models that could identify patients at high risk of developing COVID-19, as well as algorithms to facilitate faster, more accurate diagnoses of the disease. The global health care AI market is now projected to achieve a compound annual growth rate (CAGR) of roughly 45% in revenues between 2023 and 2033.[37]

The shift to remote work also contributed to the rise in chatbots, virtual assistants, and other AI technologies that could support communication and collaboration between workers. AI technologies have also been used to optimize supply chain operations, predict demand and inventory levels, and identify and mitigate supply chain disruptions—addressing the global challenges seen at the pandemic's height.

Opportunities to develop new regulatory frameworks for the use of AI were also highlighted in response to challenges that arose from the pandemic. In the health care sector, for example, the need for regulations on AI-powered medical devices and solutions grew quickly. In response, Health Canada, in collaboration with the US Food and Drug Administration (FDA) and the UK Medicines and Healthcare products Regulatory Agency, developed a regulatory framework to help ensure the safety and efficacy of AI-powered medical devices and software.

With our increasing reliance on digital and AI-enabled technologies for remote communication and work, concerns about data privacy and cybersecurity have also increased. This has reinforced the need for regulations that can protect personal data and help ensure the ethical and transparent use of AI.
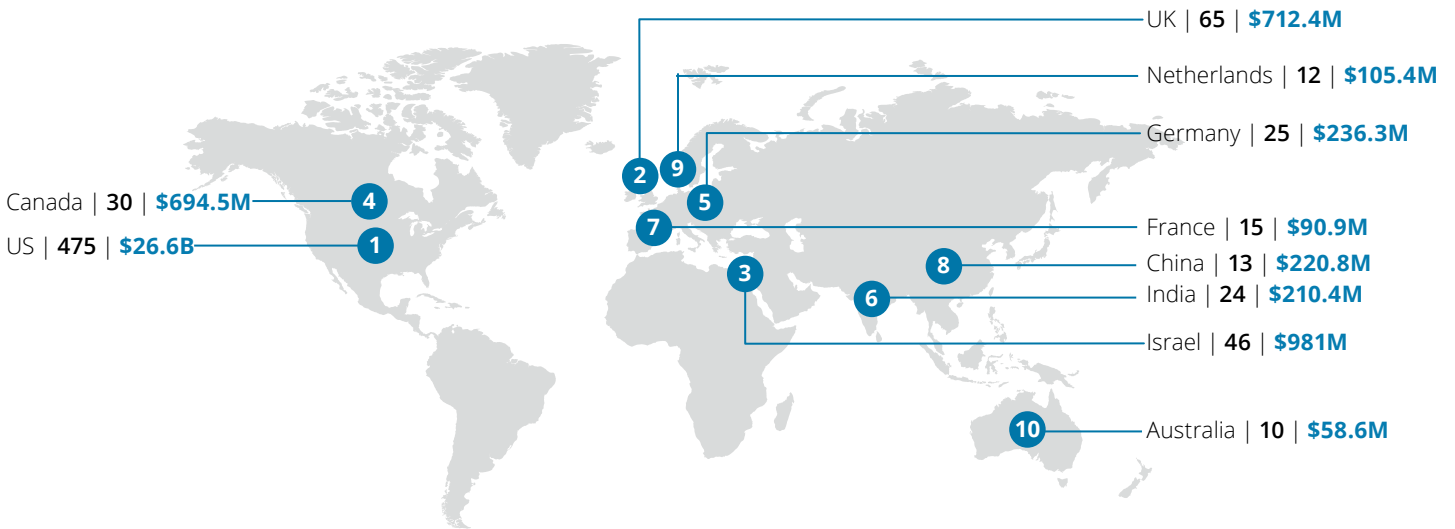
Special feature

Canada stakes its claim in the generative AI landscape

Generative AI—focused on the ability of machines to create outputs across modalities such as text, video, and audio—goes back as far as the mid-2010s, but interest and investment surged beginning in late 2022 with the emergence of much more sophisticated tools. Public adoption of the technology, too, has been swift: for one, OpenAI's ChatGPT reached one million users in just five days. And Canada is advancing its sophistication in exciting areas of AI development.

The speed of innovation in generative AI is being driven by improvements in cloud compute technology, software engineering, deep learning and machine learning more broadly, natural language processing (NLP), and large language models (LLMs). Additionally, an ever-increasing number of users are using generative AI models to help develop various user-facing applications.

Figure 13: Top 10 countries with highest number of GenAI companies

UK | **65** | **$712.4M**
Netherlands | **12** | **$105.4M**
Germany | **25** | **$236.3M**
France | **15** | **$90.9M**
China | **13** | **$220.8M**
India | **24** | **$210.4M**
Israel | **46** | **$981M**
Australia | **10** | **$58.6M**
Canada | **30** | **$694.5M**
US | **475** | **$26.6B**

Note: Dollar figure represents total funding raised (USD)

Table 3: Top 10 countries ranked by number of GenAI companies

Country	# of GenAI companies	Total funding raised (USD)
US	475	$26.6B
UK	65	$712.4M
Israel	46	$981M
Canada	**30**	**$694.5M**
Germany	25	$236.3M
India	24	$210.4M
France	15	$90.9M
China	13	$220.8M
Netherlands	12	$105.4M
Australia	10	$58.6M

Generative AI is accelerating in Canada

Canada's generative AI ecosystem is globally competitive: in fact, Canada is one of the world's most innovative places for AI research and commercialization. The country ranks fourth in number of generative AI companies and third in total per capita funding raised. As of June 30, 2023, Canada was home to 30 generative AI-focused companies—more than in Germany or India. With USD $694.5 million in investment in Canadian generative AI companies, the country is in good company with other global leaders such as Israel and the United Kingdom.

Table 4: Top 10 countries ranked by number of GenAI companies per million capita

Country (Population size)	# of GenAI companies	# of GenAI companies per million capita
Israel (9.364M)	46	4.91
US (331.9M)	475	1.43
UK (67.33M)	65	0.965
Canada (38.25M)	**30**	**0.784**
Netherlands (17.53M)	12	0.685
Australia (25.69M)	10	0.389
Germany (83.2M)	25	0.3
France (67.75M)	15	0.221
India (1.408B)	24	0.017
China (1.412B)	13	0.00921

Table 5: Top 10 countries ranked by total funding raised per capita

Country (Population size)	Total funding raised (USD)	Total funding raised per capita
Israel (9.364M)	$981M	104.76
US (331.9M)	$26.6B	80.14
Canada (38.25M)	**$694.5M**	**18.16**
UK (67.33M)	$712.4M	10.58
Netherlands (17.53M)	$105.4M	6.01
Germany (83.2M)	$236.3M	2.84
Australia (25.69M)	$58.6M	2.28
France (67.75M)	$90.9M	1.34
China (1.412B)	$220.8M	0.16
India (1.408B)	$210.4M	0.15

Note: Information obtained for the tables are from June 30, 2023. With the rapidly changing nature of the total and corresponding companies during the period of the report we have included information outside of the date range to provide a more complete reflection of the evolving ecosystem.

Figure 14: Total capital raised and deal count of Canadian GenAI companies, 2017-2023
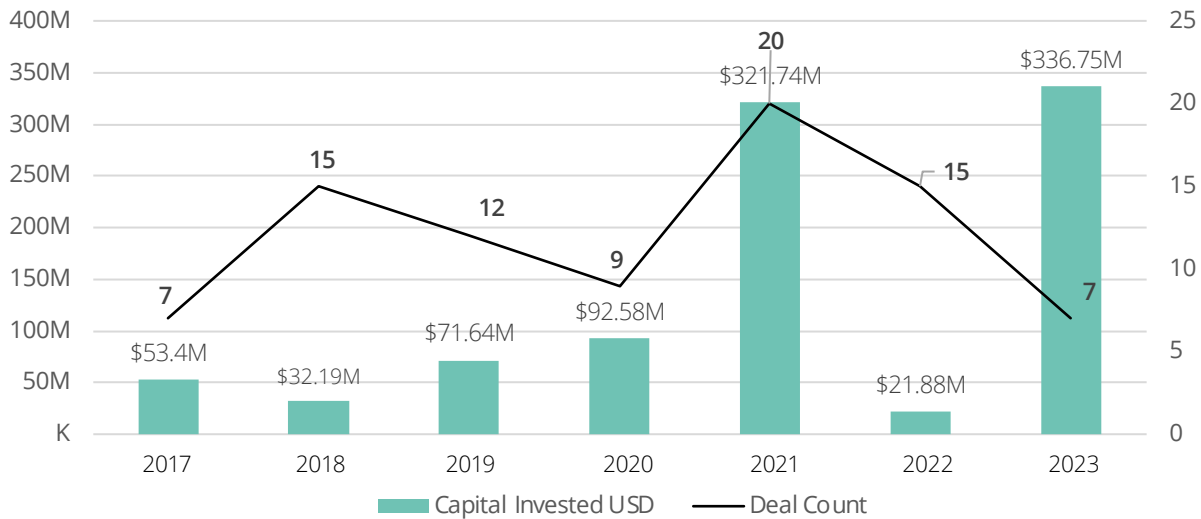
Note: Source: PitchBook Data, Inc.

By mid-2023, the total capital raised by Canadian generative AI companies—nearly USD $340 million—was already greater than that raised in all of 2021, indicating an upward trend in investor interest.

There are considerations as we move forward in this space
The generative AI market is projected to grow to USD $98.1 billion by 2026.[38] The technology has immense potential to affect business operations across industries, but given its relative novelty, its risks still have yet to be fully explored, with new challenges being identified as it acquires more users. Therefore, now is the time to address concerns about the use and proliferation of generative AI—including AI bias, data privacy, and cybersecurity, as well as any associated legislative and regulatory implications that may arise.

Firstly, it's imperative that generative AI be used in a safe and ethical manner. Misinformation and disinformation may increase due to training-data corruption or even due to new AI models being created from biased data unless our AI literacy and understanding of trustworthy AI improves.
Data privacy is another issue, as users may unknowingly provide sensitive data to generative AI models, which can then be leaked or accessed in potential cyberattacks.

For these reasons, it's essential to have a clear and trustworthy AI framework and governance in place, as these tools can help build, institute, use, and commercialize generative AI applications responsibly.

Our next move: Acting now to lead globally

Canada's AI ecosystem has advanced significantly since 2017, positioning us at the forefront of AI innovation and research. We are developing new talent with the AI knowledge and skills needed to advance AI research and bring exciting AI solutions to market. We are attracting significant AI investment. And we are establishing a growing ecosystem of AI start-ups and world-class institutions to support an ever-growing number of AI-enabled companies. At this moment in time, Canada is truly a global leader in AI.

But we can't simply rest on our laurels: more must be done to help ensure Canada remains a leader in the global AI landscape. We need to invest even more in AI to help Canadian AI companies move beyond research and exploration to application and commercialization with AI deployment throughout the product life cycle. We need Canadian companies to commercialize their innovations aggressively, scale their businesses abroad, and succeed globally.

To accomplish this, Canada's AI community should take a multi-pronged approach, with the following steps:

- **Strengthen AI fluency in Canada's businesses, public sector, and communities.** AI adoption across the wider Canadian economy is essential to building a growing national AI ecosystem that helps to boost Canada's prosperity. To encourage AI adoption, Canadian leaders, influencers, and decision-makers need to better understand what AI is—and what it isn't—and how they can use it to achieve their own goals.

- **Invest in scalable AI opportunities.** It's vital that investors look for—and fund—AI ventures that have potential to allow them to differentiate themselves in a crowded AI market and scale up into thriving, growing businesses at an international level.

- **Make use of CIFAR and Canada's AI institutes.** CIFAR, Amii, Mila, and the Vector Institute are pivotal to the execution of the Pan-Canadian AI Strategy. Canadian AI companies should seek to better harness the knowledge, expertise, and networks available courtesy of CIFAR and Canada's three National AI Institutes in order to connect with investors and other members of the AI community, and grow beyond experimental projects and pilots. Not only would such connections further individual companies' ambitions, they would also highlight to the world the wealth of connections and cooperation that exists in Canada's AI ecosystem.

- **Keep our AI talent in Canada.** AI talent was already in high demand around the world—but with generative AI, the demand has skyrocketed. For Canada to remain a leader in AI, it's imperative that the talent we attract and develop stays here. That means providing our AI talent with meaningful opportunities to build careers that are personally and professionally satisfying.

- **Establish and maintain a strong presence on the global stage.** Canadian AI researchers make significant contributions to AI scientific publications, but Canada should make its presence known on the global AI stage in other ways, including taking a clear, visible role in the ongoing conversations about AI regulation. Our governments, investors, National AI Institutes, and AI companies should do more to promote our national AI ecosystem in order to demonstrate to the world that there's no better place than Canada for top AI innovation and opportunities.

- **Identify use cases that drive value.** Identifying appropriate use cases continues to be a bottleneck in AI adoption, and failing to target business-critical challenges is at the root of AI use cases falling short of delivering true value. Leaders should thus identify and prioritize use cases that support their strategic priorities and solve specific business problems, such as improving customer service and automating labour-intensive activities.

- **Continue our wide-ranging collaborations to drive responsible AI development and use.** Governments, regulators, and industry leaders worldwide are striving to keep up with the pace of AI development and evolving regulatory landscape establishing rules and principles to help ensure AI technologies are developed and used responsibly and ethically. CIFAR and the three National AI institutes already play significant roles in Canada and globally, helping to guide critical conversations and ensure that responsible AI measures are effective—yet without stifling AI innovation and growth.

It's time for Canada to embrace this potential and further enhance its standing as a global AI leader.

Spotlight

CIFAR ● Toronto, Ontario   cifar.ca/ai | cifar.ca/fr/ia

The Canadian Institute for Advanced Research (CIFAR) has evolved since its founding 40 years ago, from a small group of Canadian academics to a leader in the global research community with cutting-edge programs ranging from quantum science to economics, microbiology, and space.

CIFAR's early and sustained leadership in AI dates back to its very first program, in 1982, along with pivotal developments in the field of deep learning by CIFAR-affiliated researchers in Alberta, Ontario, and Québec. These achievements inspired the federal government in 2017 to further capitalize on Canadian-directed opportunities and ask CIFAR to lead the world's first fully funded national AI strategy.

Since then, through the Pan-Canadian AI Strategy and the Canada CIFAR AI Chairs program, CIFAR and Canada's three National AI Institutes—Amii in Alberta, Mila in Montréal, and the Vector Institute in Toronto—have attracted 122 world-leading AI researchers to Canada's AI ecosystem. These professionals have, in turn and with the same support, launched the careers of thousands of trainees at the AI institutes, further securing Canada's position as a global leader in AI research.

Highlights: Talent and job market

The importance of equity, diversity, and inclusion in the design, regulation, and use of AI has never been more apparent, as the world begins to realize the economic and social benefits—and risks—of AI. CIFAR plays a leadership role in Canada through the design and funding of next-generation training programs that bring STEM access to under-represented groups, helping to ensure both the presence of diverse perspectives and knowledge in the design, implementation, and beneficial spread of these technologies. CIFAR

also facilitates and leads national and international research and policymaking discussions on important issues related to responsible AI—what could be our era's most transformative technology.

The 122 Canada CIFAR AI Chair professionals—internationally recognized leaders in the field—supervise more than 1,600 graduate students who themselves are positioned to go on to leadership roles in research and academia, further expanding the pool of talent that promises to drive Canadian-led advances in AI.

Canada ranks second in terms of the world's most elite AI researchers: a full 10% of researchers with the highest citation counts in AI and machine learning reside in Canada. Many retain academic posts while working in industry, ensuring a strong pipeline of talent and idea-exchange opportunities as research moves into actualization. In 2022-23, Canada posted the second-highest increase among G20 countries in its number of AI researchers.

Canadian channels for AI talent are long-standing and well-entrenched, as exemplified by CIFAR's Deep Learning + Reinforcement Learning Summer School. Launched nearly 20 years ago, this prestigious, internationally recognized training opportunity for early-career computer scientists has trained more than 2,500 carefully selected Canadian and international attendees.

Highlights: Ethical AI and diversity

To advance a more inclusive AI ecosystem in Canada, including tearing down the barriers to entry into STEM fields faced by Indigenous youth, CIFAR partners with Actua—a national STEM education-outreach organization—on directing a culturally inclusive AI education curriculum for Indigenous high school students.

CIFAR
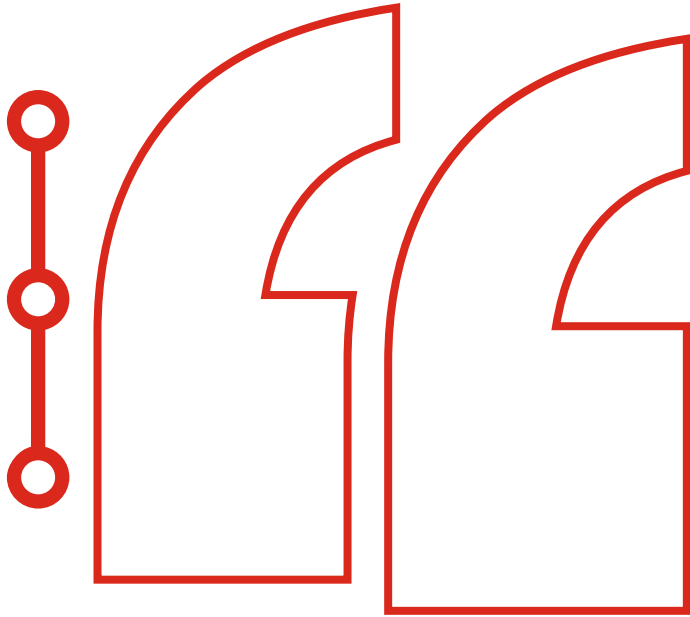
"Since the launch of the Pan-Canadian AI Strategy six years ago, Canada has experienced tremendous growth in our AI sector. This report confirms that Canada is viewed by the international AI research community as a rich source of new ideas and collaboration, ranking second in the world for AI research paper contributions per capita. It's no accident that Canada is well-placed to lead in the development and commercialization of advances such as generative AI. This is the result of Canada's long-standing leadership and investments in the advances and skills that make these new opportunities possible. It's equally important that Canada is also a world leader in our prioritization of smart, principles-based legislation governing the use of AI, ensuring that this powerful technology will deliver positive social and economic benefits for all."

Elissa Strome
Executive Director
Pan-Canadian AI Strategy
CIFAR

To address barriers to entry for Black and Indigenous students in CIFAR's partnered NextGen AI Training Program, CIFAR's Inclusive AI Scholarship covers the costs of participation of self-identified Black and Indigenous students.

Recognizing the thousands of years of scientific knowledge developed in Indigenous communities, CIFAR also partnered with Ridge Road, an Indigenous-led educational consulting firm, to develop training on Indigenous perspectives for AI researchers. This curriculum is currently being adapted into all NextGen AI training programs supported by CIFAR.

Highlights: Toward an AI-ready society

In 2021, the Public Awareness Working Group of Canada's Advisory Council on Artificial Intelligence surveyed thousands of Canadians about their perspectives on AI. The resulting report included recommendations to make a free online course on AI literacy available to all Canadians. Responding to the current and future need for AI literacy, CIFAR launched the e-learning program Destination AI, a free, self-paced course available in English and French that covers topics ranging from the science behind AI to the technology's societal implications and future applications.

AI institute spotlight

Amii 📍Edmonton, Alberta amii.ca/

(Alberta Machine Intelligence Institute)

Established in 2002, Amii (Alberta Machine Intelligence Institute) is the oldest AI institute in the country and the epicentre of AI excellence in Western Canada. Guided by its central purpose—AI for good and for all—Amii works to bridge world-leading research with commercial adoption of AI.

Amii funds the AI and machine learning (ML) research of more than 30 research fellows—including 36 Canada CIFAR AI chairs—and eight Canada CIFAR AI chairs at universities across Western Canada.

Amii also recently invested $30 million in the University of Alberta, the institute's primary research partner, to recruit 20 new AI researchers from around the globe in health, energy, space, quantum AI, and Indigenous leadership. These recruits are well-positioned to build on Alberta's strong legacy of AI research by advancing fundamental AI and addressing the world's most complex challenges, such as food insecurity, climate change, and health care.

Amii's AI research investments further focus on advancing AI science and creating knowledge for world-changing commercial success. In 2022-23, Amii worked with more than 100 companies; this included working with start-ups to accelerate AI product development, helping SMEs and large companies identify where AI could have the highest impact, training corporate teams, and placing talent on high-impact industry problems.

Highlights: Talent and job market

Since 2017, Amii has selected hundreds of early-career professionals from a crop of thousands globally, working with them as they complete their AI studies under an Amii research fellow or Canadian CIFAR AI Chair. Amii provides programming to all incoming grad-level technical talent through its AI Career Accelerator initiative; this includes the Work Integrated Learning Opportunities (WILO) program, which provides participants with a paid, part-time placement and hands-on experience working with Amii and its client companies.

Amii offers professional development opportunities to teach AI literacy skills. This past year, more than 800 participants joined Amii's popular ML Foundations courses, while the institute's massive open online course (MOOC) has had over 14,000 enrolments since its 2019 launch.

Highlights: Ethical AI and diversity

For AI to realize its potential, it must positively impact all people. This ethos is represented in Amii's mission: AI for good and for all. Amii is committed to the development, launch, and use of ethical AI, as well as to the nurturing of a diverse and healthy AI ecosystem.

Ensuring a universal, baseline understanding of AI will become increasingly important for businesses, especially regarding its responsible use. Amii encourages broad-based AI literacy through its training curriculum—including its mandatory Principled AI Framework course, which aims to help staff understand and adopt principled AI practices. Amii also teamed with the CIO Strategy Council (CIOSC) to launch an AI-governance course to empower start-ups and SMEs to develop strong, ethical governance foundations for AI-enabled products.

Amii provides access to trusted resources and a diverse AI ecosystem by hosting events and workshops and offering the Edmonton and larger Alberta tech communities state-of-the-art event space. The institute's signature events, TechAid and Upper Bound, focus on strengthening the local community through economic impact and philanthropy while raising funds for the United Way, Boyle Street Community Services, and other charities. Amii's Talent Bursary Program, which helps fund Upper Bound attendance, awarded more than $500,000 to 800 members of the AI community across 22 countries, 81% of whom self-identified as belonging to marginalized groups in STEM fields.

"We know that AI is not a passing trend; it is an ever-evolving force that will reshape industries and society, making it essential for individuals and businesses to invest in AI. Guided by our mission—AI for good and for all—Amii will continue to lead with ambition to increase broad-based AI literacy, advance fundamental AI research that tackles the most pressing and complex challenges facing the world today, and empower industry with responsible and ethical AI tools to stay ahead of and harness its transformative power. The barriers to getting started in applied AI have never been lower: Now is the time to act. It is no longer a choice of whether to be involved in AI or not—it's whether to lead or be led."

Cam Linke
CEO
Amii
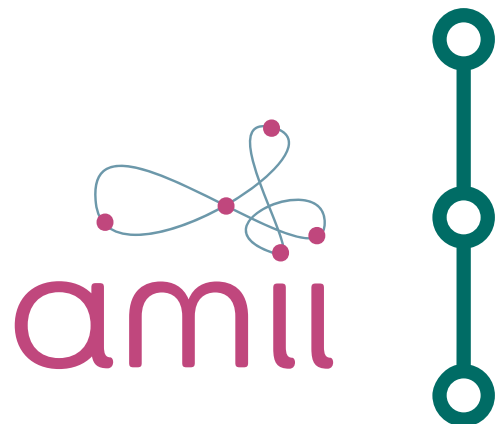
In 2022-23, Amii worked with pipikwan pêhtâkwan, an Indigenous-owned, Edmonton-based communications firm, to explore how AI could keep online spaces free of Indigenous-directed hate, such as that the firm experienced on social media and other online forums when working on Indigenous initiatives. The project (still in the data-training stage) employs AI/ML solutions to collect and silo any offensive online content so that the employee tasked with flagging, reviewing, and or/responding to any vitriol can first prepare and ensure they can proceed. Essentially, the objective is to create an additional level of safety and reduce harm and trauma to the human behind the employee.

Highlights: Toward an AI-ready society

Amii has empowered companies to use ML to expand their internal capabilities, as well as to accelerate AI adoption and minimize its risk.

Amii recently completed a two-year prototype with Attabotics, a Calgary-based company that designs and uses intelligent cube-storage systems in warehouses via autonomous robots. The goal was to maximize package throughput and increase robotic supply-chain operations' efficiency using reinforcement learning and robotics (Results surpassed initial projections.) Building on Attabotics' prior work, Amii used ML models to improve the company's robotic system—the robots could make intelligent decisions on which packages to retrieve, thereby improving efficiency and reducing backlog—a feat that would have been impossible without AI.

AI institute spotlight

Mila   📍 Montréal, Québec   mila.quebec/en | mila.quebec/
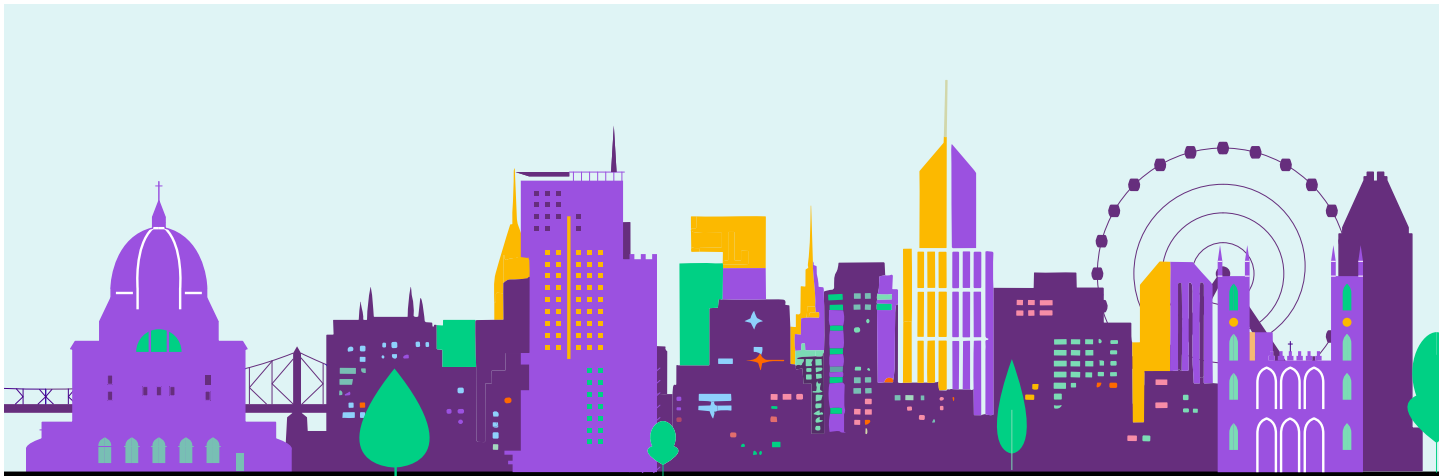
Mila – Québec AI Institute, is a leader in AI research in Canada and one of the world's leading academic research institutes specialized in deep learning. Headed by Professor [Yoshua Bengio](), co-recipient of the 2018 Turing Award for his groundbreaking work on deep learning, Mila is located in the heart of the Mile-Ex, an effervescent innovation-oriented Montréal neighborhood at the epicentre of Québec's AI ecosystem.

Thanks to a unique community of experts, Mila has enabled Québec to become a world leader in AI research. More than 3,000 scientific papers by Mila researchers have been published in major journals and at AI conferences in recent years, including hundreds at the prestigious NeurIPS, ICLR, and ICML conferences.

Projects at the intersection of AI and health, biotechnologies, and the environment are among the top priorities of Mila's research teams.

Highlights: Talent and job market

Mila – a non-profit stemming from the collaboration of several top Québec universities including Université de Montréal and McGill University – brings together a community of more than 1,200 leading AI researchers and hosts top AI university professors from across the province.

Mila collaborates on research with more than 100 industrial partners in Québec, the rest of Canada, and around the world. Close to one-quarter of these organizations operate in the health care or life-sciences sectors – pointing to the strategic importance of AI for these industries.

To help AI companies understand the technology's potential, Mila has worked with hundreds of SMEs across Canada since 2018, including as part of the National Research Council of Canada's IRAP interactive tour program and Mila's own AI Activation program. Mila also works with larger companies on [complex AI projects](), enabling them on their AI journeys.

In addition, Mila has its own [program]() aimed at developing the entrepreneurial fiber of its researchers to develop innovative ideas for AI applications. Since 2018, Mila has guided more than 30 start-ups in this way.

With 53 Canada CIFAR AI Chair positions, Mila is recognized worldwide for its scientific influence and its leadership in research and responsible AI.

Highlights: Ethical AI and diversity

Mila has been collaborating for several years with international organizations such as the UN, UNESCO, and the OECD, focusing on regulatory frameworks for AI and ethical issues that may arise from its development. In the past year, Mila has collaborated with UNESCO on a [book]() on AI governance, as well as with UN-Habitat on a [white paper on the responsible use of AI by cities]().

Mila also plays an important role on the global stage, consulting on the governance and the responsible and socially beneficial development of AI. The Institute has several initiatives overseen by a team focused on AI for Humanity – including programs and applied-research projects. One recent example is a [program to enable business leaders]() to design, launch, and use trustworthy AI systems.

"With a community of nearly 1,500 researchers, experts and partners, Mila is at the heart of the AI ecosystem in Québec and Canada. Québec's global impact on AI research and technology governance enables us to attract top talent from around the world and develop one of the largest AI communities in the world. Despite some challenges, Canada is positioned among the world's leading forces in AI, and Mila is a central player in its success, as this report shows."

Valérie Pisano
CEO
Mila

Highlights: Toward an AI-ready society

Québec is home to more than 750 organizations specializing in AI—and this network continues to grow, thanks in part to the provincial government's efforts to encourage AI adoption. One such initiative is an innovation council that oversees the provincial AI ecosystem and offers programs and tools of its own, such as Vitrine IA Québec – a virtual gateway to AI institutes and organizations in the province.

Since 2018, a significant number of international technology companies have set up AI research labs or businesses in Montréal, including several at Mila itself. Recognizing that AI is at the heart of many industries, Mila is working with other organizations nationwide to attract foreign companies to Canada, to be part of our economic boom and growing AI ecosystem.

AI institute spotlight
Vector Institute 📍 Toronto, Ontario vectorinstitute.ai/

The Vector Institute is an independent, not-for-profit corporation launched in 2017 with support of the Government of Canada, the Province of Ontario, industry sponsors from across the country, and AI trailblazers at the University of Toronto. Vector's vision is to drive excellence and leadership in Canada's knowledge, creation, and use of AI to foster economic growth and improve the lives of Canadians.

Sitting in the heart of the Toronto–Waterloo innovation corridor, the Vector Institute is a pillar of Ontario's AI ecosystem, leading the province's efforts to build and sustain AI-based innovation, growth, and productivity in Canada by focusing on the transformative potential of deep learning, machine learning, and artificial intelligence more broadly. Vector works with Canadian businesses and public institutions to help ensure they have the people, skills, and resources to be best-in-class in the use of AI. Vector supports the country's AI innovation clusters and helps start-ups grow to become Canada-based global leaders. It also attracts the best global talent: Vector's researchers and academic partners form part of a vibrant community of innovative problem solvers working across disciplines on both curiosity-driven and applied research.

Highlights: Talent and job market
Focused on nurturing and retaining Ontario's AI talent, the Vector Institute collaborates with universities and employers through Vector-recognized AI master's programs to address the demand for AI expertise. Since the inception of these programs in 2018, there have been more than 1,000 graduates, 92% of whom have stayed in Ontario. Currently, there are 26 Vector-recognized AI master's programs across 11 universities in the province.

Additionally, Vector works to retain AI talent in the province by offering its community members opportunities to connect with leading Ontario employers via the Vector Digital Talent Hub, which features AI-specific job postings, recruitment events, and career-guidance services.

Highlights: Ethical AI and diversity
The Vector Institute is dedicated to driving safe and trustworthy AI. It recently developed six AI trust and safety principles to guide other organizations implementing their own AI policies.

Any responsible approach to AI includes ensuring that equitable, diverse, and inclusive perspectives are represented, from research to launch and usage. Recognizing there is still work to be done in bringing a richer diversity of perspectives to Ontario's AI ecosystem, Vector is leading a variety of such endeavours to this end.

- **Black and Indigenous Research Internship program**. This program connects students and post-doctoral fellows studying in Canada with Vector Faculty Members to help advance research and expand career pathways in AI.

- **Introduction to Machine Learning for Black and Indigenous Post-Secondary Students**. This course enables students to develop market-ready skills in model-building, optimization techniques, and other advanced ML concepts.

- **Caregivers and Machine Learning programs**. Developed and delivered by Vector, with supporting funds from CIFAR, this program taps into the talent of caregivers on parental leave, introducing them to AI with a focus on either computer vision or natural language processing, and helping to prepare them to re-enter the workforce.

"The Vector Institute's influence in Ontario is exemplified through our collaborative efforts to establish pathways that cultivate the AI skills employers need to advance our economy. By joining the Vector community, AI practitioners gain an extra incentive to stay in Ontario, actively contributing to our vibrant AI ecosystem. Vector's unique position connects our community of researchers, industry sponsors, and health partners, which propels their growth and increases their impact."

Tony Gaffney
President and CEO
Vector Institute

Highlights: Toward an AI-ready society

Ontario is one of North America's fastest-growing AI hubs, according to CBRE's Scoring Tech Talent 2023 report. By fostering growth in established SMEs, Vector is fuelling Ontario's economic expansion and positioning the province as the ultimate destination for AI talent. For example, in the past year alone, 27 new AI companies were established in Ontario. That's in addition to Vector's 30 industry sponsers and 30-plus hospitals, 30-plus health and life-science organizations, and 20-plus universities Vector's health team has partnered with across Ontario.

Additionally, Vector's FastLane program, which helps small- and medium-sized businesses accelerate their AI commercialization journeys and compete more effectively in the global economy, includes 175 AI SMEs as at March 31, 2023.

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9. Survey participants were asked what percentage of open AI jobs at their organization could not be filled or were still vacant at the end of 2022 (0%, up to 10%, more than 10% to 30%, more than 30% to 50%, and more than 50%). Deloitte then calculated a weighted average of the responses to determine the estimated percentage of unfilled AI jobs. The number of open AI jobs was derived by collecting data from LinkedIn Talent Insights (https://business.linkedin.com/talent-solutions/talent-insights), using the search terms "artificial intelligence," "machine learning," and "deep learning" and restricting the search location to Canada. The result—2,322 AI-related job postings at the time of search on May 29, 2023—was used as our estimate.

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23. Market research for AI developer investments comprised PitchBook searches for deals made in Canada between April 1, 2022, and March 31, 2023. Industries, verticals, and keywords used: "artificial intelligence & machine learning (vertical)" OR "robotics & drones (vertical)" OR "advanced manufacturing (vertical)" OR "autonomous cars (vertical)." Search terms used for enablers and users were excluded.

24. Market research for AI user investments comprised PitchBook searches for deals made in Canada between April 1, 2022, and March 31, 2023. Industries, verticals, and keywords used: "adTtech," "B2B payments," "fintech," "e-commerce," "cryptocurrency/blockchain," "digital health," "health tech," "food tech," "insurtech," "legal tech," "marketing tech," "mobility tech," "real estate technology," "restaurant technology," "ride-sharing," "VR," "AR," "wearables & quantified self," "supply-chain tech," "TMT," "SaaS," "ag tech," "climate tech," "clean tech," "Internet of Things." Search terms used for enablers and developers were excluded.

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29. We used the NetBase Quid market-research application to identify AI companies founded globally between April 1, 2021 - March 31, 2022 and April 1, 2022 – March 31, 2023. Search terms used: "artificial intelligence" OR "machine learning" OR "data science" OR "natural language processing" OR "image recognition" OR "computer vision" OR "deep learning" OR "predictive analytics" OR "health information technology" OR "big data" OR "quantitative analytics" OR "quantitative computing" OR "AI" OR "ML" OR "DL" OR "NLP" OR "RL" OR "reinforcement learning" OR "bioinformatics" OR "virtual reality" OR "augmented reality" OR "intelligent systems" OR "human computer interaction" OR "robotics" OR "text recognition" OR "virtual world" OR "virtual assistant" OR "data mining" OR "generative AI."

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