



MAPPING CANADA'S SEMICONDUCTOR INDUSTRY:

**Insights on Talent, Workforce Development,
and Technological Strengths**

Research by



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PREFACE:

The Information and Communications Technology Council (ICTC) is a neutral, not-for-profit, national centre of expertise with the mission of strengthening Canada's digital advantage in the global economy. For more than 30 years, ICTC has delivered forward-looking research, practical policy advice, and capacity-building solutions for individuals and businesses. The organization's goal is to ensure that technology is utilized to drive economic growth and innovation and that Canada's workforce remains competitive on a global scale.

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ABSTRACT

The modern digital economy depends on semiconductors: small electronic devices, often called chips, which are used to process data, amplify and convert signals, manage power flows, and store information for computing hardware and other electronic devices. Semiconductors underpin nearly all modern digital computing processes, electronics, and information technologies.

Today, Canada hosts a relatively small but dynamic semiconductor industry, with Canadian companies working at the forefront of advanced semiconductor technologies, including advanced packaging, analog and mixed-signal semiconductors, compound semiconductors, microelectromechanical systems, and photonics. The Canadian semiconductor industry enjoys strengths in R&D and design, as well as in advanced packaging. Canada's technological capabilities offer significant potential in advanced computing fields such as artificial intelligence and quantum computing, which depend heavily on advanced semiconductor technologies and a stable, secure supply chain.

Canada's semiconductor firms take part in global supply chains and offer products and services across key parts of the worldwide industry. Although some manufacturing occurs in Canada, it is limited and makes up a smaller share of the industry compared to

research, design, and development activities.

Canada has a deep pool of semiconductor talent, but since semiconductors are a global industry, Canadian semiconductor firms must compete with peer countries to attract and retain top talent. A large part of Canada's semiconductor expertise comes from highly qualified personnel, often with advanced degrees in STEM fields; therefore, the industry must compete for talented graduates with other leading tech sectors like software development and artificial intelligence. Additionally, much of Canada's semiconductor workforce was developed by legacy companies, most notably Nortel, and is now approaching retirement. To meet future industry needs and leverage its technological strengths, Canada needs to expand its talent development pipeline to bring in new, highly trained workers for the semiconductor sector.

LIST OF ACRONYMS

ADC/DAC: Analog-to-Digital/
Digital-to-Analog converter

AI: Artificial Intelligence

AMD: Advanced Micro Devices

ASIC: Application-Specific
Integrated Circuit

ATP: Assembly, Testing, Packaging

C2MI: MiQro Innovation Collaborative
Centre

CMA: Census Metropolitan Area

CPFC: Canadian Photonics
Fabrication Centre

CSC: Canada's Semiconductor Council

CSET: Center for Security and
Emerging Technology

DRAM: Dynamic Random-Access
Memory

EDA: Electronic Design Automation

EUV: Extreme Ultraviolet

Fab: Semiconductor Fabrication
Facility

FDI: Foreign Direct Investment

FPGA: Field-Programmable Gate
Array

GaAs: Gallium Arsenide

GaN: Gallium Nitride

GPU: Graphics Processing Unit

ICTC: Information and
Communications
Technology Council

IC: Integrated Circuit

IoT: Internet of Things

IP: Intellectual Property

LED: Light Emitting Diode

LMIA: Labour Market Impact
Assessment

MEMS: Microelectromechanical
Systems

ML: Machine Learning

MNE: Multinational Enterprise

MoU: Memorandum of Understanding

OSAT: Outsourced Semiconductor
Assembly and Test

PCBA: Printed Circuit Board Assembly

PCB: Printed Circuit Board

R&D: Research and Development

SECTR: Semiconductor Ecosystem
and Centre for Talent and Research

STEM: Science, Technology,
Engineering, and Mathematics

SoC: System-on-Chip

TSMC: Taiwan Semiconductor
Manufacturing
Company Limited

VHDL: Very High-Speed Integrated
Circuit (VHSIC) Hardware Description
Language

WIL: Work-Integrated Learning

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FOREWORD

Through strategic partnerships, international collaborations, and industry-informed research and policy initiatives, the Information and Communications Technology Council (ICTC) has made significant strides in advancing Canada's semiconductor industry.

From September 2024 to June 2025, ICTC conducted the research for this study, analyzing Canada's semiconductor industry and labour market. The research involved interviewing 27 industry experts, mapping 248 semiconductor firms operating in Canada, and analyzing over 1,500 Canadian semiconductor industry job postings from January 2022 and March 2025. This study captures key insights into the current landscape of Canada's semiconductor industry, identifying technological areas where Canada holds a competitive edge, regional clusters of industry activity across the country, and the industry's challenges and current gaps. Additionally, the study explores jobs and skills driving the industry, identifies in-demand knowledge and capabilities, highlights workforce challenges, and recommends strategies for workforce development.

In addition to this study, ICTC has formed a partnership with the Center for Security and Emerging Technology (CSET) at Georgetown University to launch a first-of-its-kind research initiative comparing the semiconductor industries of Canada and the United States from a workforce perspective.¹ The initiative, which is still underway, will focus on national strengths, supply chain resiliency, labour market needs, opportunities for workforce development, and potential avenues for Canada-United States collaboration to bolster economic security and global competitiveness. This study is set to be released in late 2025.



Beginning in October 2024, ICTC partnered with Canada's Semiconductor Council (CSC) to conduct primary research on Canada's semiconductor industry.² This collaboration broadened the scope and reach of both initiatives, enabling joint interviews, the sharing of key findings, and the integration of wider industry insights that have informed the study you are reading today.



- ¹ Information and Communications Technology Council (ICTC), "ICTC Partners with Georgetown's CSET to Map Semiconductor Industries in Canada and the United States (Press Release)," November 2024, <https://ictc-ctic.ca/news-and-events/news-articles/ictc-partners-georgetown-cset-map-semiconductor-industries-canada>.
- ² See: Canada's Semiconductor Council, "Strengthening Canada's Semiconductor Talent Pipeline for Global Competitiveness: Talent & Workforce Development Working Group Report 2025," June 2025, <https://www.canadasemiconductorcouncil.com/chips-without-people-why-canadas-semiconductor-growth-depends-on-talent>.



In early 2025, ICTC signed a memorandum of understanding with CMC Microsystems to enhance the impact of ICTC's various talent development initiatives, including its WIL Digital Program, on Canada's semiconductor industry. Work-integrated learning (WIL) Digital helps eligible employers to hire postsecondary students for WIL placements, with subsidies covering up to 70% of wages (up to \$7,000).³ As part of this MOU, ICTC designated a portion of its WIL Digital placement subsidies for eligible students hired by CMC Microsystem's network of semiconductor firms, thereby fostering the development of a stronger talent pipeline for the semiconductor industry.



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In 2025, ICTC collaborated with a consortium of semiconductor and hardtech organizations—CSC, CMC Microsystems, Semiconductor Ecosystem and Centre for Talent and Research (SECTR), and ventureLAB—in multiple joint submissions to the Government of Canada's consultations the 2025 Budget.⁴ The submissions emphasized the urgent need for Canada to invest in targeted, industry-driven workforce training and development initiatives to address talent shortages within the semiconductor industry. They also called for strategic investments in domestic semiconductor commercialization, protection of intellectual property, and the expansion of research, development, design, and commercial fabrication facilities, as well as the development and implementation of a national semiconductor strategy for Canada.⁵



This report builds on ICTC's ongoing efforts to grow Canada's semiconductor industry and provides industry stakeholders with a clear summary of its current state. It highlights the country's competitive advantages, workforce challenges, in-demand jobs and skills, and existing workforce initiatives aimed at overcoming industry hurdles.

³ For more information, see: "eTalent Canada: Work Integrated Learning (WIL) Digital," Information and Communications Technology Council (ICTC), <https://etalentcanada.ca/for-businesses/programs/work-integrated-learning-wil-digital>.

⁴ See: "Written Submission for the Pre-Budget Consultations in Advance of the Upcoming 2025/26 Federal Budget," Information and Communications Technology Council (ICTC), Canada's Semiconductor Council (CSC), CMC Microsystems (CMC), Semiconductor Ecosystem Centre for Training and Research (SECTR), ventureLAB, April 8, 2025, <https://ictc-ctic.ca/reports/written-submission-for-the-pre-budget-consultations-in-advance-of-the-upcoming-2025-26-federal-budget>.

⁵ See: Canada's Semiconductor Council (CSC), CMC Microsystems, Information and Communications Technology Council (ICTC), and ventureLAB, "Submission for the Pre-Budget Consultations in Advance of the Fall 2025 Federal Budget," July 2025, <https://www.canadasemiconductorcouncil.com/initiatives#BudgetProposals>.

INTRODUCTION

CANADA'S SEMICONDUCTOR INDUSTRY IS CRITICAL TO THE NATION'S FUTURE PROSPERITY AND GROWTH.

Semiconductors form the basis of the modern digital economy. They are vital inputs for strategically important technologies, including telecommunications, high-speed data communications, photonics, computing, aerospace and defence, automotives, including electric vehicles and batteries, advanced manufacturing machinery, and consumer electronics. Semiconductors are also key inputs to the sensors and microchips that drive artificial intelligence (AI) applications from healthcare and drug discovery to precision agriculture, smart food systems, intelligent buildings, and clean technologies.

Beyond being critical inputs for technologies of national importance, semiconductors present a major opportunity for economic growth. Rising global demand for AI products, services, and advanced networking and computing infrastructure is fueling the need for semiconductor technologies, such as sensors, microchips, and advanced processing units. Many Canadian semiconductor firms already report robust and growing demand for their products and services. Innovative Canadian startups focused on semiconductors have also become a key asset in Canada's innovation ecosystem.

CANADA HAS AN OPPORTUNITY TO BECOME AN INDUSTRY LEADER IN KEY SEGMENTS OF THE SEMICONDUCTOR SUPPLY CHAIN.

Canada boasts significant expertise in semiconductor research and development (R&D), design, and targeted manufacturing. While other regions have strengths in high-volume, low-margin segments, Canadian firms excel in smaller-volume, high-margin segments—such as photonics, optical communications, compound semiconductors, and advanced packaging—critical for technologies like AI and quantum computing. Today's expertise comes from the early success of firms like Nortel, which

inspired a generation of entrepreneurs in Toronto, Waterloo, Ottawa, Montreal, Bromont, Calgary, Edmonton, and Vancouver and has attracted a wealth of multinational firms to Canada.

STILL, CANADA'S SEMICONDUCTOR INDUSTRY FACES CHALLENGES.

Participants in this study highlighted critical challenges that threaten the growth of Canada's semiconductor industry. These include an insufficient supply of talent to meet growth trajectories and a shortage of local fabrication, packaging, and test infrastructure. These factors inhibit workforce development and subject Canadian firms to long R&D cycles due to the time it takes to ship physical products around the world.

Growing firms report plans to open their next design centres abroad or hire talent remotely from regions like Texas, California, the Netherlands, and France due to insufficient local talent supply. Industry leaders have identified the competition for highly qualified personnel as the number one barrier to retaining semiconductor firms in Canada.

Industry experts consulted for this study also cite a dearth of government support in comparison to other technology ecosystems, with strategic semiconductor investment and policy development being slow to emerge in Canada.

Key informants in this study emphasized that, while Canada has been slow to invest in its semiconductor industry, other countries around the world are accelerating their efforts, acquiring strategic technologies and intellectual property (IP) at a rapid pace. This includes not just legacy leaders like Japan, Taiwan, the United States, and Europe, but also new entrants into the industry. "That's who we're up against [...] and there is not a good appreciation of how quickly we can fall behind," as one industry leader stated during an interview.

Others interviewed highlighted how Canada is the only G7 nation without a semiconductor strategy, signaling that the government does not consider semiconductors as critical as downstream technology areas like AI and quantum, despite the interlinkages between these technologies.



STRENGTHENING CANADA'S ONSHORE SEMICONDUCTOR INDUSTRY AND ADDRESSING KEY CHALLENGES IS AN ISSUE OF NATIONAL IMPORTANCE.

To remain competitive in strategic digital industries like AI and quantum computing, Canada must address industry challenges and strengthen its onshore semiconductor industry, including its research, development, design, and targeted semiconductor fabrication capacity.

Canada must also secure access to semiconductor supply chains. A lack of access to semiconductors and other essential inputs would jeopardize Canada's participation in transformational fields like quantum and AI. This is especially true in a geopolitical context of declining multilateral cooperation, international trade uncertainty, and disrupted supply chains.

Over time, failure to access and participate in global semiconductor supply chains would degrade Canada's status as an advanced economy and weaken its influence over technological developments. Global trade disruptions and geopolitical tensions threaten to destabilize the physical and IP-based supply chains that support the semiconductor industry. While complete self-sufficiency is unnecessary, investing in onshore research, development, collaboration, and fabrication with global partners is crucial for maintaining Canada's economic and technological security.

THE WINDOW OF OPPORTUNITY TO SECURE CANADA'S SEMICONDUCTOR INDUSTRY IS CLOSING.

Interviewees in this study report that there is a tight window of opportunity to invest in Canada's semiconductor industry. Large portions of Canada's current semiconductor workforce are set to retire in the coming decade, meaning there is a closing window of time to pass down expertise in key semiconductor technologies, such as photonics and optical communications, microelectromechanical systems (MEMS), compound semiconductors, and advanced packaging, to the next generation.

At the same time, growing global demand for AI products, services, and advanced networking and computing infrastructure is intensifying demand for semiconductor products and services. Semiconductor firms face mounting pressure to meet global demand quickly. Firms may choose to invest elsewhere if Canada's talent supply and business supports are unable to meet contemporary industry needs.

TO POSITION CANADA TO CAPITALIZE ON THESE TRENDS, THIS REPORT OFFERS TIMELY INSIGHT REGARDING THE STATE OF THE SEMICONDUCTOR INDUSTRY IN CANADA.



Section I provides an overview of Canada's strengths, including verticals and strategic technology areas where Canada has a competitive advantage. It also details the challenges facing Canadian semiconductor firms.



Section II provides an overview of the occupations and skills that are in-demand in Canada's semiconductor industry, as well as the talent needed for the industry to succeed in a competitive global marketplace. It also highlights gaps in Canada's semiconductor workforce and identifies the roles most susceptible to labour shortages.

INTRODUCTION TO THE SEMICONDUCTOR INDUSTRY

WHAT IS A SEMICONDUCTOR?

Semiconductors are materials, such as silicon, that lie between electrical conductors (like copper) and insulators (like glass or rubber), which allow them to control the flow of electrical current under different conditions.⁶ These properties are harnessed in electronic devices and computing hardware for a variety of tasks, such as microprocessors in computers. Indeed, the modern digital economy is made possible by semiconductor technology.

From the perspective of the digital economy, the word “semiconductors” refers to chips made of millions, or even billions, of small transistors placed onto a die that control the flow of electricity through a semiconducting material. In general, the more transistors that can be fit onto a semiconductor die, the greater the chip’s computational capability or processing power. Moore’s law, posited by

semiconductor pioneer Gordon Moore in 1965, asserts that the density of transistors that can fit on a chip doubles every two years, leading to exponential growth in chip capability.

This observation has held true for decades, driving the semiconductor industry and enabling remarkable advancements in electronics and computing technology.⁷ Recently, some experts have questioned if Moore’s law will continue to hold into the future, as cutting-edge chip design meets significant, and potentially insurmountable, physical and technological hurdles, and whether other paradigms of semiconductor design—beyond transistor miniaturization—will be needed to design chips for the next generation of electronics and advanced computing hardware.⁸

HOW SEMICONDUCTORS ARE MADE

The semiconductor value chain can be broken down into three main steps: (1) design, (2) fabrication, and (3) assembly, testing, packaging (ATP). In the design step, engineers and scientists will design new chips using powerful semiconductor electronic design automation (EDA) software tools. Semiconductor designers may also incorporate pre-designed IP cores for certain chip functions that can be licensed from specialized semiconductor IP companies. The design will be rigorously tested for functionality and potential errors. Semiconductor designers may also work closely with semiconductor fabricators (fabs) to ensure the resulting designs can be manufactured in an economical manner.

In the fabrication step, the finished designs will be manufactured into microchips from raw materials, such as silicon wafers, using a series of highly complex and precise processes. These include photolithography, material deposition (such as chemical vapor deposition and atomic layer deposition), etching (wet and dry), ion implantation (for doping), and chemical-mechanical planarization.

The exact manufacturing process undertaken by fabs is dependent on the type of semiconductor device being produced, the materials from which it is made, and the target performance characteristics. Semiconductor fabrication is widely regarded as one of the most complex manufacturing processes in

⁶ See: Trevor Thornton, “What is a semiconductor? An electrical engineer explains how these critical electronic components work and how they are made,” *The Conversation*, August 10, 2022, <https://theconversation.com/what-is-a-semiconductor-an-electrical-engineer-explains-how-these-critical-electronic-components-work-and-how-they-are-made-188337>; Taylor Kubota, “Engineering professor explains semiconductors,” *Stanford Report*, Stanford University, September 20, 2023, <https://news.stanford.edu/stories/2023/09/stanford-explainer-semiconductors>; Lenovo, “What is a semiconductor?,” accessed March 20, 2025, <https://www.lenovo.com/ca/en/glossary/what-is-semiconductor/>.

⁷ Synopsys, “How Does Moore’s Law Work?,” accessed March 20, 2025, <https://www.synopsys.com/glossary/what-is-moores-law.html>

⁸ Deborah Fischler, “Is Moore’s Law Really Dead?,” *Penn Engineering Magazine*, School of Engineering and Applied Science, University of Pennsylvania, 2024–2205, <https://magazine.seas.upenn.edu/2024-2025/>.



human history.⁹ Fabrication takes place in massive cleanrooms where dust, temperature, humidity, and vibration are rigorously controlled to nanometer-level tolerances. The equipment used, such as extreme ultraviolet (EUV) photolithography systems or deposition tools, is highly specialized, and a single machine can cost hundreds of millions of dollars in some cases.¹⁰ As a result, building and operating a leading-edge semiconductor fab is astronomically capital-intensive, often requiring investments of \$10 billion or more for a single facility.¹¹

Once they have been fabricated, semiconductor wafers are split into individual chips, tested, and then packaged for inclusion into electronic devices, computing hardware, and digital infrastructure,

such as data centre servers. Advanced packaging has become more prevalent, as chip functionality has increased and chiplets and other multi-die chip designs have become more common in the industry. A 2024 study by the Boston Consulting Group projects that the market for advanced packaging will double by 2030 due to the technology's increasing importance in advanced semiconductor designs.¹²

The newly packaged chips will be then shipped to customers, such as computer hardware and electronics manufacturers, for incorporation into new devices. Figure 1 outlines, at a high level, the semiconductor value chain and key material, software, and equipment inputs.

Figure 1. High-Level Semiconductor Value Chain

Step	Equipment, Software, and Material Inputs
1 Design	› EDA software tools › Hardware description languages (e.g., Verilog, VHDL) › Architectures (e.g., ARM, RISC-V, x86) › IP core
2 Fabrication	› Manufacturing equipment (e.g., photolithography machines) › Chemicals (e.g., dopants, photoresist mask, ultrapure water) › Wafer materials (e.g., silicon, gallium nitride)
3 Assembly, Testing, Packaging (ATP)	› Testing tools for finished wafers and devices › Wafer dicing (diamond saws/scribes, lasers, etc.) › Packaging materials (metals, thermoplastics and resins, ceramics, etc.) › Advanced packaging may include specialized interconnects and components (e.g., wire bonds, solders, lasers, photodiodes)
Ship to downstream customers for inclusion in electronic devices and computing hardware.	

Source: Adapted from Centre for Strategic & International Studies, 2023; Center for Security and Emerging Technology, 2021.¹³

9 Bradley Ramsey, "The Complicated (And Expensive) Process of Manufacturing Semiconductors," Supplyframe, accessed May 16, 2025, <https://intelligence.supplyframe.com/complex-expensive-manufacturing-semiconductors/>.

10 Anton Shilov, "ASML's High-NA chipmaking tool will cost \$380 million – the company already has orders for '10 to 20' machines and is ramping up production," Tom's Hardware, February 13, 2024, <https://www.tomshardware.com/tech-industry/manufacturing/asmls-high-na-chipmaking-tool-will-cost-dollar380-million-the-company-already-has-orders-for-10-to-20-machines-and-is-ramping-up-production>.

11 Brian Potter, "How to Build a \$20 Billion Semiconductor Fab," Construction Physics, May 3, 2024, <https://www.construction-physics.com/p/how-to-build-a-20-billion-semiconductor>.

12 Joseph Fitzgerald, et al., "Advanced Packaging Is Radically Reshaping the Chip Ecosystem," Boston Consulting Group, May 20, 2024, <https://www.bcg.com/publications/2024/advanced-packaging-is-reshaping-the-chip-industry>.

13 Akhil Thadani and Gregory C. Allen, "Mapping the Semiconductor Supply Chain: The Critical Role of the Indo-Pacific Region," Center for Strategic & International Studies, May 2023, <https://www.csis.org/analysis/mapping-semiconductor-supply-chain-critical-role-indo-pacific-region>, Figure 2; Saif M. Khan, Dahlia Peterson, and Alexander Mann, "The Semiconductor Supply Chain: Assessing National Competitiveness," Center for Security and Emerging Technology, January 2021, <https://cset.georgetown.edu/publication/the-semiconductor-supply-chain/>, Figure 1.



PART I:

THE CANADIAN SEMICONDUCTOR INDUSTRY

Canada is home to numerous startups, small- and medium-sized enterprises (SMEs), large multinational firms, and a supportive ecosystem of technology incubators, industry groups, and academic research networks that drive progress and innovation in Canada's semiconductor industry. Interviews with industry experts highlighted the globalized nature of the semiconductor industry, with Canadian semiconductor firms regularly conducting business with counterparts worldwide, including in Taiwan, the United States, and Europe.

FIRMS IN CANADA AND THE SEMICONDUCTOR VALUE CHAIN

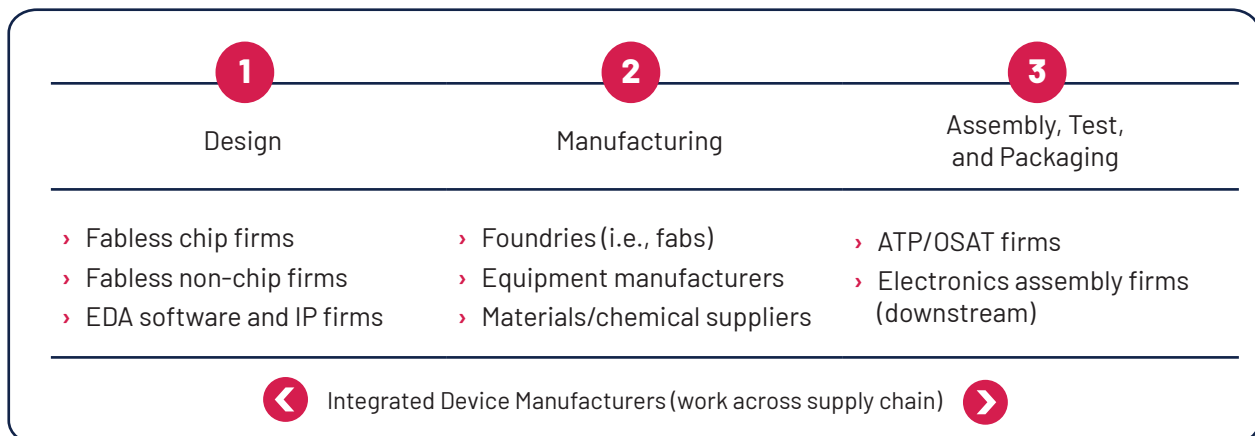
Types of firms that participate in the global semiconductor supply chain include fabless chip firms, which focus on R&D and the design of new chips, EDA software and IP core firms, and fabless non-chip firms, which design customized semiconductors for use in their own products and services.

Semiconductor foundries (i.e., fabs) form the core of semiconductor manufacturing. The largest semiconductor fabs—such as Taiwan Semiconductor Manufacturing Company Limited (TSMC)—produce chips for customers across the globe at an immense scale and world-leading level of technological sophistication. Semiconductor manufacturing equipment suppliers, such as ASML and Carl Zeiss SMT, and materials suppliers, such as DuPont, make

up the global semiconductor production supply chain. ATP and outsourced semiconductor assembly and test (OSAT) firms provide packaging, assembly, and testing services.

Larger firms may encompass multiple activities across the value chain. For example, large multinational enterprises (MNEs) such as Texas Instruments—often described as integrated device manufacturers—span multiple steps across the entire semiconductor value chain, often carrying out their vertically integrated operations globally. The entirety of the semiconductor supply chain is complex and global in scope, with knowledge, materials, skilled labour, and finished products moving frequently across borders. Figure 2 outlines the different types of firms that participate in the global semiconductor value chain.

Figure 2. Overview of Semiconductor Firm Type Across the Value Chain



Source: Adapted from *Generative Value*, 2023.¹⁴

¹⁴ Eric Flaningam, "An Overview of the Semiconductor Industry," *Generative Value*, November 16, 2023, <https://www.generativevalue.com/p/an-overview-of-the-semiconductor>.



Interviews with Canadian industry experts suggest that a significant part of semiconductor activity in Canada takes place within the R&D and design segment of the semiconductor industry, primarily through fabless chip firms. Prominent examples of Canadian fabless chip firms include companies such as Alphawave Semi, Peraso, and Untether AI.¹⁵ Canadian firms also produce EDA software and other software tools used in the design of semiconductors. For example, Siemens EDA operates a major R&D facility in Saskatoon, focused on advanced EDA solutions, following its acquisition of Solido Design Automation—a Canadian startup originally based adjacent to the University of Saskatchewan.¹⁶

A small amount of specialized semiconductor fabrication does take place in Canada, mainly in niche technologies such as compound semiconductors, microelectromechanical systems (MEMS), and photonic chips and optical microelectronics. Notable facilities supporting this activity include Teledyne DALSA, which operates a MEMS and image sensor foundry in Ontario; the Canadian Photonics Fabrication Centre (CPFC) at the National

Research Council, which focuses on compound semiconductors; and nanoFAB, a nanofabrication facility at the University of Alberta.¹⁷ Canada is also home to a small number of semiconductor ATP/OSAT operations, most notably IBM's advanced packaging facility in Bromont, Québec, one of the largest of its kind in North America.¹⁸

In addition to the core semiconductor firms discussed above, there are numerous supporting firms, such as suppliers of material inputs and specialized manufacturing equipment, as well as firms offering specialized commercial and professional services to the Canadian semiconductor industry. Furthermore, non-profit organizations, including industry associations and technology incubators, play an important role in supporting and developing Canada's semiconductor technology ecosystem. Notable non-profit organizations playing key roles in supporting Canada's semiconductor industry include CSC, CMC Microsystems, SECTR, and ventureLAB.¹⁹ Figure 3 outlines different types of firms that play key supporting roles in Canada's semiconductor industry.

Figure 3. Overview of Supporting, Non-Core Firms Across Canada's Semiconductor Industry

Firm Type	Equipment and Materials Input Suppliers	Commercial and Specialized Professional Services	Other Supporting Ecosystem Actors
Examples	› Fabrication equipment and chip manufacturing automation › Fabrication equipment repair services › Material input suppliers › Specialized semiconductor/microelectronic component suppliers	› Specialized semiconductor and microelectronic distributors › Manufacturer's representatives › Market research and reverse engineering services › Professional services firms with specific semiconductor industry practices (legal/patent, HR)	› Industry associations › Semiconductor technology incubators and innovation hubs › Industry training providers

Data source: ICTC's dataset of semiconductor firms in Canada, 2025.

¹⁵ Alphawave Semi, "About Us: Company," accessed July 31, 2025, <https://awavesemi.com/company/>; Peraso, "About Peraso," accessed July 31, 2025, <https://perasoinc.com/about-peraso/>; Untether AI, "Company: About," accessed July 31, 2025, <https://www.untether.ai/about/>.

¹⁶ "Saskatoon tech company Siemens EDA expects continued growth," Saskatoon StarPhoenix, February 13, 2025, <https://thestarphenix.com/news/local-news/saskatoon-tech-company-siemens-eda-expects-continued-growth>.

¹⁷ "Teledyne DALSA," accessed May 1, 2025, <https://www.teledynedalsa.com/en/home/>; "Canadian Photonics Fabrication Centre," National Research Council of Canada (Government of Canada), last update March 13, 2025, <https://nrc.canada.ca/en/research-development/nrc-facilities/canadian-photonics-fabrication-centre>; "nanoFAB," University of Alberta, accessed May 1, 2025, <https://www.nanofab.ualberta.ca/>.

¹⁸ IBM, "IBM Semiconductors chiplets and advanced packaging," accessed March 19, 2025, <https://www.ibm.com/services/semiconductor-assembly-test>.

¹⁹ Canada's Semiconductor Council (CSC), "Our Purpose," accessed May 1, 2025, <https://www.canadasemiconductorcouncil.com/about>; CMC Microsystems, "About Us," <https://www.cmc.ca/about-us/>, accessed May 1, 2025; Semiconductor Ecosystem & Centre for Talent & Research (SECTR), "SECTR," accessed May 1, 2025, <https://sectr.ca/>; ventureLAB, "About Us," accessed May 1, 2025, <https://www.venturelab.ca/about>.

What is a Semiconductor Fab?

Put simply, semiconductor fabrication facilities are large-scale industrial plants where semiconductors, like microprocessors and memory chips, are produced. Technology company Lenovo describes a fab as being akin to a “high-tech workshop where raw materials are transformed into the tiny chips that power our modern electronic devices.”²⁰ Semiconductor fabs are precision manufacturing environments where factors such as temperature, humidity, dust, and even outside vibrations are strictly controlled to prevent damaging sensitive chips as they undergo the fabrication process. This requires fabs to be composed of massive cleanrooms where semiconductor fabrication occurs.

Producing semiconductors at scale necessitates enormous fabs, which are immensely capital-intensive to build, equip, and maintain. Intel notes that, for a series of fabs it is currently building in the United States, Israel, and Ireland, each fab facility takes three to five years to build and costs upwards of USD \$10 billion to construct.²¹ Furthermore, each of these fabs is equipped with USD \$1.2 billion in machinery, tooling, and other equipment.²²

Cutting-edge extreme ultraviolet (EUV) light photolithography machines, such as ASML’s EUV scanners, which are used to produce the most advanced chips, can cost hundreds of millions of dollars each and can become obsolete in as little as a few years.²³ Even for the largest multinational semiconductor fabrication firms, investing in a new fab is a business-defining undertaking.

While older fabs can produce older commodity semiconductors economically for decades, to produce at the leading edge of chip technology—currently 3nm (nanometre) and 5nm technology nodes, with 2nm chips expected to go into regular production in 2025²⁴—the most advanced semiconductor fabs must reliably produce high-end chips at a significant volume over a short period of time to cover the massive initial investment and remain economical.

The largest and most advanced fabs, such as those found in Taiwan, can each employ several thousand people directly, while also acting as an economic anchor for supporting supplier firms, as well as higher education and research institutes, which co-locate around large fabs.

²⁰ Lenovo, “Glossary: What is a fab?,” accessed March 22, 2024, <https://www.lenovo.com/ca/en/glossary/what-is-a-fab/>.

²¹ See: Intel, “Global Manufacturing at Intel (Press Release),” last update August 8, 2024, <https://newsroom.intel.com/press-kit/global-manufacturing>.

²² “How a Semiconductor Factory Works,” Intel, accessed April 22, 2025, <https://www.intel.com/content/www/us/en/newsroom/tech101/manufacturing-101-how-semiconductor-factory-works.html>.

²³ “ASML’s High-NA chipmaking tool will cost \$380 million—the company already has orders for ‘10 to 20’ machines and is ramping up production,” Tom’s Hardware, February 13, 2024, <https://www.tomshardware.com/tech-industry/manufacturing/asmls-high-na-chipmaking-tool-will-cost-dollar380-million-the-company-already-has-orders-for-10-to-20-machines-and-is-ramping-up-production>.

²⁴ “TSMC to start 2nm orders in April, with iPhone 18 set to feature 2nm A20 chip,” TechNode, March 25, 2025, <https://technode.com/2025/03/25/tsmc-to-start-2nm-orders-in-april-with-iphone-18-set-to-feature-2nm-a20-chip/>.



A Semiconductor Fab for Canada?

While Canada has semiconductor fabrication capabilities in the form of small-scale manufacturing of MEMS and photonic semiconductor devices, it lacks large-scale fabs comparable to those found in countries such as Taiwan and the United States. Noting this gap in semiconductor manufacturing capability, there has been significant discussion amongst the Canadian semiconductor industry and policy community on the question of whether Canada, through a major act of industrial policy, should build its own large-scale fab.²⁵

In a 2021 industry roadmap report, CSC notes that Canada has many of the key attributes needed to be an attractive jurisdiction to locate a large-scale fab, including a skilled workforce and education and training system, access to large amounts of fresh water, reliable infrastructure, and a dynamic and innovative technology sector. CSC also observes that attracting fabs requires “targeted and robust government incentives and policies.”²⁶

A domestic fab could help Canada enhance the security of its semiconductor supply chain and shelter Canadian industry from chip shortages brought on by supply chain and geopolitical shocks. A Canadian fab could also create thousands of high-paying jobs, both direct and indirect, while acting as a hub for suppliers and other supporting firms to co-locate around. A large fab could develop the country’s scientific, technological, and industrial base, helping Canada keep pace with advances in chip technology being made in other advanced economies in the Asia-Pacific region, Europe, and across the border in the United States.

Establishing a leading semiconductor fab in Canada could enhance Canada’s digital sovereignty, considering the important role that semiconductors play as inputs into all digital technologies.

Yet, building a leading-edge semiconductor fab would represent an astronomical investment, in the tens of billions of dollars, and would necessitate a robust industrial policy to attract a large semiconductor company to locate a leading-edge fab in the country. The economic risks that such a policy would entail would be significant. As a point of

comparison, total public investment in the buildout of Canada’s electric vehicle supply chain, including several battery manufacturing plants, amounts to an estimated \$52.5 billion, according to the Office of the Parliamentary Budget.²⁷

A number of industry experts consulted for this study note that Canada, which has a relatively small computer hardware and consumer electronics sector, may not have the level of domestic demand for the amount of chips a large-scale fab would need to produce to remain economically viable. Thus, most chips produced at such a fab would need to be exported internationally and compete with similar, leading-edge chips being produced in countries like Taiwan.

Interviewees observed that, if Canada were to instead invest in a fab to produce silicon chips at a lower technology node, it might still have difficulty making such an arrangement economical. A lower-end semiconductor fab with the capacity to build older-generation commodity chips would be less capital-intensive up front. However, it would also struggle to compete with legacy fabs located abroad, which have long since recouped their capital costs and can therefore produce commodity chips more economically.

Rather than focus on building a state-of-the-art silicon fab to produce cutting-edge chips at the highest technology nodes, some interviewees suggested that Canada could instead lean into its existing strengths in compound and photonic semiconductors. Compound semiconductors use multiple chemical elements (unlike semiconductors

²⁵ For example, see: “Embarrassingly behind: Is Canada doing enough on semiconductors?,” Global News, June 26, 2023, <https://globalnews.ca/news/9787308/canada-semiconductors-taiwan-china/>; “Canadian Chip Manufacturing Needs Industrial Policy,” EE Times, November 12, 2024, <https://www.eetimes.com/canadian-chip-manufacturing-needs-industrial-policy/>.

²⁶ Canada’s Semiconductor Council (CSC), “Roadmap to 2050: Canada’s Semiconductor Action Plan,” November 2021, <https://irp.cdn-website.com/e5abb5aa/files/uploaded/Canadas-Semiconductor-Action-Plan.pdf>, 17–18.

²⁷ Office of the Parliamentary Budget Officer, “Tallying Government Support for EV Investment in Canada,” June 18, 2024, <https://www.pbo-dpb.ca/en/additional-analyses—analyses-complémentaires/BLOG-2425-004—tallying-government-support-ev-investment-in-canada—bilan-aide-gouvernementale-investissement-dans-ve-canada>.

made only of silicon), giving them different properties than single-element semiconductors. Photonic semiconductors are typically compound and are specifically designed for applications in optical devices. Several interviewees suggested that Canada could build a capable—but much less expensive—fab based around these technologies.

Compound and photonic semiconductors have important applications in industries such as telecommunications and data centres, automotives, power electronics, defence and aerospace, and advanced computing. The Yole Group forecasts that the global compound semiconductor market could be worth US\$25 billion by 2030.²⁸ McKinsey & Company estimates that globally, the market for photonic technologies is currently valued at around US\$2 trillion.²⁹ Jurisdictions with comparable technological strengths to Canada in compound and photonic semiconductors include the United States, Japan, China, and the European Union.

Photonic and compound semiconductor technology do not demand the same level of miniaturization as leading silicon chips. Compound semiconductor technology prioritizes performance characteristics such as high electron mobility, thermal conductivity, and energy efficiency, rather than transistor density and miniaturization.

Experts consulted for this study noted that a shortage of local fabrication infrastructure hinders workforce development because students lack access to real-world hardware. Furthermore, it subjects Canadian firms to lengthy learning cycles, with firms' R&D cycles slowed due to the need to wait for products to ship back and forth from Asia or Europe. Moreover, smaller firms that are transitioning from R&D to prototyping but are not yet in mass production are often unable to work with high-volume fabs in jurisdictions like Taiwan.

Meanwhile, Canada's semiconductor industry loses highly trained talent. Professionals often relocate overseas to be closer to innovative semiconductor manufacturing ecosystems that can absorb them into the labour market and provide promising career paths. A domestic fab could act as a magnet for highly qualified Canadian semiconductor design and manufacturing talent.

Increasing domestic capacity to produce compound or photonic chip devices would enable Canada to maintain its technological lead and capacity in these alternative yet still critical semiconductor technologies. It would avoid setting up a risky and astronomically expensive silicon chip fab and competing with established foreign competitors.

²⁸ Yole Group, "Compound semiconductors: strategic moves & collaborations in a nutshell," February 26, 2025, <https://www.yolegroup.com/press-release/compound-semiconductors-strategic-moves-collaborations-in-a-nutshell/>.

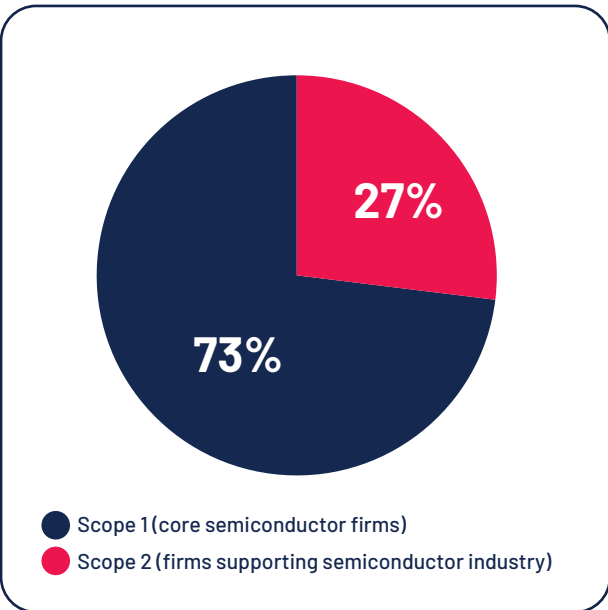
²⁹ Ryan Fletcher, et al., "Imperatives for photonics companies in the next wave of growth," McKinsey & Company, January 20, 2023, <https://www.mckinsey.com/industries/semiconductors/our-insights/imperatives-for-photonics-companies-in-the-next-wave-of-growth>.

Mapping Canada’s Semiconductor Value Chain by Firm Activities

ICTC developed an industry map of 248 firms in the Canadian semiconductor industry, including firms that have a significant presence in the industry as suppliers of equipment and materials, supporting firms offering specialized commercial and professional services, and other ecosystem organizations such as industry associations and technology incubators. Most of the firms mapped by ICTC for this study were involved in more than one segment of the Canadian semiconductor value chain.

Figure 4 outlines the portion of firms mapped participating in core semiconductor activities (scope 1), including R&D and design, EDA software production and IP cores, manufacturing, and ATP/OSAT. It also shows supporting firms (scope 2), involved in activities such as material and equipment inputs, commercial and professional services, and other supporting ecosystem activities. Of the 248 firms ICTC included in its industry map, 182 (73%) were scope 1 firms involved in core semiconductor activities, while 66 firms (27%) were involved in scope 2 supporting activities. In some cases, scope 1 semiconductor firms also participated in scope 2 activities—for example, as suppliers of materials or equipment. In these cases, they remained classified as scope 1 firms.

Figure 4. Core Semiconductor Firms (Scope 1) and Supporting Firms (Scope 2) in Canada

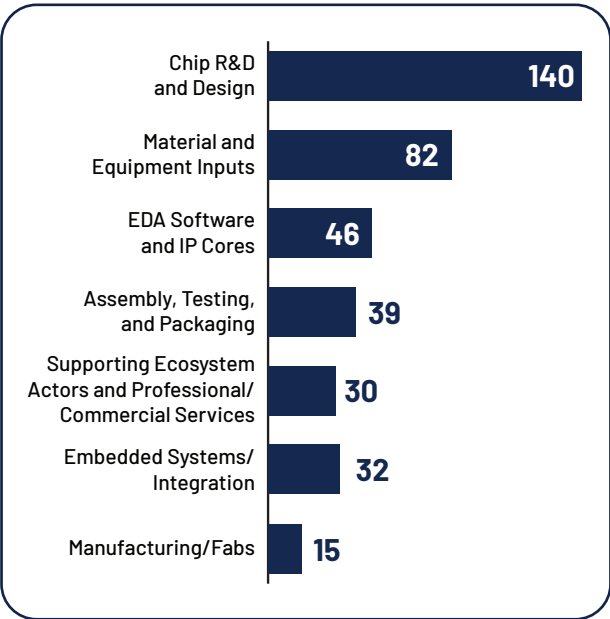


Data source: ICTC’s dataset of semiconductor firms in Canada, 2025. (n = 248 firms.)

Of the 248 mapped firms participating in Canada’s semiconductor value chain, 140 firms (56%) were involved in semiconductor R&D and design activities, while a further 46 firms (19%) were involved in developing EDA tools and other relevant semiconductor design software, as well as vendors designing licensable IP cores. Only 15 firms (6%) were directly involved in semiconductor manufacturing in Canada, though numerous large multinational firms with a presence in Canada do operate semiconductor fabs abroad. Thirty-nine firms (16%) were involved in ATP/OSAT activities, mainly consisting of OSAT firms. A further 32 firms (13%) also had expertise in systems integration and embedded software development capabilities directly relevant to semiconductors.

Eighty-two firms (33%) participated in the semiconductor value chain as suppliers of material and manufacturing equipment inputs, and an additional 30 (12%) firms were made up of specialized distributors, market researchers, and non-profit organizations—including industry associations and technology incubators. Figure 5 provides a breakdown of semiconductor firms located in Canada across the different segments of the semiconductor value chain.

Figure 5. Semiconductor Firms in Canada’s Semiconductor Industry by Value Chain Segment



Data Source: ICTC’s dataset of semiconductor firms in Canada, 2025. Note: firms listed may participate in business activities across multiple segments of the semiconductor value chain, thus individual firms may be counted more than once in this graph. (n = 248 firms.)

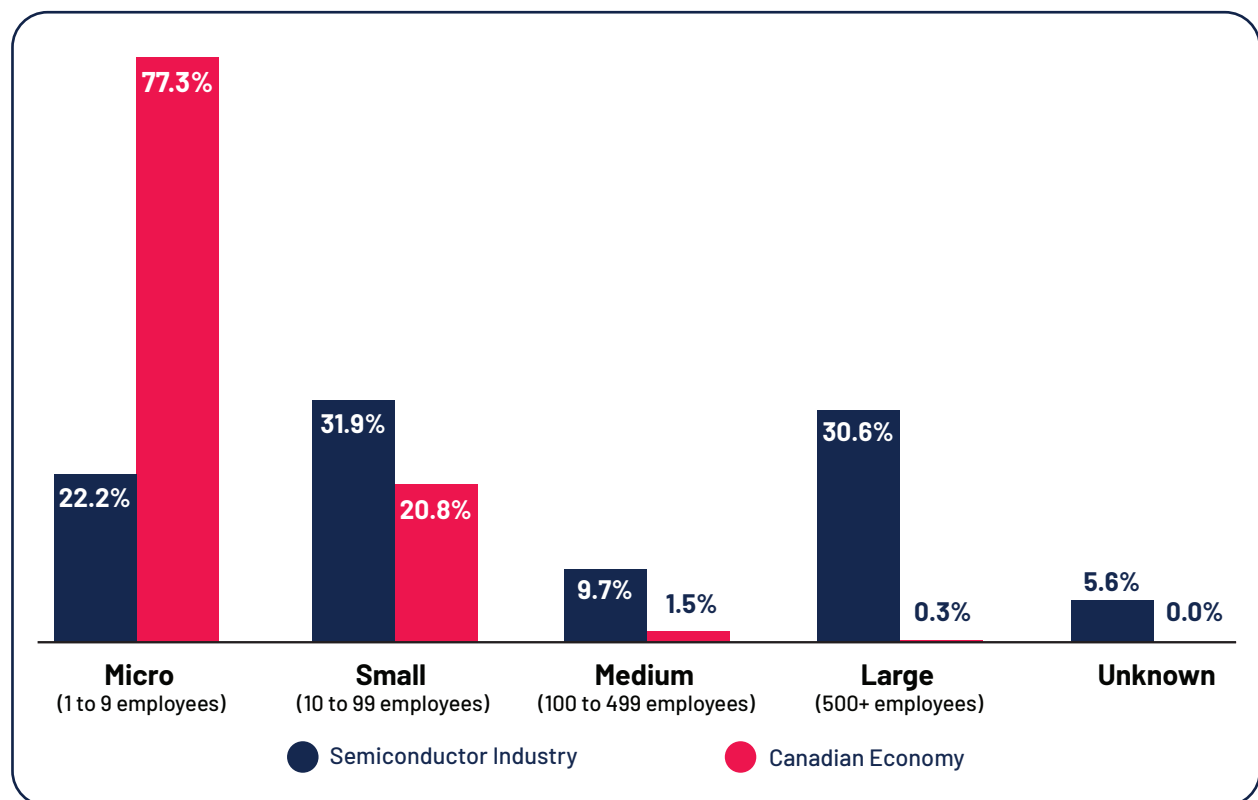


FIRMS IN CANADA'S SEMICONDUCTOR INDUSTRY BY BUSINESS SIZE

Canada's semiconductor industry has a much larger share of medium- and large-sized firms compared to other sectors of the economy (Figure 6).³⁰ Nearly one-third (31.9%) of businesses in Canada's semiconductor industry are large, with more than 500 employees, and nearly one in ten (9.7%) are medium, with 100 to 499 employees. While some Canadian firms, such as Alphawave Semi,³¹ have scaled to become large firms over time, the high presence of large

semiconductor firms in Canada is primarily due to the strong presence of large multinational enterprises like Marvell, Microchip Technology, and Advanced Micro Devices (AMD). Smaller firms in Canada's semiconductor industry (31.9% small, 22.2% micro) often include research, development, and design consultancies. Figure 6 outlines semiconductor firms by size (number of employees) compared to Canadian companies in general.

Figure 6. Firms in Canada's Semiconductor Industry by Size



Data sources: ICTC's dataset of semiconductor firms in Canada, 2025; ISED Key Small Business Statistics, 2024.³² (n = 248 firms.)

³⁰ Innovation, Science and Economic Development Canada (Government of Canada), "Key Small Business Statistics 2024," last update April 1, 2025, <https://ised-isde.canada.ca/site/sme-research-statistics/en/key-small-business-statistics/key-small-business-statistics-2024>.

³¹ In June 2025, multinational semiconductor firm Qualcomm announced the acquisition of Alphawave Semi in a USD \$2.4 billion deal; see: "Qualcomm to Acquire Alphawave Semi (press release)," Business Wire, June 9, 2025, <https://www.businesswire.com/news/home/20250609911615/en/Qualcomm-to-Acquire-Alphawave-Semi>.

³² Innovation, Science and Economic Development Canada (Government of Canada), "Key Small Business Statistics," last update March 5, 2025, <https://ised-isde.canada.ca/site/sme-research-statistics/en/key-small-business-statistics>.

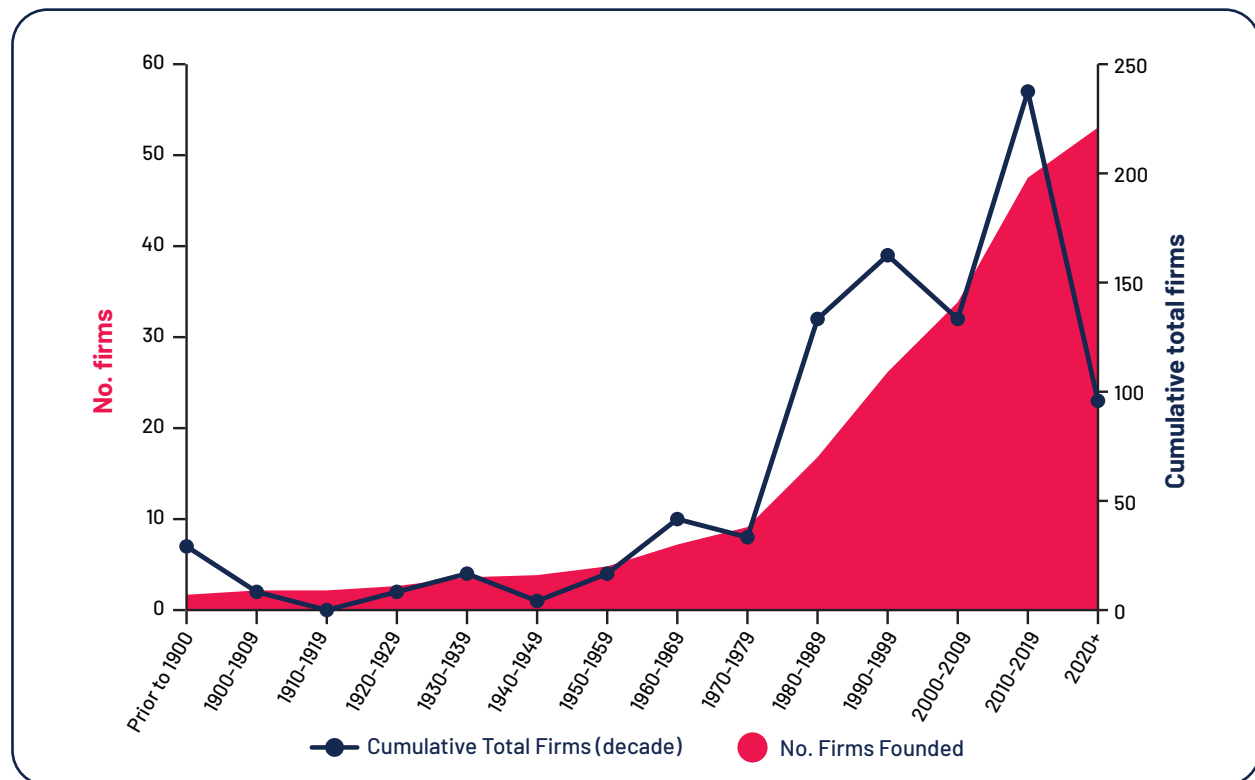
FIRMS IN CANADA'S SEMICONDUCTOR INDUSTRY BY FOUNDING YEAR

Active firms presently operating in Canada's semiconductor industry were founded over an extensive time period. For example, the multinational chemical company DuPont, founded in 1802, remains active today as a materials supplier for Canada's semiconductor industry. The oldest and most storied firms active in the Canadian semiconductor industry tend to be large, diversified companies that entered the semiconductor industry long after their founding, often through mergers and acquisitions, diversification, spin-offs, or internal evolution, rather than starting their business journeys in the semiconductor industry.

Conversely, most semiconductor companies founded since the late 1960s and early 1970s began as core semiconductor or adjacent firms, focusing on technologies such as integrated circuits and

microprocessors.³³ Early global examples include Analog Devices, Intel, and AMD, while domestic Canadian examples include Nortel. In the 1980s and 1990s, a cluster of new firms emerged, characterized by a growing demand for computerized consumer products, including household appliances, thermostats, videocassette recorders, telephones, and personal computers.³⁴ In the late 1990s and early 2000s, firms emerged alongside the dot-com bubble era. From 2015 to 2021, a period characterized by low interest rates, record venture capital investment in tech startups, and growing global demand for digital technologies like AI, internet of things (IoT), cloud computing and data centres, and mobile devices, another cluster of active firms were founded. Figure 7 outlines semiconductor firms (scope 1 and scope 2) presently operating in Canada by founding year.

Figure 7. Active Firms in Canada's Semiconductor Industry by Founding Year



NOTE: This analysis does not include firms that have gone out of business or are otherwise no longer in operation, or no longer active in Canada. Acquired firms have been assigned their acquiring parent company's founding date. See Appendix for full methodology. Data sources: ICTC's dataset of semiconductor firms in Canada, 2025. (n = 248 firms.)

³³ Robert Scace, "The Semiconductor Revolution," April 17, 2025, Britannica, <https://www.britannica.com/technology/electronics/The-semiconductor-revolution>.

³⁴ Ibid.

FIRMS IN CANADA'S SEMICONDUCTOR INDUSTRY BY GEOGRAPHIC DISTRIBUTION

The Canadian semiconductor industry is primarily concentrated in Ontario, which accounts for more than half (56.6%) of local offices or branches belonging to semiconductor firms and 44.7% of job postings between January 1, 2022 and March 31, 2025.³⁵ Ontario's strengths in the semiconductor industry are rooted in historical firms like Nortel Networks and Mitel Networks, which were headquartered in Ottawa from the late 1970s to the early 2000s. While many of these firms have since ceased operations or been acquired, their influence helped create a deep pool of semiconductor talent in

the province. Many former employees of such firms went on to found or contribute to startups in regions including Ottawa and Toronto.³⁶

These two Ontario cities are home to a variety of Canadian and multinational semiconductor firms, with Ottawa also being home to the Canadian Photonics Fabrication Centre (CPFC), a pure-play compound semiconductor foundry focused on photonic device fabrication located at the National Research Council. Canadian semiconductor firm Ranovus is also set to open a \$100 million expansion of its facilities in Ottawa.³⁷

Figure 8. Geographic Distribution of Canada's Semiconductor Industry: Provinces



Given that some firms operating in the semiconductor industry are not solely focused on semiconductor products, the job postings data may include a small portion of postings that are not relevant to the semiconductor industry, despite being posted by semiconductor firms. Job posting data collected between January 1, 2022, and March 31, 2025. Many large semiconductor companies operate in more than one location, so the total number of offices is larger than the total number of semiconductor firms mapped. Data sources: ICTC's dataset of semiconductor firms in Canada, 2025; Vicinity Jobs, 2025. (n = 248 firms.)

³⁵ Data on job postings was collected from Vicinity Jobs for semiconductor-related jobs posted between January 1, 2022, and March 31, 2025 (see Appendix A for details on methodology).

³⁶ Daniel Munro and Creig Lamb, "Chipshot: A Semiconductor Strategy for Canada," CSA Public Policy Centre, CSA Group, <https://www.csagroup.org/article/public-policy/chip-shot-a-semiconductor-strategy-for-canada/>, 16.

³⁷ Government of Ontario, "Ontario Welcomes Over \$100 Million Investment in the Critical Technologies Sector (press release)," August 20, 2025, <https://news.ontario.ca/en/release/1006340/ontario-welcomes-over-100-million-investment-in-the-critical-technologies-sector>.

Interviewees participating in this study highlighted Toronto, Ottawa, and the Kitchener–Waterloo region as having the right ingredients to succeed—a cluster of talent that combines experienced industry veterans with emerging junior talent, expertise in areas of the semiconductor industry that do not require significant capital investment, and a local network of semiconductor firms and customers creating a robust industry cluster.

These cities are primarily involved in semiconductor design, but while Ottawa’s key strengths are compound semiconductors and photonics, Toronto specializes in analog, mixed-signal, and photonics. Kitchener–Waterloo leverages its dynamic startup and technology incubation ecosystem, anchored around higher education institutions such as the University of Waterloo, with emerging strengths in AI and quantum chip technology, as well as exiting strengths in MEMS, analog, and photonic chip design. Several industry experts consulted for this study noted how universities and large semiconductor firms can act as anchors for smaller firms to co-locate around, creating crucial regional industry clusters.

Québec is home to Canada’s second largest semiconductor industry, accounting for nearly a quarter of local offices or branches (24.5%) and job postings (24.9%). Bromont, Québec is famously home to Teledyne MEMS, a microfabrication facility specializing in MEMS development and production,³⁸ as well as IBM’s Bromont facility, North America’s largest OSAT facility. IBM Bromont manufactures more than 433,000 advanced flip chip modules each month.³⁹ The province is also home to the MiQro

Innovation Collaborative Centre (C2MI), Canada’s largest microelectronics research and development centre, which assembles next-generation electronic chips and acts as a crucial link between academic and industry researchers.⁴⁰

British Columbia accounts for 11% of local offices or branches and 20.1% of job postings. The lower mainland region specializes in advanced network technologies and chip design, home to a mix of Canadian and multinational firms. These include Daanaa, which offers a novel, high-efficiency system-on-a-chip product,⁴¹ Bonsai Micro, a fabless semiconductor firm that is combining wireless technology with machine learning,⁴² and Microchip Technology, which acquired Vancouver-based semiconductor firm PMC-Sierra via Microsemi in 2016.⁴³

Alberta accounts for 6.1% of local offices or branches and 6.3% of job postings.⁴⁴ Edmonton, Alberta is home to nanoFAB, an open-access nanofabrication and characterization centre, housed at the University of Alberta, that services academic and industry players in the semiconductor industry and provides a hub for industry and academic collaboration.⁴⁵ Alberta is also home to companies like Teledyne Micralyne, a MEMS foundry based in Edmonton and Applied Quantum Materials, which designs, develops, and manufactures silicon nanomaterials.⁴⁷

In terms of regional hubs, Toronto is Canada’s largest semiconductor industry hub, home to 83 local offices, or branches. This is followed by Montréal, which has 61 local offices or branches, Ottawa–Gatineau, which has 55, Vancouver, which has 30, and Kitchener–Cambridge–Waterloo, which has 24.

³⁸ “Teledyne acquires Micralyne MEMS foundry,” Teledyne MEMS, September 3, 2019, <https://www.teledynemems.com/en-150/company/news-center/teledyne-acquires-micralyne/>.

³⁹ IBM, “IBM Semiconductors chiplets and advanced packaging,” accessed March 19, 2025, <https://www.ibm.com/services/semiconductor-assembly-test>.

⁴⁰ “MiQro Innovation Collaborative Centre (C2MI),” University of Sherbrooke, accessed April 30, 2025, <https://www.usherbrooke.ca/recherche/en/udes/unique-identity/unique-infrastructures/c2mi>.

⁴¹ “One Power Electronics Architecture for All,” Daanaa, accessed April 30, 2025, <https://daanaa.com/technology/>.

⁴² Meagan Simpson, “BDC, Vanedge invest in semiconductor startup Bonsai Micro to create advanced wireless networks,” May 11, 2023, Betakit, <https://betakit.com/bdc-vanedge-invest-in-semiconductor-startup-bonsai-micro-to-create-advanced-wireless-networks/>.

⁴³ “Microsemi Corporation,” Microchip, accessed April 30, 2025, <https://www.microchip.com/en-us/about/corporate-overview/acquisitions/microsemi>.

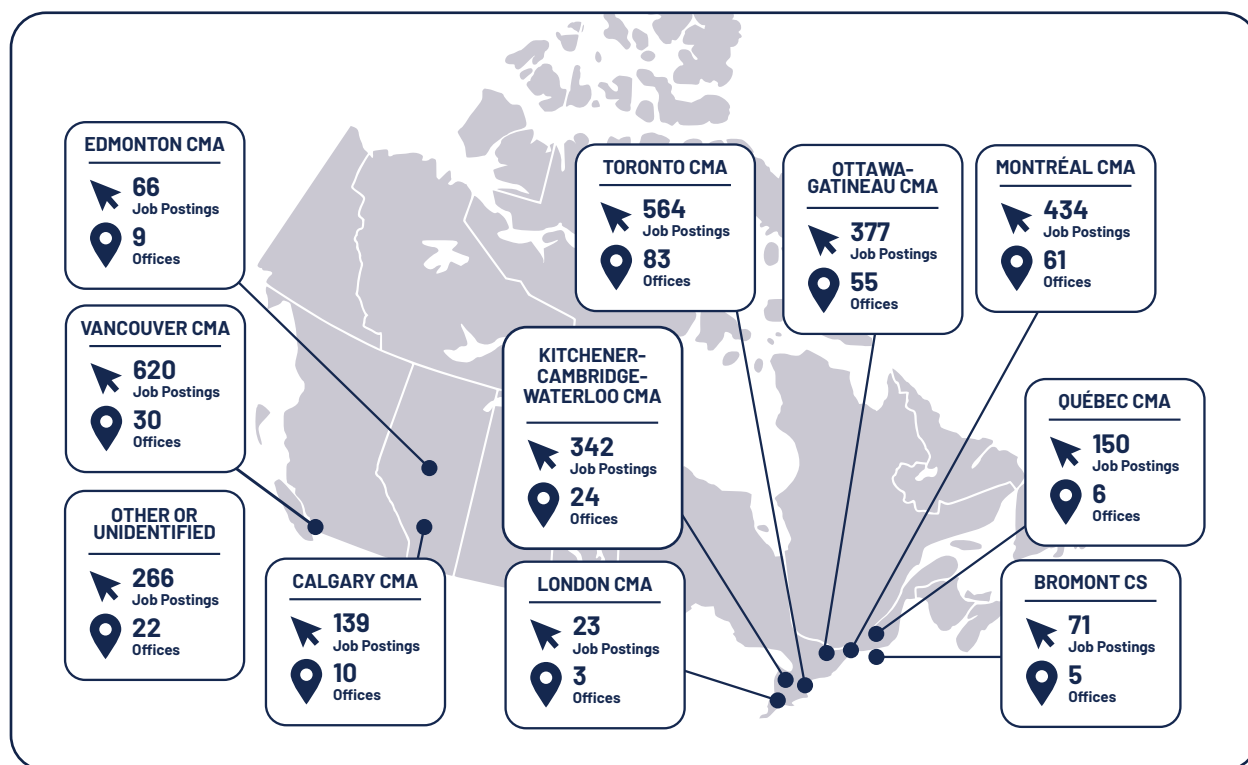
⁴⁴ Given that some firms operating in the semiconductor industry are not solely focused on semiconductor products, the job postings data may include a small portion of postings that are not relevant to the semiconductor industry despite being posted by semiconductor firms. This could explain why British Columbia accounts for a significantly greater percentage of job postings than local offices.

⁴⁵ “The nanoFAB,” University of Alberta, accessed April 20, 2025, <https://www.nanofab.ualberta.ca/>.

⁴⁶ “Contact Us,” Teledyne MEMS, accessed April 30, 2025, <https://www.teledynemems.com/contact-us/>.

⁴⁷ “Corporate,” Applied Quantum Materials, accessed April 30, 2025, <https://www.aqmaterials.com/aqm-company-profile>.

Figure 9. Geographic Distribution of Canada's Semiconductor Industry: Census Metropolitan Areas and Subdivisions



Given that some firms operating in the semiconductor industry are not solely focused on semiconductor products, the job postings data may include a small portion of postings that are not relevant to the semiconductor industry, despite being posted by semiconductor firms. This may explain why the number of job postings in Vancouver is uncharacteristically high. Job posting data collected between January 1, 2022, and March 31, 2025. Data sources: ICTC's dataset of semiconductor firms in Canada, 2025; Vicinity Jobs, 2025. (n = 248 firms.)

CANADIAN SEMICONDUCTOR TECHNOLOGY STRENGTHS

Industry experts noted that, while Canada does not have a significant semiconductor manufacturing capability in terms of production volume, Canadian firms stand out for smaller-volume, high-margin semiconductor production in niche areas. Furthermore, Canada's fabless semiconductor R&D centres and design firms boast significant experience working in niche technology areas.

Industry experts interviewed for this study highlighted Canada's strengths in several semiconductor technologies, including advanced packaging, analog and mixed-signal semiconductor technology, the design of application-specific integrated circuit (ASIC) and field-programmable gate array (FPGA) chips for advanced computing applications such as AI

and quantum, microelectromechanical systems (MEMS), semiconductor photonics and optical communications, and compound semiconductors.⁴⁸

Several of these niche technology areas may have significant applications in specialized hardware optimized for AI and other advanced computing applications, as well as sensor devices relevant to IoT and industrial internet of things (IIoT) applications. For this reason, the Canadian semiconductor industry, despite having limited manufacturing capacity, has both national and global relevance.

Figure 10 outlines the abovementioned semiconductor technologies that Canada enjoys strengths in based on interviews ICTC carried out with Canadian semiconductor industry experts consulted for this study.

⁴⁸ The CSA Group's 2024 study on the Canadian semiconductor industry also noted Canadian technological strengths in "compound semiconductors, photonics, and advanced packaging," see: Daniel Munro and Creig Lamb, "Chipshot: A Semiconductor Strategy for Canada," CSA Public Policy Centre, CSA Group, <https://www.csagroup.org/article/public-policy/chip-shot-a-semiconductor-strategy-for-canada/>, 21.

Figure 10. Key Canadian Semiconductor Technology Strengths (alphabetical order)

Key Semiconductor Technology	Description
Advanced packaging	Once a finished semiconductor wafer is split into individual chips, these chips need to be packaged into a protective casing before they are incorporated into computing and electronic hardware. This packaging keeps chips safe and reliable, while also allowing them to communicate with the outside world. Common packaging materials include metals, such as copper, thermoplastics and resins, and ceramics.⁴⁹ As complex chip designs, such as chiplets and system-on-chip (SoC), become more common, advanced packaging technology is used to integrate stacks of chips with different capabilities together into powerful, high-performance modules. Advanced packaging technology, such as 2.5-D and 3-D stacking, allow chips to transfer data within and between modules, while managing heat and increasing device speed.⁵⁰ Heterogeneous integration allows semiconductors produced from compounds made up of different types of materials (e.g., Si, GaN).⁵¹ Advanced packaging technology has significant potential in advanced computing applications such as AI and quantum computing, IoT and industrial internet, consumer electronics and computer hardware, and the automotive sector.
Analog and mixed-signal semiconductors	Analog and mixed-signal semiconductors are chips designed to process analog signals, as opposed to digital signals. Analog semiconductors are used for applications such as power management and telecommunications, as well as processing sound, temperature, pressure, vibrations, and light.⁵² For this reason, they play an important role in many sensors, IoT devices, and edge computing applications.⁵³ There are also potential applications for analog chips to be used in low-power edge AI computing applications.⁵⁴ Mixed-signal semiconductors, such as analog-to-digital converter (ADC/DAC) chips, convert analog signals to digital information and vice versa, making them an essential technology to allow the digital and analog worlds to interact.⁵⁵ Complex semiconductor technology like SoC and chiplet designs may include both analog and digital components on a single chip.⁵⁶
AI chips (ASICs and FPGAs)	As AI technology demands increasing amounts of computing power, specific AI chips are being developed for AI data centres that are optimized for AI training and inference tasks. These chips can process AI workloads quicker, produce less heat, and are more energy efficient.⁵⁷ Common chip technology being used by Canadian companies to develop AI chips include ASICs and FPGAs. ASICs are semiconductors designed and optimized to perform a specific task, rather than being designed for general purposes.⁵⁸ ASICs are currently being custom designed for advanced computing applications, such as replacing GPUs in AI data centres, as they can be designed from the ground up and optimized for specific AI computing applications. However, ASICs cannot be re-programmed and are thus inflexible and locked to one specific purpose once fabricated.⁵⁹ FPGAs are general purpose semiconductors that can be reprogrammed post-production to perform various tasks and even reconfigured to perform new tasks. This can include specific configurations for AI coWmputing tasks. While FPGAs are not as optimized as a purpose-designed ASIC for AI computing, they are flexible and ideal for prototyping and avoiding the risk and upfront design work required to produce an ASIC.⁶⁰

⁴⁹ IBM, "What is chip packaging?," November 27, 2023, <https://research.ibm.com/blog/what-is-computer-chip-packaging>.

⁵⁰ Ansys, "What Is Advanced Semiconductor Packaging?," accessed March 20, 2025, <https://www.ansys.com/simulation-topics/what-is-advanced-semiconductor-packaging>.

⁵¹ See: "Gallium Nitride on Silicon," Lincoln Laboratory, Massachusetts Institute of Technology, accessed May 2, 2025, <https://www.ll.mit.edu/research-and-development/advanced-technology/microsystems-prototyping-foundry/gallium-nitride>.

⁵² Ansys, "What is an Analog Integrated Circuit (IC) and How is it Designed?," accessed May 2, 2025, <https://www.ansys.com/simulation-topics/what-is-analog-integrated-circuit>.

⁵³ "Analog's critical role in the IoT," Embedded, January 12, 2023, <https://www.embedded.com/analog-critical-role-in-the-iot/>.

⁵⁴ IBM, "IBM Research's newest prototype chips use drastically less power to solve AI tasks," August 23, 2023, <https://research.ibm.com/blog/analog-ai-chip-low-power>.

⁵⁵ Ansys, "What Is a Mixed-Signal Integrated Circuit?," accessed May 2, 2025, <https://www.ansys.com/simulation-topics/what-is-mixed-signal-integrated-circuit>.

⁵⁶ Synopsys, "Understanding SoC Chips: Components, Construction, & Capabilities," November 14, 2022, <https://www.synopsys.com/blogs/chip-design/system-on-chip.html>.

⁵⁷ See: Saif M. Khan and Alexander Mann, "AI Chips: What They Are and Why They Matter," Center for Security and Emerging Technology (CSET), April 2020, <https://cset.georgetown.edu/publication/ai-chips-what-they-are-and-why-they-matter/>, 5.

⁵⁸ Arm, "Arm Glossary: What is ASIC?," accessed March 19, 2025, <https://www.arm.com/glossary/asic>.

⁵⁹ IBM, "What is an AI chip?," June 6, 2024, <https://www.ibm.com/think/topics/ai-chip>.

⁶⁰ Arm, "Glossary: What is an FPGA?," accessed June 16, 2025, <https://www.arm.com/glossary/fpga>.

Compound semiconductors (GaN, InP, III-V group elements, etc.)	Compound semiconductors are semiconductors created using a compound of elements, rather than just using silicon. III-V semiconductors refer to compound semiconductors based on Groups III and V of the periodic table, such as gallium and arsenic. One popular non-silicon-based semiconductor wafer material is Gallium Nitride (GaN), while silicon carbide (SiC) is used in power electronics,⁶¹ and indium phosphide (InP) is used in applications such as in optoelectronics.⁶² By using properties provided by different elements, compound semiconductors exhibit useful characteristics not possible using traditional silicon-based designs, such as faster data transfer, faster switching speeds, better heat handling capabilities, higher voltages, and detecting and producing light (photonics). These properties provide III-V compound semiconductors with significant potential in applications, such as advanced computing.⁶³ However, these elements are more difficult to work with and harder to produce wafers in the required amounts.
Microelectro-mechanical systems (MEMS)	MEMS are micro-sized electrical-mechanical devices produced using semiconductor fabrication techniques. MEMS can be used to detect changes in things like pressure, temperature, momentum, or chemistry and create electrical signals that can be processed in a computer or other electrical system. MEMS are used in a variety of applications, such as the automotive sector, where they are used as momentum detectors to trigger the deployment of airbags.⁶⁴
Photonics and optical communication/optoelectronics	Photonics, optical communication, and optoelectronics use light to communicate within or between chips utilizing technologies such as laser diodes, LEDs, and fiberoptics. Photonics have significant potential in high-speed data transfer in computing and telecommunications, sensing and imaging, and reducing energy-use and excess heat within data centre servers and other computing infrastructure. The speed and heat reduction promised by photonics has significant implications for cloud computing infrastructure and hyperscalers. The emerging technology of photonic computing has the potential to replace electrical circuitry with optoelectronic circuits, which has important applications in advanced computing applications.⁶⁵

Source: ICTC interviews with Canadian semiconductor industry experts and corroborating secondary research.

⁶¹ Synopsys, "Beyond Silicon: A Look at Alternative Semiconductor Materials," February 20, 2024, <https://www.synopsys.com/blogs/chip-design/alternative-semiconductor-materials.html>.

⁶² PhotonDelta, "What Is Indium Phosphide and What Can It Do More Than Other PIC Platforms?," October 2, 2022, <https://www.photondelta.com/news/what-is-indium-phosphide-and-what-can-it-do-more-than-other-pic-platforms/>.

⁶³ National Research Council (Government of Canada), "Empowering Canada's future: Why compound semiconductors matter to Canadians," last update July 8, 2024, <https://nrc.canada.ca/en/stories/empowering-canadas-future-why-compound-semiconductors-matter-canadians>; Sumitomo Electric Industries, "Compound Semiconductor," accessed March 19, 2025, https://global-sei.com/sc/com_semi_e/; Compound Semiconductor Applications Catapult, "What are compound semiconductors?," accessed March 19, 2025, <https://csa.catapult.org.uk/what-we-do/what-are-compound-semiconductors/>.

⁶⁴ Arrow Electronics, "MEMS overview: MEMS devices & uses in IoT," February 13, 2019, <https://www.arrow.com/en/research-and-events/articles/mems-and-iot-applications>; Bosch, "MEMS – Micro-Electro-Mechanical Systems," accessed March 19, 2025, <https://www.bosch.com/stories/topics/mems-micro-electro-mechanical-systems/>; Jim Turley, The Essential Guide to Semiconductors, (Hoboken, NJ: Pearson Education, 2003), 24-25.

⁶⁵ Synopsys, "What is Photonics?," accessed March 19, 2025, <https://www.synopsys.com/glossary/what-is-photonics.html>.

Emerging Semiconductor Technologies and Canada

In addition to existing industry strengths mentioned above, innovative Canadian semiconductor firms, including startups, established Canadian-owned companies, and multinational firms operating R&D and innovation hubs in Canada, are working on novel emerging technologies. Several of these emerging technologies have significant implications for the

future of the semiconductor industry, electronic devices, computing hardware, and the broader digital economy.

Emerging semiconductor technologies under development in Canada include developing AI-enabled EDA software/plugin-ins, superconductors, and quantum computing chips. Figure 11 describes exciting emerging semiconductor technologies currently being explored by Canadian companies.

Figure 11. Key Canadian Semiconductor Emerging Technologies (alphabetical order)

Key Semiconductor Technology	Description
AI-enabled EDA software/plugin-ins	AI technology is increasingly being deployed in EDA software and other semiconductor design tools. Generative AI and machine learning (ML) tools are commonly offered as software plug-ins by prominent EDA companies. ⁶⁶ Using AI to facilitate semiconductor design can help chip designers quickly and efficiently design increasingly complex high-performance chips, help optimize chip layouts (i.e., “floorplans”) and increase efficiency, verify chip designs, and use data of past chip designs to improve the chip design process. ⁶⁷
Chip Security/ cryptography	Like software and other types of computing hardware, semiconductor technology is subject to security vulnerabilities. ⁶⁸ Complex chips such as microprocessors and SoC designs require embedded software and firmware to operate, which makes them vulnerable to certain types of malware. ⁶⁹ Semiconductor supply chains are also vulnerable to being tampered with—for example, complex chip designs could covertly include unauthorized functionalities, creating backdoors for sophisticated threat actors to exploit down the line (sometimes referred to a hardware-trojans). ⁷⁰ Furthermore, protecting valuable IP from theft and duplication is an important consideration for IC designers. Advanced chips may include security IP cores, such as cryptographic modules, as part of their designs. ⁷¹

⁶⁶ For example, see: Ansys, “Ansys AI,” accessed May 2, 2025, <https://www.ansys.com/ai>; Cadence, “Accelerating the AI Transformation with Cadence,” accessed May 2, 2025, https://www.cadence.com/en_US/home/ai/overview.html; Siemens, “Siemens EDA AI,” accessed May 2, 2025, <https://eda.sw.siemens.com/en-US/trending-technologies/eda-ai-page/>; Synopsys, “AI & Machine Learning Solutions,” accessed May 2, 2025, <https://www.synopsys.com/ai.html>.

⁶⁷ Institute of Electrical and Electronics Engineers, “Transformative Effect: AI in Semiconductor Design,” IEEE Innovation at Work, accessed May 2, 2025, <https://innovationatwork.ieee.org/transformative-effect-ai-in-semiconductor-design/>.

⁶⁸ See: Satya S. Sahu, “A Survey of Chip-Based Hardware Backdoors,” Takshashila Discussion Document No. 2024-06, The Takshashila Institution, May 2024, <https://takshashila.org.in/research/a-survey-of-chip-based-hardware-backdoors>.

⁶⁹ Aman Mishra, “Threat Actors Launch Active Attacks on Semiconductor Firms Using Zero-Day Exploits,” GBHackers on Security, April 11, 2025, <https://gbhackers.com/threat-actors-launch-active-attacks-on-semiconductor-firms/>.

⁷⁰ Jeff Goldman, “Chip Backdoors: Assessing the Threat,” Semiconductor Engineering, August 4, 2022, <https://semiengineering.com/chip-backdoors-assessing-the-threat/>; Tyler McGill, “Hardware Trojans and Supply Lines,” U.S. Naval Institute, April 2021, <https://www.usni.org/magazines/proceedings/2021/april/hardware-trojans-and-supply-lines>.

⁷¹ Any Silicon, “Security IP Cores: Ultimate Guide,” accessed May 6, 2025, <https://any silicon.com/security-ip-cores-ultimate-guide/>.



Super-conductors	According to CERN, certain materials that fall below a specific temperature become superconductors, which offer no resistance to electrical current and repel sufficiently weak magnetic fields, known as the Meissner effect.⁷² These novel properties provide significant potential for superconductors to be used in the microelectronics and semiconductor industries in hybrid semiconductor-superconductor chips with relevance for advanced computing applications, such as quantum computing.⁷³ Superconductors also have potential applications in leveraging quantum effects for semiconductor miniaturization.
Quantum chips	A number of existing and emerging semiconductor technologies have significant applications in quantum computing and the ongoing development of quantum chips.⁷⁴ Potentially relevant semiconductor technologies include utilizing GaN and other III-V materials for quantum-dots, incorporating superconducting materials into quantum chip designs, silicon photonics and other photonic technologies for quantum processors,⁷⁵ and analog and mixed-signal semiconductors for quantum processor control.⁷⁶ Advanced packaging solutions are also critical in developing quantum chip technology.⁷⁷ The federal government's 2022 National Quantum Strategy positions Canada as a leader in quantum technology, including quantum computing. The strategy document notes the importance of advances in quantum science for driving semiconductor innovation forward.⁷⁸

Source: ICTC interviews with Canadian semiconductor industry experts and corroborating secondary research.

⁷² CERN, "Superconductivity," accessed March 24, 2025, <https://home.cern/science/engineering/superconductivity>.

⁷³ QuTech, "Integrating a semiconducting quantum dot with a superconductor," February 21, 2025, <https://qutech.nl/2025/02/21/integrating-a-semiconducting-quantum-dot-with-a-superconductor/>.

⁷⁴ See: Siemens, "Quantum semiconductor research forges ahead with steady breakthroughs," Siemens Digital Industries Software, February 2, 2024, <https://blogs.sw.siemens.com/cicv/2024/02/02/quantum-semiconductor-research-forges-ahead-with-steady-breakthroughs/>.

⁷⁵ Diana James, "Photonics and Quantum Computing: A Radiant Revolution," IEEE Computer Society, December 19, 2024, <https://www.computer.org/publications/tech-news/trends/photonics-and-quantum-computing-revolution>; "Xanadu Announces Aurora, A Universal Photonic Quantum Computer," Quantum Insider, January 22, 2025, <https://thequantuminsider.com/2025/01/22/xanadu-announces-aurora-a-universal-photonic-quantum-computer/>.

⁷⁶ Joseph C. Bardin, "Analog/Mixed-Signal Integrated Circuits for Quantum Computing," IEEE BiCMOS and Compound Semiconductor Integrated Circuits and Technology Symposium, Institute of Electrical and Electronics Engineers, November 16-19, 2020, 10.1109/BCICTS48439.2020.9392973.

⁷⁷ Applied Materials, "Materials Innovations Can Help Make Quantum Computing a Reality," July 1, 2024, <https://www.appliedmaterials.com/us/en/blog/blog-posts/materials-innovations-can-help-make-quantum-computing-a-reality.html>.

⁷⁸ Innovation, Science and Economic Development Canada (Government of Canada), "Canada's National Quantum Strategy," 2022, <https://ised-isde.canada.ca/site/national-quantum-strategy/en/canadas-national-quantum-strategy>, 4.

Mapping Canada's Semiconductor Industry by Technology Emphasis

Semiconductor firms operating in Canada place a strong emphasis on advanced semiconductor technologies like advanced packaging, photonics, optical chips, and analog chip technology. They also emphasize AI chip technology, compound semiconductors, RF chips, semiconductors for sensors and Internet of Things (IoT) applications, MEMS, and chiplets.

Canada is also home to semiconductor firms working in emerging technology areas such as quantum computing, chip security and cryptography, superconductors, and the development of AI-enabled EDA and other design software for semiconductor design. Figure 12 outlines Canadian semiconductor firms by their core technology offerings.

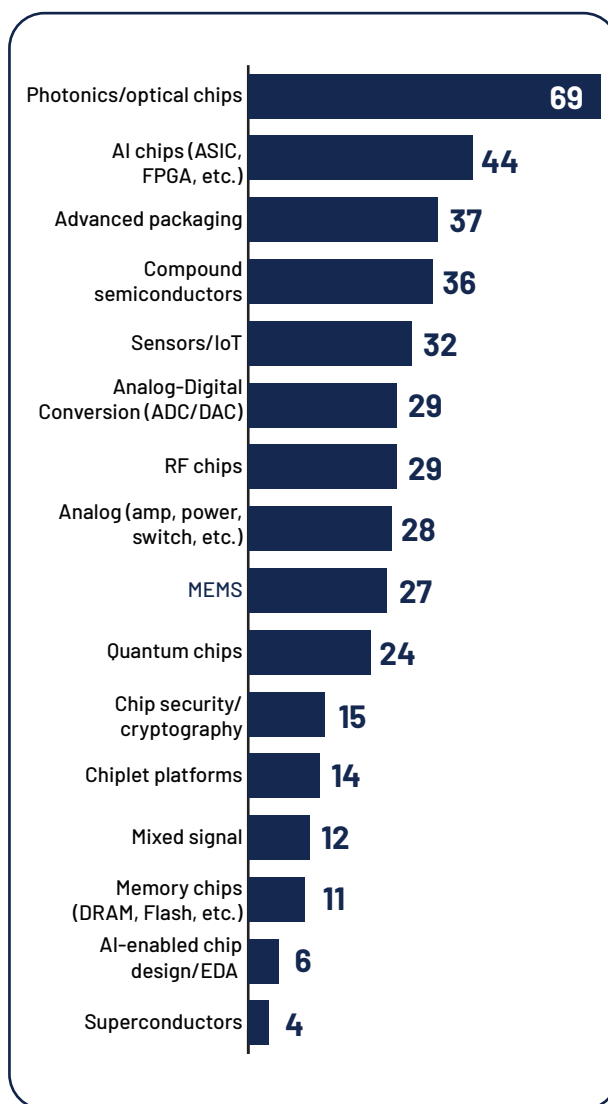
As Figure 12 demonstrates, of the 248 semiconductor firms mapped by ICTC, 69 firms (28%) have a focus on applying photonics, including silicon photonics and optical communication technology, to semiconductors, while 44 firms (18%) focus on AI chips, including technologies such as ASIC and FPGA chips. Thirty-seven firms (15%) have a focus on advanced packaging technology.

Thirty-six firms (15%) focus on compound semiconductors (including GaN and other III-V chips), 32 firms (13%) focus on sensor and IoT chips, 29 firms (12%) on radio frequency (RF) chips, 29 (12%) firms have capabilities in analog-to-digital/digital-to-analog (ADC/DAC) conversion chips, and 28 (11%) firms in other analog chip technologies (amp, power, switch, etc.), while 27 firms (11%) focus on MEMS.

Furthermore, there are 24 firms (10%) with a focus on semiconductors for quantum computing applications, 14 firms (6%) focused on chiplets and other non-monolithic semiconductor technologies, 15 firms (6%) focused on chip security and cryptography, 12 firms (5%) on mixed-signal chips, 11 firms (4%) on memory chips (DRAM, Flash, etc.), six firms (2%) on AI-enabled EDA tools and design software plug-ins, and four firms (2%) on superconducting technology applied to semiconductors.⁷⁹ It should be noted that many firms will focus on more than one of these technologies, with firms specializing in entire clusters of interrelated technologies, so the statistics presented above will add up to over 248 firms.

The variety of established and emerging technologies that Canadian semiconductor companies emphasize demonstrates both the diversity of technical expertise located in Canada's semiconductor industry as well as the vast diversity of semiconductor technology produced by Canadian firms, essential to downstream industries.

Figure 12. Technology Emphasis of Semiconductor Firms in Canada



Data Source: ICTC's dataset of semiconductor firms in Canada, 2025. Note: Many Canadian firms focus on more than one core semiconductor technology. (n = 248 firms.)

⁷⁹ Reported percentage figures have been rounded to nearest percent.

Canadian Semiconductor Industry End-User Markets

Canadian semiconductor firms provide products and services to a wide variety of industries critical to the modern economy, such as the automotive, aerospace, defence, and telecommunications sectors, forming critical inputs into downstream supply chains for these industries.

To understand the end-user markets, Canadian semiconductor firms are counted as customers. ICTC mapped firms by the end-user market segments to which semiconductor firms self-report providing products and services. ICTC determined end-user industries for each firm based on the industries/markets each semiconductor firm self-reports to serve, which was based on information contained within their websites, under headings such as “solutions,” “markets,” and “industries.” Most semiconductor firms ICTC mapped served multiple end-user markets, as they provide products and services applicable across a variety of industries.

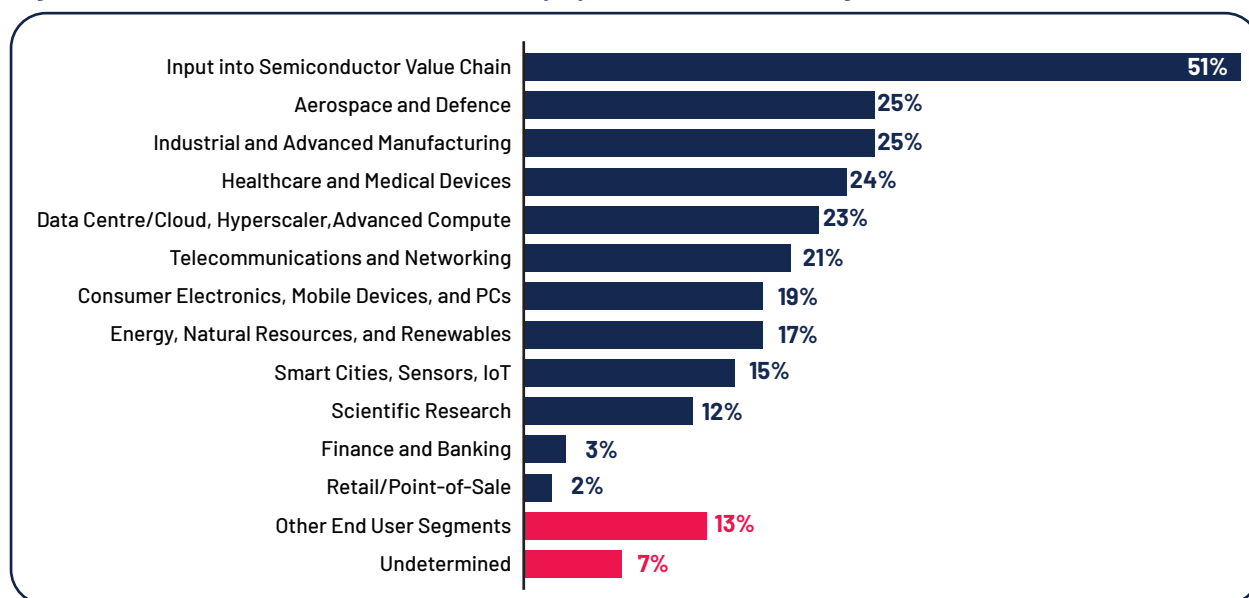
Out of the 248 semiconductor firms ICTC mapped as part of this research, just over half (51%) reported that their primary end-users for their products or services were other firms in the semiconductor

industry—demonstrating the complex value chains and interdependence between firms inherent in Canada’s semiconductor industry.

Furthermore, 25% of semiconductor firms offered products and services to the aerospace and defence sector, as well as 25% offering products to the industrial and advanced manufacturing sector, while 24% of firms offered products to the automotive sector,⁸⁰ and 23% offered products to the medical and healthcare sectors, including life sciences. Canadian semiconductor firms were also prominent in supplying telecommunications and data centres, with 21% of firms providing products and services to data centres, cloud computing, hyperscaler and advanced computing firms, and 19% of semiconductor firms supplying products and services to the telecommunications industry.

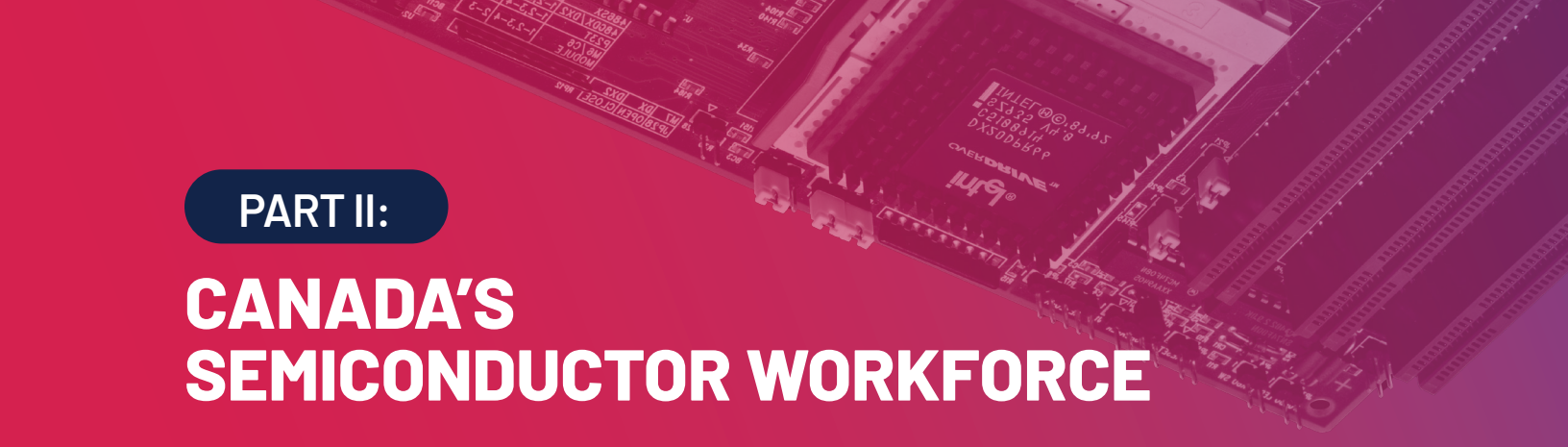
Other prominent industries that Canadian semiconductor firms offered products and services include consumer electronics, mobile devices, and personal computers (17%); natural resources, energy, and renewables (17%); smart cities, sensors, and IoT (15%); scientific research applications (12%); finance and banking (3%); and retail (2%). Figure 13 outlines the end-user industry segments to which Canadian semiconductor firms offer products or services.

Figure 13. Canadian Semiconductor Industry by End-user Market Segments



Data source: ICTC’s dataset of semiconductor firms in Canada, 2025. Note: many Canadian semiconductor firms often focus on more than one end-user market. (n = 248 firms.)

⁸⁰ Though recent research by CSC’s Automotive Microchips Working Group found that Canadian semiconductor firms currently have little to no market participation in the electric vehicle (EV) manufacturing sector, including in key components such as EV batteries, drivetrains, and other power systems, see: Canada’s Semiconductor Council (CSC), “Automotive Microchips Working Group Report: Bridging the Gap in Canada’s EV Supply Chain,” CSC Automotive Microchips Working Group, 2024, <https://www.canadasemiconductorcouncil.com/csc-automotive-microchips-report-landing-page>.



PART II:

CANADA'S SEMICONDUCTOR WORKFORCE

A highly skilled workforce is essential to the semiconductor industry's ability to innovate, compete, and scale. Semiconductor research and development, design, engineering, and production are complex processes requiring extensive education and training. Highly qualified personnel with the knowledge, skills, and experience to perform these tasks form the backbone of Canada's contemporary semiconductor industry. A 2023 report by Statistics Canada noted that highly qualified personnel such as scientists, engineers, and other researchers working in the semiconductor industry made up an estimated 6.5% of all R&D staff employed in Canada, underscoring the semiconductor industry's critical role in Canadian innovation.⁸¹

Access to a deep talent pool can enable firms to accelerate R&D, scale quickly, and respond to shifts in global demand with agility, making access to reliable and scalable talent pools a key factor when determining where to establish semiconductor facilities. Without access to talent, firms risk losing revenue, falling behind competitors, and passing up opportunities and new clients. At the national level, Canada risks losing its competitive advantage and economic sovereignty in a highly strategic industry.

Canada's semiconductor workforce is built on a strong foundation of innovation, academic excellence, and industrial leadership, with deep historical roots. At the heart of this legacy is Nortel Networks, which played a transformative role in establishing Canada as a global leader in photonics and telecommunications in the 1980s and 1990s. Industry experts interviewed for this study shared how Nortel acted as a national anchor company for Canada, fostering an entire generation of engineers,

technologists, and researchers with deep expertise in semiconductor design and manufacturing. It supported a dense ecosystem of suppliers, startups, and spinoffs that continue to shape Canada's technology sector today.

Today, Canada is home to a modestly sized workforce of highly qualified personnel with deep expertise in semiconductor research, development, design, and engineering, as well as smaller pockets of talent specialized in semiconductor fabrication, packaging, and test. Indeed, leading companies from around the world have established branches in cities like Toronto, Ottawa, Bromont, Montreal, and Vancouver to access this deep semiconductor expertise. In interviews, representatives from several multinational firms indicated that Canada has a strong base of growing talent and highlighted that they had either recently hired a high number of new workers or had plans to expand in Canada in the immediate future.



"The industry will keep growing. The question is: when companies like mine grow from a small startup to a large firm, will they grow in Canada, or will they be forced to grow elsewhere due to talent constraints, and if they grow elsewhere, are they still Canadian?"

– Canadian semiconductor firm CEO

⁸¹ Thomas Wood, Greg Maloney, and Charlene Lonmo, "Chipping away at economic growth: Jobs, gross domestic product, and research in the semiconductor industry," Statistics Canada (Government of Canada), November 2023, <https://www150.statcan.gc.ca/n1/pub/11-621-m/11-621-m2023016-eng.htm>.

WORKFORCE CHALLENGES

Despite these strengths, critical workforce challenges threaten the potential of Canada's semiconductor industry. Semiconductor firms face mounting pressure to be responsive to global demand and may choose to invest elsewhere if Canada's talent supply is unable to keep up. As one interviewee, the CEO of a large Canadian semiconductor firm, commented, "the industry will keep growing. The question is: when companies like mine grow from a small startup to a large firm, will they grow in Canada, or will they be forced to grow elsewhere due to talent constraints, and if they grow elsewhere, are they still Canadian?"

In this study, a number of semiconductor firms operating in Canada reported their intention to open their next design offices in Europe instead of Canada due to limitations on the talent supply. Others shared that staffing limitations have caused them to forgo business opportunities, resulting in lost clients and new revenue.

As one interviewee shared, "We only have so many staff. When new opportunities become available to us, we have to weigh our options and determine

which areas we should invest our limited talent pool of employees in." Another interviewee shared that workforce challenges have forced them to use third parties instead of hiring internally, so they can move at the pace their investors expect, costing them double what they would need to pay to hire someone directly.

In terms of specific challenges, interviewees highlighted several challenges that threaten the potential growth of Canada's semiconductor industry:

Insufficient talent supply:

There is an insufficient supply of semiconductor talent in Canada to meet industry demand in roles like analog engineer, firmware developer, and nanofabrication. Growing firms report plans to open their next design centers abroad or hire talent remotely from regions like Texas, California, the Netherlands, and France, due to an insufficient local talent supply in Canada.

High competition for talent:

Insufficient supply of highly qualified personnel domestically results in high competition for available talent. Canadian startups and SMEs face significant challenges in attracting and retaining top talent, particularly when competing with large multinational enterprises, which tend to have greater resources and can thus offer higher salaries. Industry representatives identify high competition for talent as the number one barrier to workforce retention, with it being common for competitors to poach key staff in order to fill positions.

Upward pressure on wages:

High competition for talent has driven up wages in the industry, eroding the competitive advantage that Canada has over other, more costly jurisdictions like the United States.

82 Canada's Semiconductor Council, "Strengthening Canada's Semiconductor Talent Pipeline for Global Competitiveness: Talent & Workforce Development Working Group Report 2025," June 2025, <https://www.canadasemiconductorcouncil.com/chips-without-people-why-canadas-semiconductor-growth-depends-on-talent>, 11.

**Ageing
workforce:**

Interviewees participating in this study report that large portions of Canada's semiconductor workforce are set to retire in the coming decade, meaning there is a closing window of opportunity to pass down expertise in semiconductor technologies such as photonics, optical communications, compound semiconductors, and advanced packaging to the next generation. As one participant shared, "There was a bulge of talent in the Ottawa area that was fostered a couple of decades ago by Nortel, and that spread out to a cluster of companies that have made the Ottawa scene very vibrant, but frankly, they're aging out, and I don't see a next wave there."

In its recent 2025 study on Canadian semiconductor talent, the Canadian Semiconductor Council (CSC) notes "the imminent retirement of experienced professionals in the semiconductor industry poses a significant threat to the continuity of technical expertise and operational capacity, jeopardizing the execution of future projects and the overall success of Canadian semiconductor companies."⁸³ CSC's study forecasts that up to 20% of semiconductor workers in Canada could retire in the next five to ten years.⁸⁴

**Under-
representation
of young
professionals:**

The challenges brought forward by the semiconductor industry's aging workforce are compounded by a lack of emerging talent. Interviewees in this study shared that it can be challenging to attract students and new workers to the semiconductor industry, particularly compared to other lucrative fields such as software development and data science. While many semiconductor industry roles require an advanced degree (master's or PhD), students graduating from computer science and computer engineering programs can earn high salaries in the software industry with just an undergraduate degree.

Large multinationals intensify this challenge by recruiting graduates from top programs early in their degrees, through campus recruitment and co-op programs.

As one executive noted, "Some companies were offering chip designers with just a bachelor's degree or a one-year master's degree over \$200,000 USD. There's steady demand for these skills, both from Canadian startups and growing companies, as well as big foreign chip companies, which all have offices in Canada and try to hire as many engineers as they can."

**Difficulty
utilizing
immigration
pathways:**

While a number of interviewees reported making use of immigration pathways to bring highly qualified personnel to Canada from abroad, they shared that bureaucratic processes like the Labour Market Impact Assessment (LMIA) are lengthy and prevent firms from utilizing such immigration pathways at scale or in cases where project timelines are tight. New study permit restrictions for international students further threaten access to international talent, a critical resource, with one executive expressing concern: "A lot of our hiring is students with post-graduate degrees—not all, but a lot—and an increasing fraction of those students have been students on visas, but I'm concerned what impact recent restrictions on student visas will have."

⁸³ Ibid., 11.

⁸⁴ See: Mairead Matthews and Faun Rice, "Context Matters: Strengthening the Impact of Foreign Direct Investment on Canada's Innovation Ecosystem," Information and Communications Technology Council (ICTC), May 2022, <https://ictc-ctic.ca/reports/context-matters>.

Shortage of founders and business leaders:

Some participants expressed concern that there has been a drop-off in the number of Canadian semiconductor startup founders. Similar to other Canadian tech industries, the strong presence of MNEs in Canada's semiconductor industry can hinder business and entrepreneurial talent development, creating a cycle of branch plant dependency.⁸⁴ One executive shared that when a large portion of your workforce works for MNEs, "you tend not to develop people with business skills, which is then self-perpetuating. There are a lot of guys who are good site managers, but they're not good business developers, not good entrepreneurs." Technical competence is essential in Canada's semiconductor industry, but leaders and founders with business acumen are also critical for the vibrancy of the industry.

Strengthening Canada's semiconductor workforce is an important national objective. As demand for semiconductors grows, regions with a robust and sustainable supply of highly qualified personnel will be better positioned for success.

APPROACHES TO WORKFORCE DEVELOPMENT

While hiring experienced professionals remains a cornerstone of talent acquisition in Canada's semiconductor industry, particularly in talent hubs such as Toronto and Ottawa, demand for talent greatly exceeds supply. Interviewees in this study highlighted how the semiconductor industry is working to build a sustainable workforce, including by:

Partnering with universities to develop a future talent pipeline:

University partnerships provide a critical long-term solution by integrating co-op students and interns into the workforce. Institutions such as the University of Toronto and the University of Waterloo serve as key pipelines, with some companies interviewed for this study sourcing more than half of their hires from these universities' programs. One executive emphasized the importance of these collaborations, stating that "the most successful companies cooperate closely with universities by influencing curriculum and bringing in students through co-ops early on."

However, maintaining these partnerships requires sustained investment and ongoing relationship-building. For example, participation in mentorship programs diverts senior engineers from billable work, creating financial and operational challenges, particularly for smaller firms. While large companies mitigate this issue by structuring overlapping internship cycles, smaller businesses often lack the resources to implement such models effectively. Additionally, while universities provide a strong theoretical foundation, graduates often require further training to meet the contemporary industry's needs, creating a gap between academic preparation and practical application in the semiconductor industry.

Hiring experienced professionals via immigration pathways:

When local talent pools fall short, firms turn to immigration, navigating Canada's Labour Market Impact Assessment (LMIA) process to bring in PhD holders and engineers from abroad. However, firms interviewed for this study noted that this process is bureaucratically complex and time-consuming. One interviewee recounted instances when it took more than a year to secure prospective hires and bring them to Canada. In some cases, this led firms to relocate talent to foreign offices, such as those in Texas or France, rather than wait for the Canadian immigration process.

Other firms reported establishing international offices to tap into broader talent pools, but this places Canadian firms at a competitive disadvantage against global rivals who can recruit and onboard talent with fewer restrictions. Additionally, large employers noted that they tend to quickly exhaust their LMIA quota given their hiring volume and must regularly request additional allocations.

Upskilling talent from adjacent industries:

Upskilling from adjacent industries presents another avenue for workforce development, with semiconductor firms recruiting professionals from sectors such as oil and gas, physics, pharmaceuticals, and advanced manufacturing. These hires often bring transferable skills, such as cleanroom experience, engineering expertise, or materials science knowledge, which reduces the time required for onboarding. However, the adjustment period remains significant—typically around six months, even for those with relevant backgrounds. The pool of talent with directly applicable skills is also limited, making this strategy only a partial solution to the broader workforce challenge. Conversely, the aforementioned industries also compete directly with the semiconductor industry for highly qualified technical talent.

Developing their internal workforces:

Internal workforce development is crucial for training new hires and reskilling existing employees, particularly in semiconductor design and engineering. Many firms invest in extensive onboarding programs to help employees master industry-specific tools such as EDA software. However, many skillsets require long-term mentorship. In the case of analog chip design, one executive estimated that “you need mentorship for probably three to five years before you’re starting to design anything on your own.” Smaller firms often struggle to provide structured training, relying instead on informal knowledge-sharing or short-term workshops. Without a dedicated training infrastructure, the pace of skill development and knowledge diffusion remains slow, making it difficult to rapidly expand the workforce. A 2025 whitepaper produced by Ranovus calls for age-inclusive workforce development initiatives, including two-way knowledge transfer programs between experienced semiconductor workers and new semiconductor talent entering the field, to accelerate internal workforce development.⁸⁵

Addressing Canada's semiconductor workforce gap requires a coordinated, multi-faceted approach that balances short-term talent recruitment with long-term capacity development. While academic partnerships, immigration routes, and cross-sector upskilling all play vital roles, ongoing investment in internal training infrastructure and policy changes to simplify international hiring will be essential for building and maintaining a globally competitive semiconductor talent pool in Canada.

⁸⁵ Hamid Arabzadeh and Anke Schuetze, “Age-Inclusive Workforce Transformation in Tech: Why Retaining Baby Boomers Is a Strategic Imperative (Executive Brief),” Ranovus, forthcoming 2025.



JOBS AND SKILLS DRIVING CANADA'S SEMICONDUCTOR INDUSTRY

This section outlines the key jobs and skills driving Canada's semiconductor industry. It focuses on the most in-demand jobs and skills required by scope 1 semiconductor firms—those engaged in R&D and design, manufacturing, assembly, packaging, and testing, as well as companies specializing in EDA software and IP cores. Scope 2 firms were excluded to focus on roles most directly aligned with core semiconductor activities. The analysis is based on 1,593 job postings collected between January 1, 2022, and March 31, 2025.

Key Roles in the Semiconductor Industry

To identify and categorize these roles, ICTC queried a national database of Canadian job postings using its internal list of scope 1 firms in Canada's semiconductor industry. A combination of natural language processing, machine learning, and manual classification was employed to categorize the postings into four main categories and 16 subcategories. The four main job categories are:



Research, Development, and Design (e.g., semiconductor design and engineering roles, hardware engineering roles, software engineering and development roles, computer science roles, product management roles, and firmware and embedded software engineering roles),



Assembly and Test (e.g., verification and test roles, assembly and production roles, supply chain management roles, industrial and mechanical engineering and technician roles),



Operations (e.g., business administration roles, human resources roles, and enterprise information technology roles), and



Customer-Facing Roles (e.g., business development, marketing, and sales roles, customer service and support roles, and writing and communications roles).

Figure 14 provides a description of each of these categories along with examples of the types of job titles that are included in each.

Figure 14. Jobs Driving Canada's Semiconductor Industry

Research, Development, and Design Roles		
Semiconductor Design and Engineering Roles	Chip-level design and layout of analog, digital, and mixed-signal integrated circuits	e.g., Analog and Mixed Signal IC Engineer, ASIC FPGA Designer, IC Design Engineer, Layout Designer
Hardware Engineering Roles	System-level and board-level design of physical electronic hardware	e.g., Hardware Engineer, Mechatronic Engineer, Electronics Engineer, Microelectronics Engineer
Software Engineering and Development Roles	Application and infrastructure software, including cloud, ML, and simulation systems	e.g., DevOps Specialist, ML Software Developer, Software Architect
Computer Science Roles	Design and development of algorithms, models, and software infrastructure for artificial intelligence, data science, and computational geometry applications.	e.g., Machine Learning Engineer, Neural Network Development Manager, Computational Geometry Specialist, Data Scientist
Product Management Roles	Strategic oversight and lifecycle management of products	e.g., Product Manager, Product Life Cycle Specialist
Firmware and Embedded Software Engineering Roles	Low-level software tightly coupled to hardware systems	e.g., Firmware Developer, Embedded Software Leader, Firmware Integration Engineer

Assembly and Test Roles		
Verification and Test Roles	Validation of chip and system performance against specifications	e.g., Design Verification Engineer, Test Engineer, Verification Engineer
Assembly and Production Roles	Hands-on roles in fabrication, assembly, and production processes	e.g., Machine Operator, Assembler, Manufacturing Technician
Supply Chain Management Roles	Procurement, inventory, logistics, and materials flow management	e.g., Buyer, Sourcing Specialist, Logistics Manager
Industrial and Mechanical Engineering Roles	Design, maintenance, and optimization of equipment, facilities, and mechanical systems	e.g., Mechanical Engineer, Process Engineer, Facilities Technician

Operations Roles		
Business Administration Roles	Office operations, finance, and admin support roles	e.g., Executive Assistant, Office Administrator, Financial Analyst
Human Resources Roles	Talent management, recruitment, and organizational development	e.g., HR Administrator, People and Culture Manager, Recruiter
Enterprise Information Technology Roles	Internal tech support, systems administration, and enterprise IT infrastructure	e.g., IT Technician, Helpdesk Technician, IT Administrator



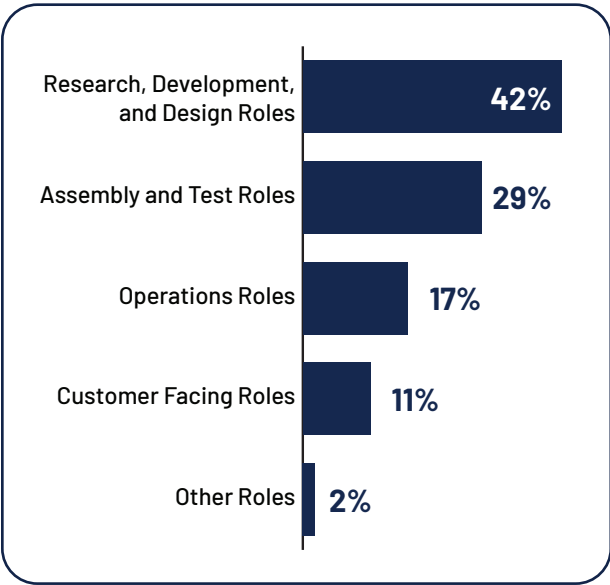
Customer-Facing Roles		
Business Development, Marketing, and Sales Roles	Outward-facing roles focused on sales, partnerships, and market growth	e.g., Business Analyst, Technical Sales Specialist, Solutions Engineer, Sales Executive
Writing and Communications Roles	Creation and management of technical documentation, marketing content, and internal communications	e.g., Technical Writer, Copywriter, Graphic Designer
Customer Service and Support Roles	Client-facing support and service roles ensuring customer satisfaction	e.g., Customer Program Manager, Customer Operations Manager

Demand for Roles in Canada’s Semiconductor Industry

Although job posting data does not fully reflect the demand for workers—mainly because of the significant reliance on direct recruitment from post-secondary institutions and personal networks in Canada’s semiconductor industry—it still provides valuable insights into roles that are otherwise hard to identify.

Figure 15 shows the proportion of semiconductor job postings by major role category. Research, development, and design roles make up the largest share (42%, followed by assembly and test roles

Figure 15. Distribution of Job Postings by Category in Canada’s Semiconductor Industry



Data Source: ICTC’s dataset of semiconductor firms in Canada, 2025; Vicinity Jobs, 2025. ICTC analysis. Job posting data collected between January 1, 2022, and March 31, 2025.

(29%. Operations (17%) and customer-facing roles (11%) represent vital support and interface functions, while a small share (2%) falls into uncategorized or miscellaneous categories. These results are supported by interviews conducted in this study, where participants consistently mentioned that most of Canada’s semiconductor workforce specialises in research, development, and design. Meanwhile, a smaller but significant segment focuses on more downstream activities like assembly and testing.

Figure 16 shows the proportion of semiconductor job postings by specific category. Semiconductor design and engineering roles dominate with 19% of all postings, emphasizing the industry’s high demand for IC and chip-level design talent, including analog and mixed-signal IC engineers, ASIC and FPGA designers, IC design engineers, and layout designers. Other significant technical roles in the data include hardware engineering (11%), verification and test (10%), and business administration (10%), indicating a balance between technical expertise and operational support.

Verification and test roles were also highlighted by interviewees as a critical component of Canada’s semiconductor workforce, with interviewees highlighting strong demand for talent capable of verifying chip design using simulation tools, characterizing finished chips, and ensuring chips meet performance standards.

The subcategory data also shows the distribution of assembly and test roles. A significant proportion of roles focused on semiconductor production—e.g., assembly and production roles and industrial and mechanical engineering and technician roles, which together account for 13% of all job postings—



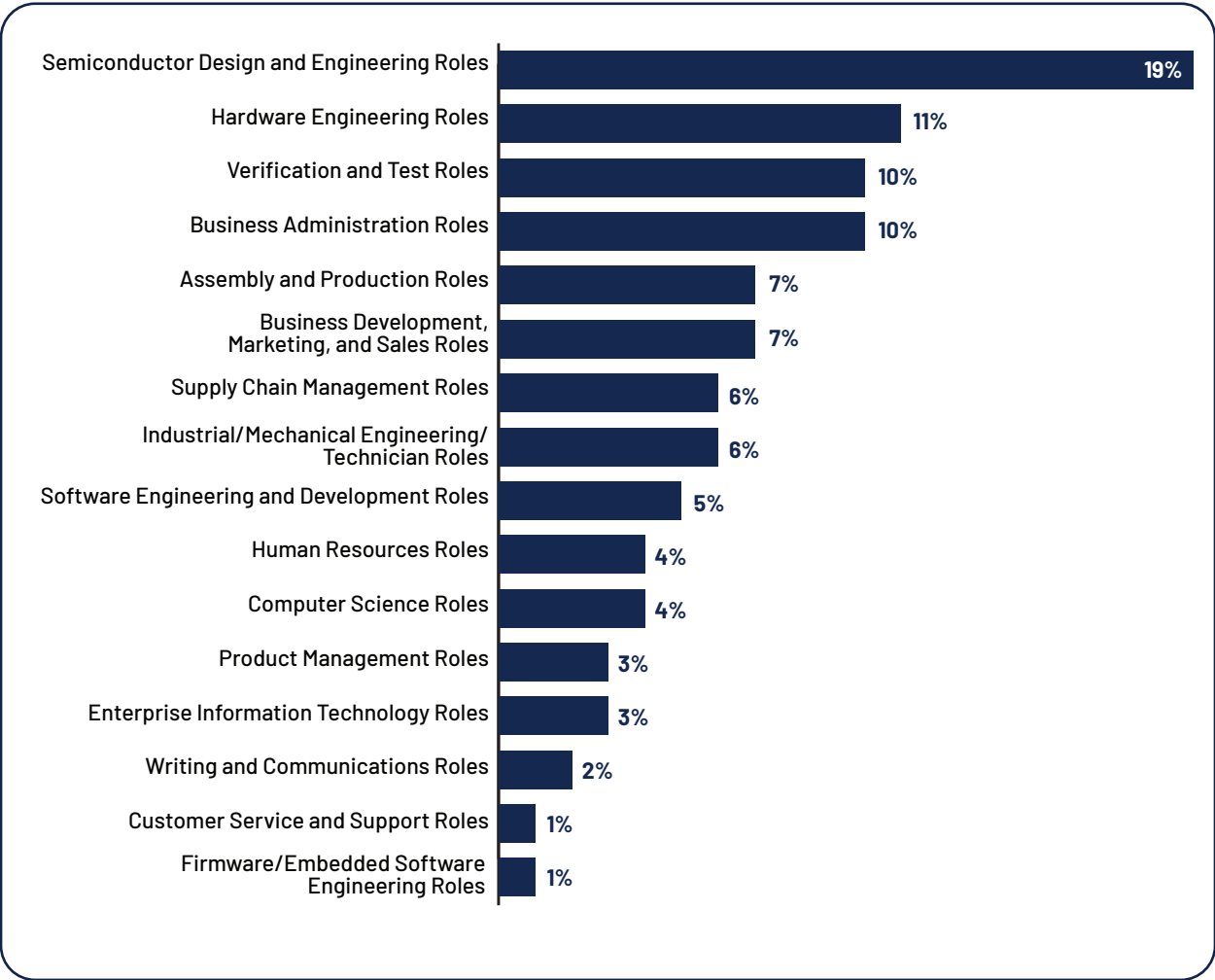
challenges the common misconception that Canada’s semiconductor industry specializes mainly in semiconductor design, engineering, and test.

The job postings dataset includes roles like mechanical engineer, process engineer, facilities technician, machine operator, assembler, and manufacturing technician. One interviewee, who runs a large organization focused on semiconductor manufacturing, also commented on the types

of roles that are most in demand within their team, highlighting roles related to maintenance and equipment engineering, manufacturing engineering, development process engineering, and project management.

Lower-frequency postings in areas such as firmware and embedded software (1%) and customer service (1%) indicate niche but nonetheless critical parts of the semiconductor workforce.

Figure 16. Distribution of Job Postings by Sub-Category in Canada’s Semiconductor Industry



Data Source: ICTC’s dataset of semiconductor firms in Canada, 2025; Vicinity Jobs, 2025. ICTC analysis. Job posting data collected between January 1, 2022, and March 31, 2025.



Demand for Skills in Canada's Semiconductor Industry

This report section outlines key in-demand skills in Canada's semiconductor industry. To identify these skills, ICTC queried a national database of Canadian job postings using its internal list of scope 1 firms in Canada's semiconductor industry. A combination of natural language processing, machine learning, and manual data sorting was used to categorize the skills into four main categories:



Technology skills



Hardware and instrumentation skill



Transferable organizational and operational skills



Social-emotional skills (i.e., soft skills)

Each of these categories is explored in more detail below.

Technology Skills

Figure 17 highlights the most frequently requested programming languages and technical proficiencies in job postings within Canada's semiconductor industry.

Python and AI top the list, appearing in over 950 postings each. Python is widely used for scripting, automation, and machine learning workflows in chip development and testing environments. Languages such as C++, Verilog, SystemVerilog, and VHDL continue to be foundational for digital design and hardware description, especially in ASIC and FPGA development. These tools enable low-level control and modeling of electronic circuits—a core requirement in chip design workflows.

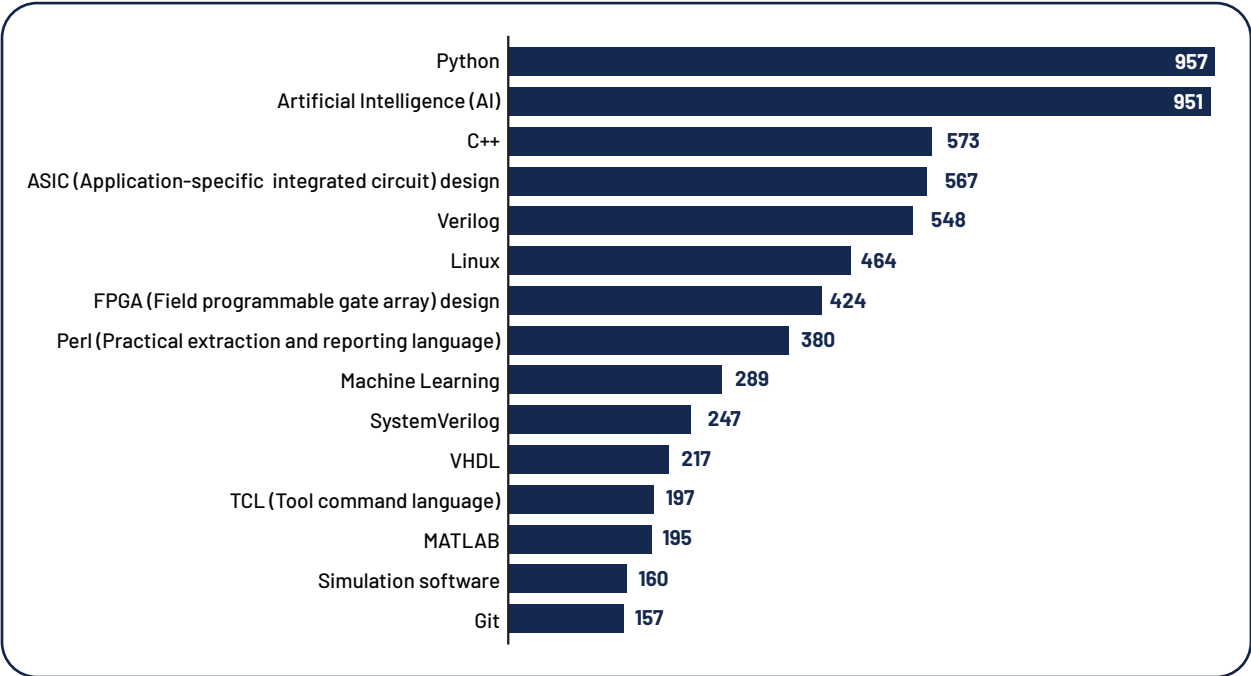
The prominence of Linux, Git, and TCL underscores the importance of development environments and version control systems in collaborative semiconductor workflows. Meanwhile, MATLAB and simulation software reflect demand for system-level modelling, signal processing, and functional validation.

Notably, FPGA, ASIC, and machine learning appear as distinct skills, further illustrating the dual demand for both hardware-specific design knowledge and the application of advanced computational methods, especially in edge AI and reconfigurable computing.

Collectively, this skill profile demonstrates that the semiconductor workforce must span deep hardware expertise, fluency in low-level design languages, and the ability to integrate and optimize intelligent systems. As the sector continues to evolve, hybrid competencies that blend traditional engineering with AI and software development will be increasingly important.



Figure 17. Frequency of Technology Skills Across Job Postings



Data Source: ICTC’s dataset of semiconductor firms in Canada, 2025; Vicinity Jobs, 2025. ICTC analysis. Job posting data collected between January 1, 2022, and March 31, 2025.

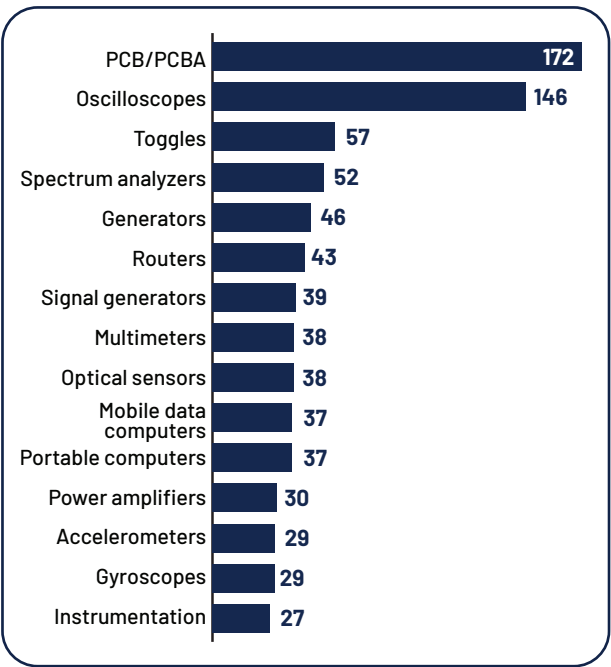
Hardware and Instrumentation Skills

As Figure 18 highlights, all the most in-demand tool and instrumentation skills cited in semiconductor-related job postings across Canada reflect practical, lab-based proficiencies required for roles in hardware testing, prototyping, assembly, and system validation.

Printed circuit board (PCB/PCBA) assembly tops the list, cited in 172 postings. This aligns with demand for technicians and engineers skilled in electronic assembly, rework, and testing of custom circuit designs. This is followed by oscilloscopes, which are a core diagnostic tool used to measure signal integrity, timing, and circuit behavior.⁸⁶ Other frequently cited equipment includes spectrum analyzers, signal generators, multimeters, and optical sensors.

The inclusion of routers, portable computers, and mobile data computers points to the growing need for skills in embedded systems, networked devices, and field-based electronics support. Additionally, tools like accelerometers, gyroscopes, and instrumentation systems indicate demand for familiarity with sensor integration, particularly in automotive, aerospace, and IoT applications.

Figure 18. Frequency of Hardware and Instrumentation Skills Across Job Postings



Data Source: ICTC’s dataset of semiconductor firms in Canada, 2025; Vicinity Jobs, 2025. ICTC analysis. Job posting data collected between January 1, 2022, and March 31, 2025.

86 “An Overview of Oscilloscopes and Their Industrial Uses,” Keysight, 2024, <https://www.keysight.com/blogs/en/tech/educ/2024/oscilloscopes>.



Transferable Organizational and Operational Skills

Figure 19 highlights the most in-demand transferable and operational skills cited in semiconductor-related job postings across Canada. These skills are applicable to semiconductor projects and teams, but are also commonly used across the economy in other industries and applications.

Project management is the top in-demand skill, cited in 441 job postings. Product management also appears in the top 15 most in-demand skills, cited in 136 job postings, as does program management, cited in 97 job postings.

These skills highlight the need for professionals who can oversee complex research and development programs, lead semiconductor projects, and develop products for the semiconductor industry. Analytical data skills and data analysis skills take the second and third top positions, highlighting the industry's strong reliance on data-driven decision making. Skills like customer service, technical support, and quality assurance also appear, and demonstrate the need for the industry to sustain highly reliable client relationships and ensure client satisfaction.

Figure 19. Frequency of Transferable Organizational and Operational Skills Across Job Postings



Data Source: ICTC's dataset of semiconductor firms in Canada, 2025; Vicinity Jobs, 2025. ICTC analysis. Job posting data collected between January 1, 2022, and March 31, 2025.

Social-Emotional Skills

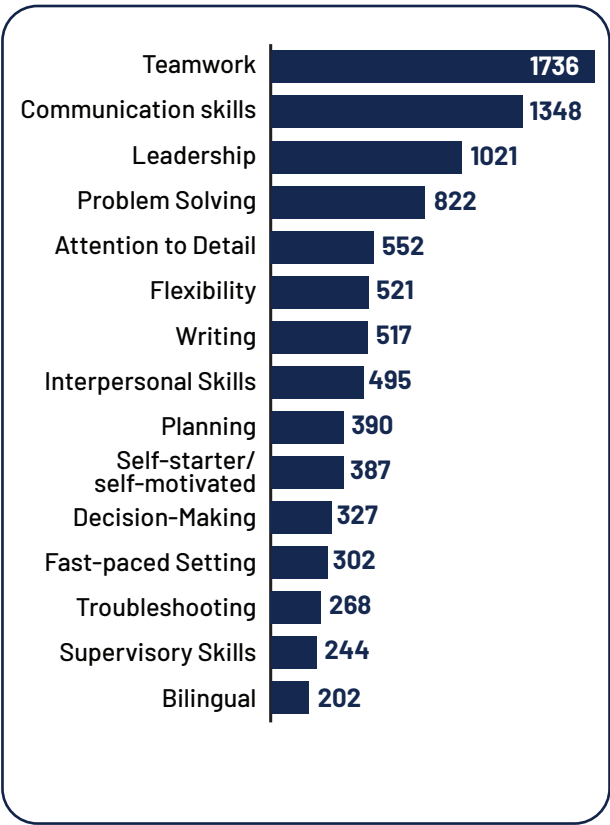
While a deeply technical industry, semiconductor firms also place significant emphasis on interpersonal and social-emotional skills. Figure 20 shows the most frequently cited interpersonal skills across job postings.

The most commonly cited social-emotional skill is teamwork, which reflects the inherently collaborative nature of semiconductor projects, involving complex teams comprised of diversely specialized talent, as well as regular collaboration with external suppliers, clients, and partner organizations. Communication skills, leadership, and problem-solving also rank highly, underscoring the need for professionals who can lead diverse teams, navigate complex situations, and clearly articulate technical ideas to a wide range of stakeholders.

Other critical competencies include writing, planning, and being a self-starter—traits especially valued in R&D, project management, and client-facing roles. The presence of decision-making, troubleshooting, and supervisory skills shows a demand for individuals who can take initiative, lead teams, and respond effectively to technical and organizational challenges.

Overall, these skills highlight that success in the semiconductor industry relies not just on technical knowledge but also on strong collaboration, adaptability, and leadership—especially as teams become more global, multidisciplinary, and integrated throughout the product lifecycle.

Figure 20. Frequency of Social-Emotional Skills Across Job Postings



Data Source: ITC’s dataset of semiconductor firms in Canada, 2025; Vicinity Jobs, 2025. ITC analysis. Job posting data collected between January 1, 2022, and March 31, 2025.



CONCLUSION AND POLICY RECOMMENDATIONS

The global digital economy is underpinned by semiconductor technology. Without these devices, modern computing hardware and electronics simply could not exist. Canada benefits from its relatively small yet dynamic semiconductor industry, which is involved in global semiconductor value chains and drives innovative microelectronic technologies—many of which are set to play a key role in advanced computing fields like AI and quantum computing.

Canadian strengths in technologies such as advanced packaging, analog and mixed-signal semiconductors, AI ASICs, compound semiconductors, MEMS, and photonics provide the country with a strong technological base to build upon in the near term, but significant barriers regarding access to talent, workforce development challenges, and industry capacity need to be addressed.

Indeed, challenges such as an aging Canadian semiconductor workforce, fierce competition for highly qualified STEM talent from other sectors of the digital economy, global competition for Canadian-trained semiconductor specialists, and gaps in Canada's training and workforce development

system all threaten to hinder the growth of Canada's semiconductor industry. Furthermore, the lack of domestic semiconductor fabrication capacity makes Canadian companies reliant on international partners for prototyping and manufacturing.

Canada faces a shrinking window to address these issues and realize its understated but strong commercial and technological potential in semiconductors. This need for change is driven by an aging workforce nearing retirement, global economic and geopolitical pressures, and rapid technological advancements in semiconductor technology made overseas.

POLICY RECOMMENDATIONS

To address these challenges, Canada could greatly benefit from the following strategic investments in the semiconductor industry:⁸⁷

1

Canadian national semiconductor strategy: Develop and implement a Canadian national semiconductor strategy that aligns federal and provincial public investments, cross-Canada ecosystem initiatives, and post-secondary training and workforce development programs. Such a strategy should capitalize on Canada's existing industrial and technological strengths in semiconductor technology and provide a future-oriented roadmap for national industrial policy regarding semiconductors. The strategy should also recognize Canada's unique role in global semiconductor value chains and speak to strategic issues like IP, supply chain security, and FDI attraction.⁸⁸ Peer economies that have developed world-leading semiconductor industries over the decades have benefited from such strategies.

⁸⁷ Also, see: "Written Submission for the Pre-Budget Consultations in Advance of the Upcoming 2025/26 Federal Budget," Information and Communications Technology Council (ICTC), Canada's Semiconductor Council (CSC), CMC Microsystems (CMC), Semiconductor Ecosystem Centre for Training and Research (SECTR), ventureLAB, April 8, 2025, <https://ictc-ctic.ca/reports/written-submission-for-the-pre-budget-consultations-in-advance-of-the-upcoming-2025-26-federal-budget>.

⁸⁸ See: Canada's Semiconductor Council (CSC), CMC Microsystems, Information and Communications Technology Council (ICTC), and ventureLAB, Submission for the Pre-Budget Consultations in Advance of the Fall 2025 Federal Budget, July 2025, <https://www.canadasemiconductorcouncil.com/initiatives#BudgetProposals>, 5.

2

Public investments in semiconductor talent development and training: Direct public investments toward targeted, industry-informed, applied training, and workforce development initiatives to address talent gaps in regional semiconductor industries. This could include support for WIL placements at leading Canadian semiconductor firms and innovative startups, as well as enhanced software-sharing programs for universities and polytechnics that train semiconductor talent. Furthermore, awareness campaigns could encourage more STEM graduates from electrical and computer engineering, computer science, and physics programs to pursue semiconductor careers.

3

Support for domestic commercialization and strategic technology IP protection: Earmark strategic investments in domestic commercialization of the Canadian semiconductor industry, including protecting the industry's IP, which may be vulnerable to foreign buyers due to limited domestic capital availability.

4

Public investments in R&D, chip design, and semiconductor manufacturing infrastructure: Direct public funding aimed at enhancing domestic semiconductor R&D, chip design, and commercial fabrication facilities to foster collaboration with partners and strengthen Canada's local semiconductor supply chain. The development of such infrastructure will also attract highly skilled semiconductor design and manufacturing talent to meet the growing global demand for Canadian semiconductor products.

5

Support for regional semiconductor innovation clusters: Implement regional funding support programs to complement national strategic investments in semiconductor manufacturing infrastructure. Such funding programs could include support for regional innovation clusters, integrating research institutions, startups, anchor firms, investors, and other ecosystem stakeholders.

6

Government procurement and industrial policy: Connect strategic government procurement in national defence, sovereign AI compute, and critical infrastructure to domestic semiconductor supply chains and Canadian-produced R&D. Use industrial policy in key sectors such as defence, aerospace, telecommunications, and automotive manufacturing to create demand for domestically-designed and secure chips to strengthen Canadian semiconductor supply chains.

APPENDIX A

RESEARCH METHODS

ICTC utilized a mixed-methods approach to map the Canadian semiconductor industry and its labour market needs. Mixed methods research fuses qualitative and quantitative research methods together into an integrated whole, allowing for data to be captured and described in a wholistic and nuanced manner.⁸⁹ Triangulating data derived from both qualitative and quantitative research methods can bolster confidence in research findings.⁹⁰

I. Review of Secondary Literature and Data

ICTC researchers reviewed existing published literature and secondary data on Canada's semiconductor industry. This review provided contextual information on the technological, economic, and policy dynamics shaping the current Canadian semiconductor industry. The review helped ICTC researchers define the scope of the study and compile an initial list of potential interviewees. Additionally, the review supported researchers in mapping Canada's semiconductor industry and structuring the subsequent analysis.

II. Key Informant Interviews

ICTC researchers conducted 27 semi-structured, key informant interviews with business leaders, senior engineers and technologists, consultants, and policy experts involved in the Canadian semiconductor industry. These interviews were held virtually from October 2024 to January 2025. The goal was to help ICTC researchers understand the industry's strengths, weaknesses, economic and historical context, challenges, and ongoing developments in Canada's semiconductor sector. The interview transcripts were coded and analyzed in NVivo using a mixed inductive and deductive approach.

III. Primary Document Analysis

A number of influential organizations within Canada's semiconductor industry provided a collection of proprietary business documents—including internal reports, proposals, presentations, business memos, emails, and meeting notes—that outline key issues and developments in Canada's contemporary semiconductor industry. ICTC researchers gathered these materials and conducted a systematic analysis to identify relevant issues and themes. The insights from this analysis helped researchers add depth and context to findings from other research methods, fill gaps in understanding, and validate their conclusions.

⁸⁹ See: Harvard Catalyst, "Community Engagement Program: Mixed Methods Research," accessed August 22, 2025, <https://catalyst.harvard.edu/community-engagement/mmr/>.

⁹⁰ See: Emerald Publishing, "How to... Use mixed methods research," accessed August 22, 2025, <https://www.emeraldgrouppublishing.com/how-to/research-methods/using-mixed-methods-research>.

IV. Semiconductor Firm Mapping

To better understand the scope of the Canadian semiconductor industry, ICTC researchers mapped semiconductor firms active in Canada. The resulting industry map is based on data provided by CMC Microsystems, Crunchbase, and data collected by ICTC researchers during the literature review and key informant interviews. In total, 248 firms were identified and mapped. Semiconductor firms were mapped using the following parameters:

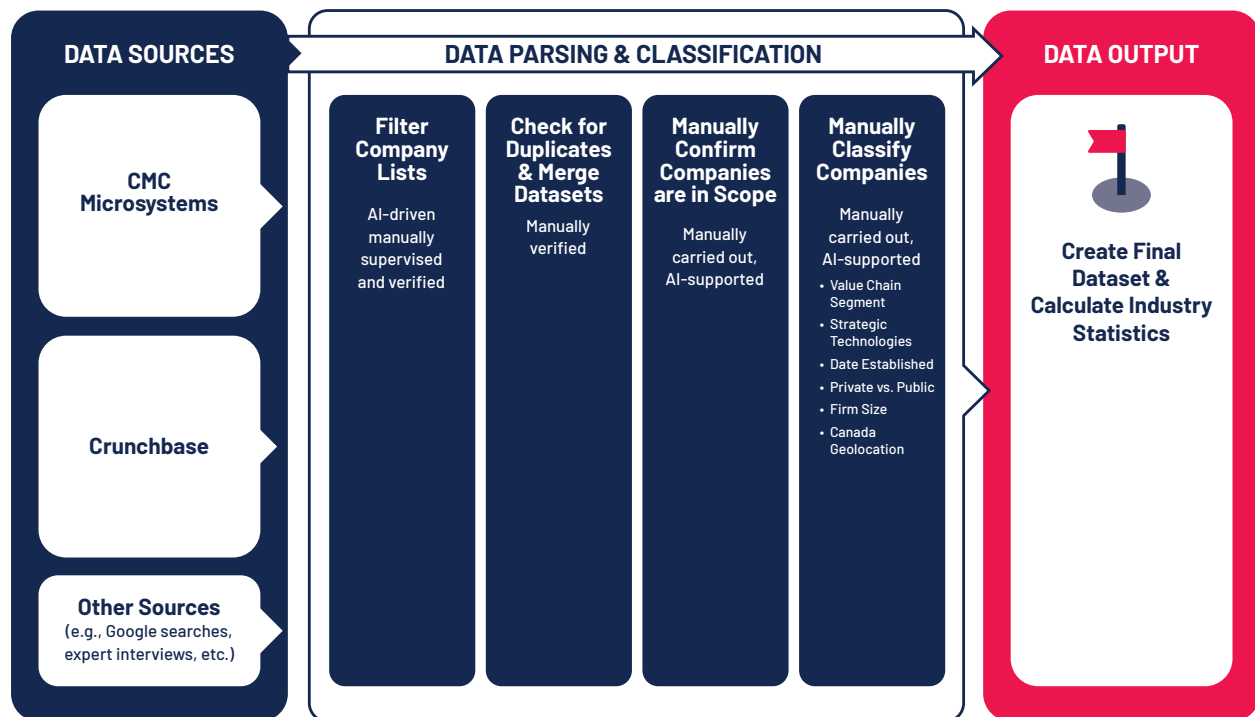
- › Assessment to determine if firm operates within the semiconductor industry.
- › Assessment to determine if firm has operations and a physical location in Canada.
- › Assessment to confirm firm is currently active.
- › Year the firm was founded (based on company website, LinkedIn page, or Crunchbase profile).
- › Location(s) firm operates (classified by province and Statistics Canada census metropolitan areas (CMAs)).
- › Estimated firm size by number of employees (micro: 1-9 employees, small: 10-99 employees, medium: 100-499 employees, and large: 500+ employees), based on estimates from Crunchbase, LinkedIn, company websites, and from key informant interviews.
- › Map firms to the semiconductor value chain segment(s) each firm operates within (i.e., R&D and design, EDA software and IP cores, manufacturing/fabrication, manufacturing equipment/repair services, material inputs supplier, assembly test and packaging, systems integration and embedded systems, specialized semiconductor distributors, electronic and semiconductor component suppliers, and other semiconductor ecosystem organizations.)
- › Map firms by strategic technologies each firms specialize in based on information provided by company websites (i.e., advanced packaging, AI chip, AI enabled chip design/EDA plug-in, analog chip, analog-to-digital/digital-to-analog conversion, chiplet platforms, chip security/cryptography, compound semiconductors, memory chips, MEMS, mixed-signal chips, photonics/silicon photonics/optical communications/infrared chips, RF chips, sensors/IoT, superconductors, quantum chips.)
- › Map firms by end-user market segment they self-report to provide products and services to based on information provided on firms' websites, under headings such as "solutions," "markets," and "industries." In cases where ICTC researchers were unable to confidently determine a firm's end-user markets, it was listed as "Undetermined" in the dataset.



Use of Generative AI to Support Industry Mapping

ICTC researchers used the generative AI tool ChatGPT to assist with the industry mapping process. ChatGPT was employed to automate the parsing of third-party firm data. This task was supervised and manually verified by ICTC researchers. Additionally, ChatGPT supported decision-making by aiding ICTC researchers in manually verifying individual firms for inclusion in the semiconductor industry map, mapping firms to their appropriate value chain segments, and identifying key technologies associated with each firm. Generative AI tools were not used to produce any written content included in this study. Figure 21 illustrates this process.

Figure 21. Use of Generative AI in Industry Mapping Process



V. Semiconductor Job Posting Data

ICTC compiled a dataset of semiconductor job postings published in Canada from January 1, 2022, to March 31, 2025, by querying Vicinity Jobs—a national Canadian job posting database—using its internal list of scope 1 firms in Canada’s semiconductor sector. Scope 1 firms include those involved in R&D, design, manufacturing, assembly, packaging, testing, and companies specializing in EDA software and IP cores. Scope 2 firms, which work in areas like materials and equipment inputs, commercial and professional services, and other supporting ecosystem activities, were excluded to focus on jobs most directly related to core semiconductor functions.

The query results were filtered to eliminate duplicate and out-of-scope postings, resulting in a final dataset of 1,593 job postings. To identify and classify these roles, ICTC used a combination of natural language processing, machine learning, and manual classification to group them into four primary categories and 16 sub-categories. In addition to categorizing the job postings by role, ICTC applied natural language processing and machine learning techniques to extract skill data from the job postings.

RESEARCH LIMITATIONS

This study employed a mixed-methods approach using primary and secondary research methods, including a review of secondary literature and data; an analysis of primary documents; key informant interviews with semiconductor industry experts; industry mapping of Canadian semiconductor firms focusing on strategic semiconductor technologies, value chain segments, and firm locations; and the collection and analysis of semiconductor job posting data.

While the outlined approach provides a rich overview of Canada's semiconductor industry, including workforce development and labour market trends, industry advantages, and key technological strengths, it is important to acknowledge study limitations:

I. Rapid Development of the Canadian Semiconductor Industry: Canada's semiconductor industry is rapidly developing, with new firms continuously entering the market and established firms ceasing operations or being acquired. Large multinational semiconductor, technology, and telecommunications firms may also enter and exit the Canadian market, significantly impacting the industry's technological capacity and employment landscape. Canada's semiconductor industry, along with the broader economy, is also influenced by global economic and geopolitical shifts, which can quickly alter the industry's positioning. Consequently, events and industry developments may outpace the data and analysis provided in this study. Keeping these dynamics in mind, this study should be viewed as a snapshot in time.

II. Industry Mapping: Industry mapping relied on publicly available data on firm characteristics such as business status, size or estimated number of employees, location(s), founding date, product and service offerings, and core semiconductor technologies. These firm characteristics are subject to rapid change and—being based on publicly available information like firm websites—may not fully reflect the true characteristics and total capabilities of some firms operating in Canada's semiconductor industry. Proprietary, non-public firm information was not used for developing ICTC's semiconductor industry map.

III. Use of Generative AI Tools for Industry Mapping: ICTC researchers employed ChatGPT to partially automate the development of the semiconductor industry map. ChatGPT was used to streamline the filtering and parsing of company lists and served as a decision-support tool for ICTC researchers when classifying semiconductor firms by value chain segment and evaluating core technologies. There is a possibility that errors could have been introduced into the industry mapping process through generative AI “hallucinations” or misinterpretation of ChatGPT output by ICTC researchers. To minimise the risk of errors, ICTC researchers supervised the automated classification process manually and verified ChatGPT's output against other sources, such as secondary literature, key informant interview data, and primary documents.

IV. Job Posting Data: While collecting and analysing job postings can provide valuable insights into labour market trends, they do not include informal hiring or the “hidden job market,” such as jobs that are never publicly posted by employers. Additionally, analysing job posting data is a retrospective exercise and does not reflect future hiring trends, like new job titles and upcoming skill requirements.

V. Key Informant Interviews with Industry Experts: Interviews with industry experts offer a rich array of insights; however, they only reflect the views, perspectives, and experiences of the individuals that ICTC researchers interviewed. Consequently, the aggregated data from key informant interviews might underrepresent the views and perspectives of certain segments of the semiconductor industry in Canada.

