Signal49
RESEARCH

# Canada's Genomics Advantage

## The Economic Impact of Genomics in Canada

IMPACT PAPER | September 16, 2026

# Contents

# Key findings

- In 2025, the genomics sector supported nearly 78,000 jobs in Canada and generated $8.9 billion in labour income, $16.7 billion in GDP, and $4.5 billion in tax revenue (federal, provincial, and municipal) through direct, indirect, and induced effects.
- A single job in the genomics sector supports an additional 1.9 jobs in the broader Canadian economy. Every dollar in direct GDP generates another $0.60 through supply-chain and household spending effects.
- By 2035, the genomics sector is projected to support more than 151,000 Canadian jobs and generate $23.2 billion in labour income, $42.6 billion in GDP, and $11.9 billion in tax revenue through direct, indirect, and induced effects.
- Canada's genomics sector comprises 100 genomics creator companies and 350 genomics implementers that apply these technologies across a wide range of industries. The sector exceeds the size of other Canadian industries, such as quantum, which includes 70 companies.
- Canada's genomics activity is heavily concentrated in core genomics (46 per cent) and therapeutics (41 per cent), with comparatively small shares in synthetic biotechnology (7 per cent), agri-genomics (5 per cent), and bioinformatics (1 per cent), indicating a strong emphasis on foundational and clinical applications.
- Canada is an international leader in health genomics and is applying this expertise and leveraging federal innovation strategies to boost productivity, resilience, and sustainability in agri-food and natural resources.

# Actionable insights

Based on the evidence identified through this research, we identify the following actionable insights for members of the Canadian genomics ecosystem to consider:

- **Increase support for research-to-venture pipelines by de-risking early-stage genomics research.** Expanding public funding for early technology readiness stage genomics research would strengthen technology validation and industry collaboration, reduce investor uncertainty, and generate more investment-ready discoveries for Canada's next generation of genomics companies.
- **Direct Canadian Genomics Strategy funding to deepen Canada's strengths in therapeutics, where global demand and venture capital interest remain strong.** Deploy funding to expand and better coordinate commercialization and scale-up supports, accelerating early market adoption in areas where Canada already performs well and can sustain world-leading advantages.
- **Expand genomic data initiatives to turn Canada's strength in generating biological sequences into real-world economic value.** Prioritize genomic data-sharing and public sector adoption to help create a stronger domestic market for sequence-based applications and accelerate technology uptake.

# Canada's genomics opportunity

## Genomics is building national resilience and economic growth as climate pressures accelerate, health threats evolve, and global competition intensifies.

From health, to agriculture, to the environment, genomics is driving innovation, sustainability, and long-term productivity. Rapid advances in genomic technologies, combined with dramatic cost reductions, faster sequencing, AI-enabled analytics, and rising global pressures are accelerating the use of genomics across clinical, agricultural, and industrial settings. Clinicians are using genomics to tailor treatments to patients[1] and treat illnesses that were once untreatable.[2] Farmers are using genomics insights to breed drought-tolerant crops and more productive livestock.[3] In forestry, researchers are using genomics to quickly detect and track destructive insect pests, enabling earlier intervention.[4] Mining companies are turning to genomics to develop more sustainable extraction methods,[5] while marine genomics is supporting monitoring of climate change and mitigation for ocean life.[6]

But we're losing ground when innovation moves from lab to market. We lack anchor firms with global reach, our data ecosystems are fragmented, and talent shortages threaten sector growth.[7]

Since 2000, the Government of Canada has invested over $1.6 billion in Genome Canada, along with $175.1 million to implement the Canadian Genomics Strategy.[8] To maximize the impact of the sizable investments in genomics, Canada would benefit from a clear understanding of where its competitive advantages lie and where targeted action can accelerate innovation, commercialization, and utilization.

Drawing on data and insights from key genomics leaders and stakeholders including Genome Canada, regional genome centres, and others in the genomics ecosystem, we conducted this research to develop an evidence-based foundation to support future strategic planning and investment decisions. We did the following:

- modelled the current and future impact of genomics across the Canadian economy;
- identified opportunities where Canada can accelerate innovation and secure a stronger position in the global bioeconomy;
- mapped Canada's national and regional genomics capabilities.

See Appendix A for our full methodology.

We found that Canada's genomics sector delivers meaningful economic impact today and is positioned for even stronger growth by 2035.

1 National Human Genome Research Institute, "Personalized Medicine."
2 Denny and Collins, "Precision Medicine in 2030."
3 Food and Agriculture Organization (FAO) of the United Nations, *Gene Editing and Agrifood Systems*.
4 Fisher, "New UBC tool may help stop a destructive insect in its tracks."
5 Defense Advanced Research Projects Agency, "EMBER"
6 van Oppen and Coleman, "Advancing the Protection of Marine Life Through Genomics."
7 Innovation, Science and Economic Development Canada, "Canadian Genomics Strategy."
8 Innovation, Science and Economic Development Canada, "Canadian Genomics Strategy."

## What is genomics?

In this study, we use the Canadian Genomics Strategy definition of genomics that defines genomics as "the science that aims to decipher and understand the entire genetic information of an organism encoded in DNA and related molecules."[9]

Advances in genomics have given rise to cutting-edge technologies and innovations that are increasingly applied across multiple sectors, including public health, food systems, and natural resources. (See Table 1.)

**Table 1**
Technologies and applications we considered in this research

| Technology | Application |
|---|---|
| Whole genome sequencing | Pathogen identification, tumor profiling, diagnosing rare genetic diseases, crop improvement, disease resistance in agriculture, food safety/traceability, and biosecurity[a] |
| CRISPR/Cas9 gene editing | Correcting mutations for genetic diseases like sickle cell anemia and beta-thalassemia, and developing advanced cell therapies (e.g., T-cells for cancer), creating disease-resistant crops, enhancing livestock traits, and engineering microbes for industrial chemical production[b] |
| Bioinformatics and AI-enabled analytics | AI is being used to analyze large genomic datasets to support personalized medicine, predict how people will respond to drugs, develop drugs more quickly, optimize biomanufacturing, and allow real-time decision-making in farming and environmental projects[c] |
| Liquid biopsies | Non-invasive diagnostics for early cancer detection, real-time monitoring of treatment response, and prenatal testing[d] |
| Metagenomics | Understanding the human microbiome and its role in health and disease, and identifying unculturable pathogens in clinical samples, studying microbial communities in environmental samples (e.g., soil, water) to improve sustainability and crop yields[e] |
| Synthetic biology | Engineering cells for advanced therapies and creating novel biological functions, such as those used in vaccine development, biomanufacturing of sustainable materials, fuels, and chemicals, and creating novel enzymes for industrial use[f] |
| Pharmacogenomics (PGx) tests | Using genetic profiles to predict individual drug metabolism and efficacy, optimizing dosages and minimizing adverse drug reactions, informing decisions in veterinary medicine and animal breeding programs to optimize treatment and feed efficiency[g] |
| Single-cell genomics | Analyzing individual cells to understand complex diseases like cancer and autoimmune disorders, leading to more targeted treatments, understanding cellular heterogeneity in industrial organisms to optimize bioproduction yields and quality[h] |
| Multi-omics integration | Combining data from genomics, proteomics, transcriptomics, and metabolomics for a holistic view of health and disease, enhancing precision medicine, integrated analysis for complex agricultural challenges like improving crop yield and resistance to climate change[i] |
| Digital genomics tools | Digital platforms and chatbots that help patients access and understand genetic information, improving genetic counseling efficiency and access to care, AI-powered knowledge solutions for life sciences and R&D to accelerate data analysis and streamline drug design for industry partners[j] |

a Canadian Food Inspection Agency, "Guidance for submitting whole genome sequencing (WGS) data to support the pre-market assessment of novel foods, novel feeds, and plants with novel traits"; U.S. Food and Drug Administration, "Whole Genome Sequencing (WGS) Program"; Center for Disease Control and Prevention, "About Whole Genome Sequencing"; Bagger and others, "Whole genome sequencing in clinical practice."
b Canada's Drug Agency, "CRISPR Technologies for In Vivo and Ex Vivo Gene Editing"; Oosthoek, "Gene Editing's Next Frontier"; National Library of Medicine, MedlinePlus, "What are genome editing and CRISPR-Cas9?"; Li and others, "CRISPR/Cas9 therapeutics."
c Canada's Michael Smith Genome Sciences Centre, "Bioinformatics & Data Analysis Services"; National Human Genome Research Institute, "Bioinformatics."
d Cheng, "Detecting Invisible Cancer"; Cleveland Clinic, "Liquid Biopsy."
e University of British Columbia, "Research Spotlight"; National Human Genome Research Institute, "Metagenomics."
f Genome British Columbia, "Synthetic Biology"; National Institute of Biomedical Imaging and Bioengineering, "Synthetic Biology."
g Verstegen and others, "Gene-based drug therapy for children and youth treated with psychoactive medications"; National Library of Medicine, "Pharmacogenetic Tests."
h Genome Canada, "Towards Single-Cell Genomics"; Cuomo and others, "Single-cell genomics meets human genetics."
i Genome Canada, "PrairieGen"; Subramanian and others, "Multi-omics Data Integration, Interpretation, and Its Application."
j Canada's Drug Agency, "Digital Tools to Access Genetic Information and Navigate Care"; Genome Alberta, "Better Tools for Bigger Data."

Source: Signal49 Research.

9 Innovation, Science and Economic Development Canada, "Overview of the Canadian Genomics Strategy."

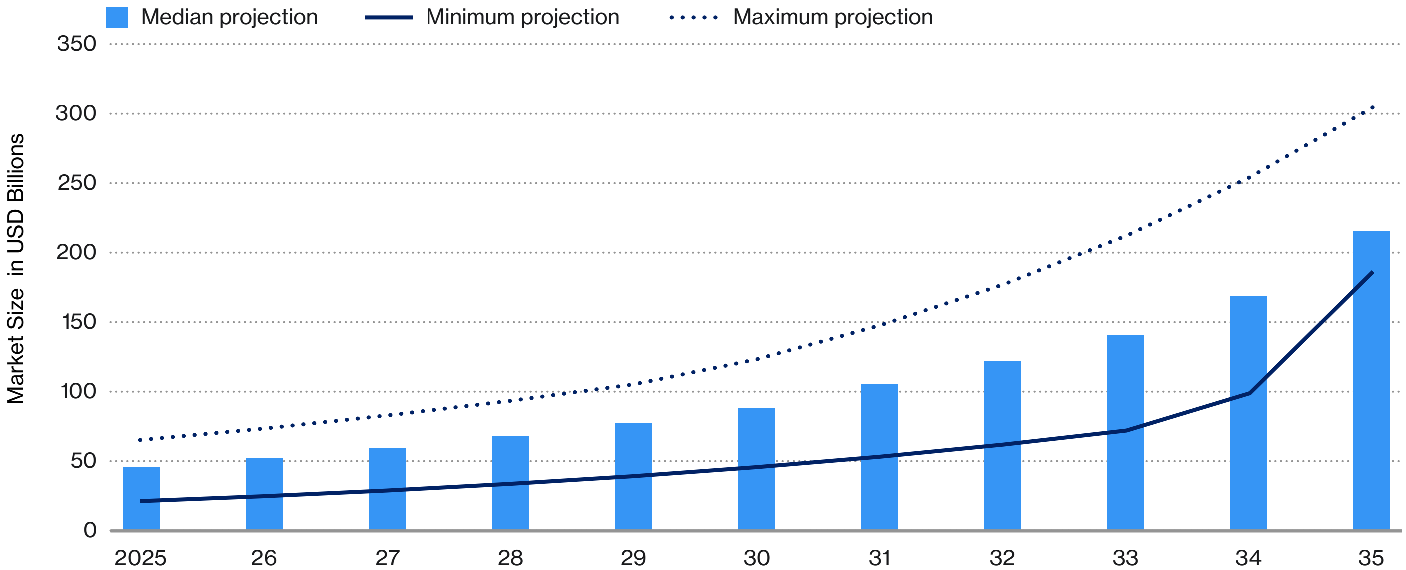
# A global genomic revolution

As genomics technologies advance and adoption increases, the global genomics market is expected to grow considerably over the next decade. (See Chart 1.) By 2030, the global market is expected to reach approximately US$88.2 billion—a 14.2 per cent compound annual growth rate. Projections for 2035 near US$215.2 billion and a compound annual growth rate of 16.8 per cent.[10]

**Chart 1**

Global genomics market size is on a strong growth trajectory

(US$ billions)




Source: Signal49 Research's analysis of forecasts by ten different market research firms (see our methodology for details).

10 The global genomics market projections used in this report only serve as a high-level reference point for understanding potential growth trajectories. The definition of the genomics sector used in global market studies differs from the firm-level taxonomy applied in our economic modelling. As a result, the revenue estimates for Canadian genomics-related firms presented in this report are not directly comparable to global market figures and should not be interpreted as the Canadian share of the global genomics market.

## What is accelerating genomics adoption?

Adoption of genomic technology is accelerating due to both technological advances, and societal and systemic factors. These changes have made applying genomics faster, cheaper, and more useful than ever before.

**Technological shifts**

- **Rapid cost declines:** Sequencing a human genome once cost about $100 million. Today it's around $500, thanks to dramatic improvements in next-generation sequencing technologies and manufacturing efficiencies.[11]
- **Faster sequencing:** What used to take months can now be done in hours.[12] This allows earlier intervention, timely disease detection, and rapid response during public health emergencies.[13] In agriculture, rapid genome sequencing helps producers and regulators identify plant pathogens and pests in almost real time, allowing quicker responses to emerging biosecurity threats and fewer crop losses.[14] In environmental and natural-resource applications, faster sequencing means that species detection and biodiversity assessments can be completed within hours or days rather than weeks, supporting timely decisions in fisheries management, invasive-species control, and ecosystem monitoring.[15]
- **AI and big data:** Modern genomics creates enormous data sets.[16] Artificial intelligence tools are being used to analyze this information quickly and accurately, making it easier to find disease-causing mutations, choose the right cancer treatments, and discover new drugs. These tools also allow researchers to accelerate applications such as developing disease-resistant soybeans.[17] In environmental monitoring, machine-learning models interpret genomic (eDNA) data to track ecosystem changes and detect invasive species in near real time.[18]

**Societal and system pressures**

- **Rising health concerns:** Cancer cases are expected to rise sharply by 2050,[19] and antimicrobial resistance is making infections harder to treat.[20] Genomics helps detect diseases earlier, tailor treatments to individual patients, and track how dangerous pathogens spread.
- **Food insecurity:** Global food demand is expected to increase by 40 per cent to 53 per cent by 2050.[21] Genomics is helping to improve livestock productivity and to develop crops that produce more and that can withstand climate stress.
- **Climate change and sustainability:** Climate change is intensifying pressures on ecosystems, forests, agriculture, and industrial systems. Genomics helps respond by enabling climate-resilient crop and tree breeding, supporting environmental and biodiversity monitoring,[22] informing sustainable forestry and land-use decisions,[23] and underpinning low-impact industrial processes such as bio-based materials.[24]
- **National security:** Genomic technologies enable rapid pathogen identification, real-time monitoring of biological threats, and the development of next-generation vaccines and countermeasures.[25]

11 Ehman and others, "The cost and cost trajectory of genome sequencing and bioinformatics analysis for Indigenous children with suspected rare diseases;" National Human Genome Research Institute, "DNA Sequencing Costs."
12 Armitage, "Fastest DNA sequencing technique helps undiagnosed patients find answers in mere hours."
13 Genome BC, "Rapid release of an easily accessible SARS-CoV-2 genome analysis pipeline."
14 Knobloch and others, "RAPiD: a rapid and accurate plant pathogen identification pipeline for on-site nanopore sequencing."
15 Sahu and others, "A systematic review on environmental DNA (eDNA) Science."
16 Subramanian and others, "Multi-omics Data Integration, Interpretation, and Its Application."
17 Singh and others, "Chapter Five—Use of artificial intelligence in soybean breeding and production."
18 Wellcome Sanger Institute, *Sanger Genomics Futures Series;* McGuire and others, *"The road ahead in genetics and genomics."*
19 Luo and Smith, "Global cancer burden."
20 World Health Organization (WHO), *Global antimicrobial resistance and use surveillance system.*
21 Food and Agriculture Organization (FAO) of the United Nations, *Gene editing and agrifood systems.*
22 Bernatchez and others, "Genomics for monitoring and understanding species responses to global climate change."
23 Environment and Natural Resources Canada, "Genomic Adaptation and Resilience to Climate Change."
24 Organization for Economic Cooperation and Development (OECD), "Financing instruments and policy levers to harness biomanufacturing for climate, biodiversity and growth."
25 Executive Office of the President of the United States, "Executive Order 14081."

# Canada's genomic research base

Canada has the potential to be a global genomics leader. Our scientific community ranks among the world's best, placing seventh globally in the number of scientific publications in biological sciences and fifth in health sciences.[26] Personalized CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats) therapy for genetic disease was made possible by research conducted at the University of British Columbia.[27]

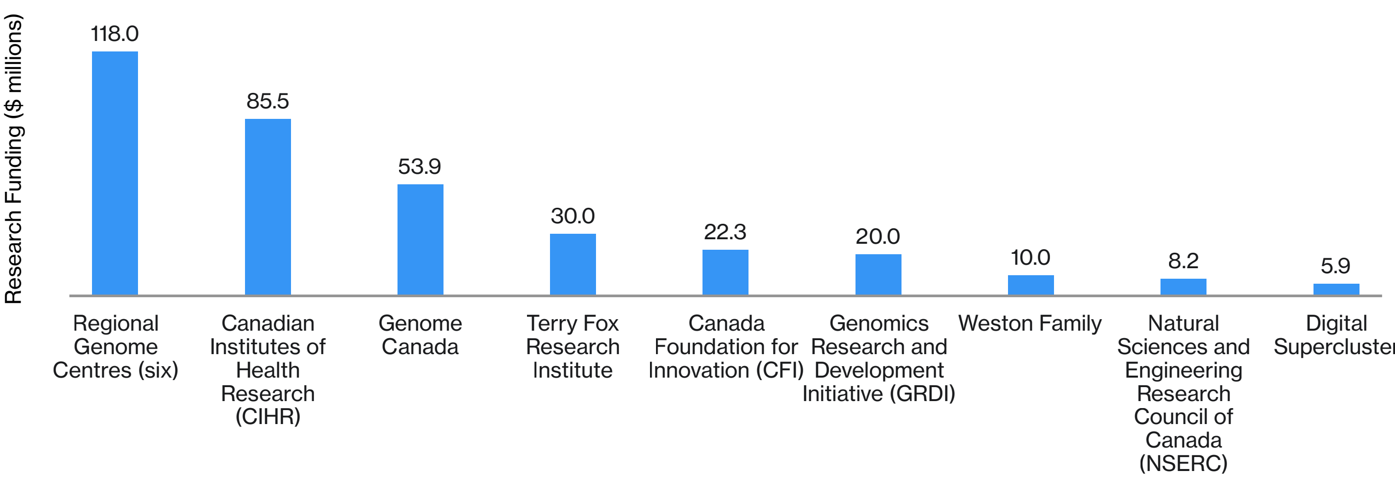
Canadian genomics research is funded through a diverse set of public, philanthropic, and science and innovation sources. (See Chart 2.) Below we summarize major sources. It is important to note that this list is not comprehensive; it is intended to give a sense of the importance of this work within Canada's research landscape and should be considered a conservative lower-bound estimate of genomics research funding.

Together, these sources provided an average of $356.5 million per year toward genomics research.[28] Sources of funding include the following:

- regional genome centres, which account for $118 million in average annual funding;
- the Canadian Institutes of Health Research, which provides an average of $86 million annually;
- Genome Canada, which contributes $54 million on average annually;
- philanthropic organizations, federal science initiatives, and innovation clusters play a secondary and important role in the genomics funding landscape.

**Chart 2**

Genomics research funding originating from different organizations
(average for the last three fiscal years, 2022–23, 2023–24, 2024–25, in $ millions)




Note: GRDI refers to the summation of spending across multiple federal departments that is genomics-specific.
Source: Signal49 Research's analysis of data obtained from Genome Canada, regional genome centres, websites of other organizations, government of Canada open data portal.

26 Nature, 2025 Research Leaders.
27 Government of Canada, Canadian Genomics Strategy.
28 Government of Canada, Canadian Genomics Strategy.

# From research to innovation

## Canada's genomics economy

Canada's genomics sector comprises 450 firms including both creator (100 firms) and implementer firms (350 firms), exceeding comparison sectors such as quantum that has 70 companies.[29]

**Creators** form the research and development (R&D) core of the ecosystem.[30]

- 67 companies are genomics creators whose primary focus is studying DNA and its interactions;
- 33 companies are diversified creators that derive most of their revenue from non-genomics activities.

**Implementers** apply genomics tools, data, and methods to develop products and services across multiple sectors such as health, agriculture, environment, natural resources, and manufacturing.

- 90 genomics-driven implementers rely on genomics as a core input into their commercial offerings;
- 260 genomics-enabled implementers use genomics in a supporting role within more diversified product lines.[31]

While most genomics companies are in the healthcare sector, genomics is also being deployed across food systems, environmental management, and resource-based industries, underscoring its role as a cross-cutting technology with relevance well beyond just the health sector. (See Chart 3.)

29 Lindzon, "Canada 'a sweet spot' for growing quantum computing industry, expert says."

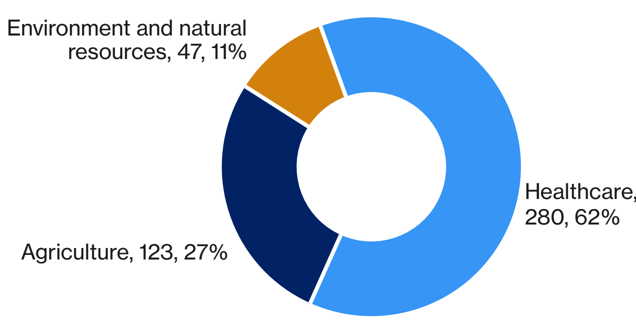
30 These companies mostly correspond to the ones identified in the Statistics Canada report prepared for the Canadian Genomics Strategy (CGS) Secretariat, "Analysis of Statistics Canada demographic and financial data of genomics companies in Canada, 2012–2023."

31 Beyond the implementers identified here, the continued diffusion of genomic tools and applications is expected to benefit hundreds of additional organizations over time, as genomics becomes increasingly embedded across value chains.

**Chart 3**

Sectoral breakdown of Canadian genomics companies

(number and percentage of companies)




Source: Signal49 Research.

## Canada's patent performance

Patents are a critical indicator of the transition from research to innovation as they signal when knowledge is being intentionally protected, positioned for commercialization, and aligned with competitive advantage in global markets, rather than remaining purely academic output.[32] Understanding genomic patent trends for Canada is a vital step to assessing innovation strengths and opportunities.

32 Sonmez, Intellectual Property in Canada.

## A global hub for biological sequences

Canada holds a sequence inventory that is unusually large relative to its population size and economy. With nearly 34.3 million disclosed biological sequences, Canada ranks second globally, ahead of Japan and behind the United States. (See Chart 4.)

Biological sequences embedded in biotechnology patents define the specific molecule, variant, or construct at the heart of the invention[33] and the scope and enforceability of the associated intellectual property. As a result, sequences are often the mechanism through which genomics discoveries become protectable commercial assets.[34]

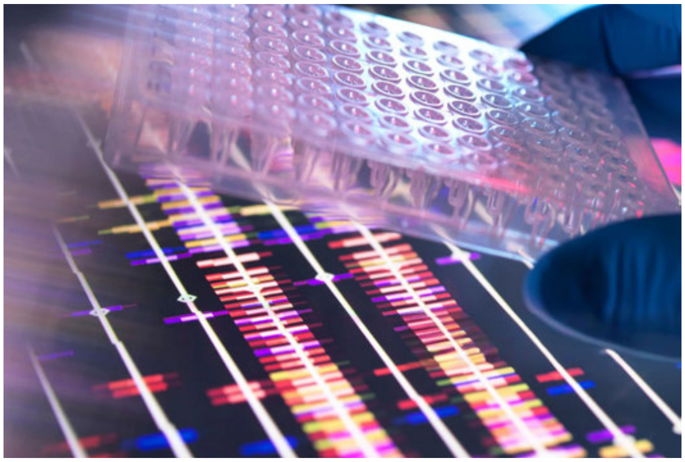
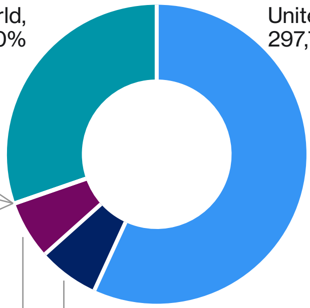


**Chart 4**

Biotechnology patents filed in Canada contain approximately 7 per cent of all biological sequences disclosed worldwide

(number and percentage of total biological sequences)




Note: No data was available for Italy (another G7 country). In addition, the Lens database does not include data for China, which is an increasingly important player in genomics.
Source: Signal49 Research's analysis of the PatSeq Data from Lens.

Strong sequence holdings signal research strength, attract investment, and enable firms to operate globally without infringing on existing IP.[35] Countries with large sequence portfolios tend to be hubs for clinical trials, licensing deals, biomanufacturing, and partnerships. Strong sequence portfolios can also accelerate adoption: precise sequence claims support regulatory approvals, validation frameworks, and procurement decisions across health, agriculture, environment, and natural-resource applications.[36]

As the second-largest repository of disclosed biological sequences in patent filings worldwide, including filings from both domestic and international organizations, Canada is a valuable market and regulatory environment for securing rights to foundational biological materials. Strengthening the mechanisms that help Canadian researchers and firms translate discoveries into protected IP would allow us to capture more economic value.

33 World Intellectual Property Organization (WIPO), *Handbook on Intellectual Property Information and Documentation.*

34 Policy Horizons Canada, *Commercialization of Biological Data.*

35 Organization for Economic Cooperation and Development (OECD), "OECD Science, Technology and Industry Scoreboard."

36 Riess and others, "Genomes in Clinical Care."

## Canada's active genomics patent portfolio[37]

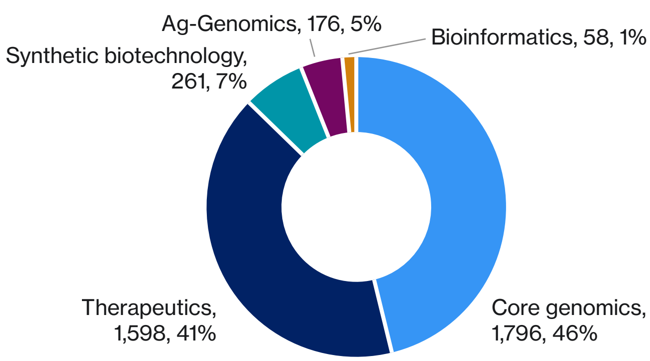
While Canada's genomics research base is internationally competitive, realizing its economic potential depends on how effectively discoveries move from labs into protected, investable IP. Patents are a critical mechanism for this conversion: they underpin firm creation, attract capital, and enable participation in global markets.[38] As of 2024, Canada's 3,889 active genomic patent families are divided as follows (see Chart 5):

- 1,796 (46 per cent) involve core genomics, including sequencing chemistries, molecular assays, platforms, and multi-omics methods;
- 1,598 (41 per cent) involve therapeutics, including gene and cell therapies, oligonucleotides, vectors, editing systems.

**Chart 5**

Core genomics and therapeutics patents dominate Canada's genomics portfolio

(number of active patent families)




Source: Signal49 Research's analysis of the European Patent Office's PATSTAT Global patent dataset.

Smaller but other important areas include the following:

- 261 patents (7 per cent) in synthetic biotechnology, including engineered organisms, metabolic pathway design, bioprocess intensification;
- 176 patents in ag-genomics (5 per cent), including those related to genomic selection, trait development, and crop/livestock health;
- 58 patents (1 per cent) in bioinformatics, including algorithms, pipelines, data models, decision-support.

37 Patent documents disclosing biological sequences filed at the Canadian Intellectual Property Office (CIPO) include applications from both domestic and foreign organizations, reflecting overall activity within the Canadian patent system. In contrast, counts of active patent families refer only to those held by Canadian organizations. As a result, a strong performance in sequence disclosures does not necessarily indicate similarly strong patent ownership or control by Canadian firms.

38 Sonmez, *Intellectual Property in Canada.*

## Genomics venture capital

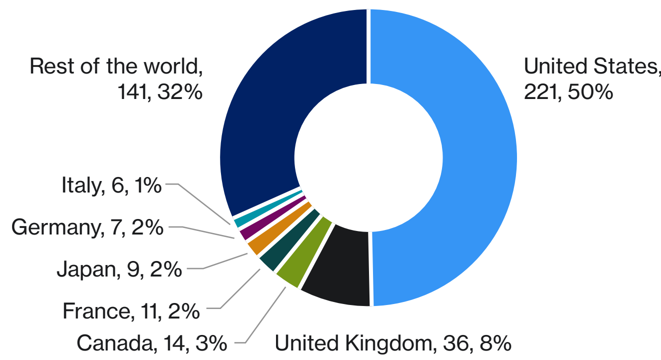
Canada places comparatively greater value on genomics than on other venture-capital-supported technologies. Venture capital activity highlights this pattern clearly. Canada has 14 venture-capital backed genomics companies, ranking third among G7 countries, behind only the United States with 221 companies and the United Kingdom with 36 companies. (See Chart 6.)

While Canada accounts for a modest share of the 445 VC-backed genomics companies identified globally, its performance in genomics exceeds its broader VC position, where Canada ranks just sixth among G7 nations.[39] This divergence indicates that Canadian investors show a stronger relative preference for genomics than for other technology areas within a smaller national VC market. Canadian investors demonstrate clear willingness to engage. Expanding the pipeline of high-quality, patent-protected inventions will help translate this interest into sustained investment, commercial outcomes and ultimately broad societal and economic benefit.

**Chart 6**

Canada ranks third amongst G7 countries in VC-backed genomics companies

(number of companies, per cent of total)




Source: Signal49's analysis of data from CB Insights.

39 This is based on our analysis of CB Insights proprietary database. See our Methodology for full details.

# The value of Canadian genomics today

Based on Signal49 Research's proprietary input-output model, conservative estimates of genomics activity in Canada in 2025 show that it supported between 41,000 and 108,000 jobs, between $8 billion and $23.3 billion in GDP, between $2.3 billion and $6.3 billion in tax revenue. Based on mid-point estimates, the genomics sector supported nearly 78,000 jobs in Canada and generated $8.9 billion in labour income, $16.7 billion in GDP, and $4.5 billion in tax revenue. (See Table 2). It is important to note that not all genomics activity is captured due to data availability.

Each job in genomics supports an additional 1.9 jobs across supplier industries and the broader economy. Each dollar of direct GDP generates $0.60 in further economic activity through supply-chain and household spending effects. The largest share of this contribution comes from direct economic activity, which encompasses the activities of genomics creators and implementers, high-skill jobs in the sector, laboratory activity, and the production of genomics-enabled goods and services.

## What are direct, indirect, and induced economic impacts?

The economic footprint of the sector is estimated using Signal49 Research's Economic Impact Assessment model. (See Appendix A.) Economic impacts are measured in three ways:

- **Direct impact** captures the economic value-added from organizations conducting genomics R&D and genomics companies as they make genomics discoveries and produce genomics products, respectively.
- **Indirect impact** (or supply-chain impacts) measure the value added generated by upstream firms that sell goods and services to genomics companies, reflecting the economic activity stimulated through the intermediate purchases made by organizations conducting genomics R&D and genomics firms.
- **Induced impact** captures the knock-on effects of household spending by employees of firms that directly or indirectly supply goods and services to genomics companies, reflecting how income earned through these supply-chain activities circulates through the broader economy.

**Table 2**

Economic impacts of the genomics sector in 2025 (midpoint estimates)
(monetary figures are in $ thousands)

| Impact type | Employment | Labor income | Value added (GDP) | Output | Tax revenue |
|---|---|---|---|---|---|
| Direct | 27,158 | 5,343,919 | 10,269,251 | 17,066,455 | 2,359,479 |
| Indirect | 24,703 | 1,916,664 | 3,039,976 | 5,578,437 | 1,019,583 |
| Induced | 26,052 | 1,596,105 | 3,397,955 | 5,986,575 | 1,137,229 |
| **Total** | **77,913** | **8,856,688** | **16,707,183** | **28,631,467** | **4,516,291** |
| *Multiplier* | *2.9* | *1.7* | *1.6* | *1.7* | *n.a.* |

Source: Signal49 Research.

Indirect impacts arise as organizations conducting genomics R&D and genomics companies purchase a wide range of inputs from Canadian-based suppliers, including routine laboratory supplies, logistics and facility services, professional and technical services, software, data storage, utilities, engineering, and financial services. While some highly specialized genomics equipment and consumables—such as sequencing platforms and reagent kits—are sourced primarily from international suppliers, these inputs represent only a subset of total operational expenditures. The input-output model used in this study explicitly accounts for such import leakages and therefore limits indirect impacts to purchases from Canadian suppliers only. Broader economic effects are captured through induced impacts, as workers employed in organizations conducting genomics R&D, genomics firms, and their domestic supply chains spend their earnings across the economy, supporting sectors such as retail, housing, transportation, and food services, ensuring that estimated supply-chain impacts accurately reflect the structure of the Canadian economy.

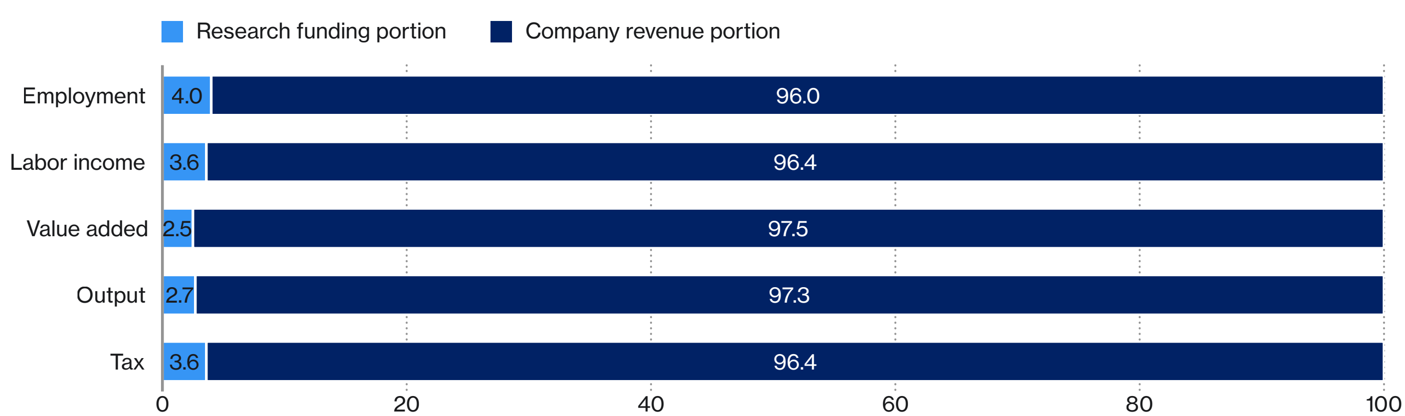
Genomics company revenue represents the largest share of the total economic impact of genomics. In 2025, company revenue accounted for approximately 97 per cent of all jobs, GDP, and tax contributions generated by the sector with the remainder coming from the impacts of research funding.[40] (See Chart 7.)

While company revenue drives most of the measurable economic value from the sector, public research funding plays an essential role in seeding innovation, talent pipelines, and foundational scientific advances that ultimately fuel commercial expansion. The Government of Canada and non-profit organizations inject hundreds of millions of dollars into the genomics sector in the form of research and development spending annually. Strengthening Canada's commercialization pathways and ensuring publicly funded research transitions into high-growth firms is essential for capturing the full economic potential of genomics.

**Chart 7**

Company revenue accounts for most of total genomics sector economic impact

(per cent)




Source: Signal49 Research.

40 While this analysis draws on major federal funding organizations to estimate genomics-related research investments in Canada, it does not capture the full spectrum of potential funders. Other contributors may also support genomics research but were not included due to data availability. As a result, the funding totals derived through this approach are likely conservative. Accordingly, the estimated economic impacts associated with genomics-related research funding in this study should be interpreted as a lower-bound estimate, reflecting only the subset of identifiable funding sources rather than the entirety of the genomics funding in Canada.

# Looking ahead: Economic potential of genomics to 2035

Canada's genomics sector is expected to play an increasingly important role in the national economy over the next decade. Technological advancements, sectoral changes, and societal imperatives are driving change internationally and at home. Using mid-point estimates, we project conservatively that genomics-related activity by 2035 will support more than 151,000 jobs across the economy, generate $42.6 billion in GDP, and generate $11.9 billion in tax revenue. (See Table 3).

The largest economic contribution comes from the direct economic activity generated within organizations conducting genomics R&D and genomics companies themselves. The direct economic impact from these organizations and genomics firms represents approximately 62 per cent of the sector's projected overall contribution to Canada's GDP in 2035.

The remaining economic contributions arise from indirect and induced impacts (representing about 18 per cent and 20 per cent, respectively). Growth in the sector will stimulate demand across a broad network of suppliers as organizations conducting genomics R&D and genomics firms procure specialized inputs, from biotechnology manufacturing and lab equipment to data analytics, engineering, and logistics. Additional economic value arises from household spending by workers employed in the sector and its supply chain.

In 2035, a single job in genomics is expected to support an additional 1.6 jobs across the economy. By this year, each dollar in direct GDP is expected to generate $0.60 in additional economic activity through supply-chain and household spending effects.[41]

**Table 3**
Projected economic impacts of the genomics sector in 2035 (mid-point estimates)
(monetary figures are in $ thousands)

| Impact type | Employment | Labor income | Value added (GDP) | Output | Tax revenue |
|---|---|---|---|---|---|
| Direct | 58,978 | 14,278,578 | 26,290,342 | 43,645,270 | 6,236,650 |
| Indirect | 45,765 | 4,864,915 | 7,714,063 | 14,128,089 | 2,659,107 |
| Induced | 46,793 | 4,055,680 | 8,634,084 | 15,207,311 | 2,970,088 |
| **Total** | **151,535** | **23,199,173** | **42,638,488** | **72,980,671** | **11,865,845** |
| *Multiplier* | *2.6* | *1.6* | *1.6* | *1.7* | *n.a.* |

Source: Signal49 Research.

41 Please see Methodology in the Appendix for more information on multipliers.

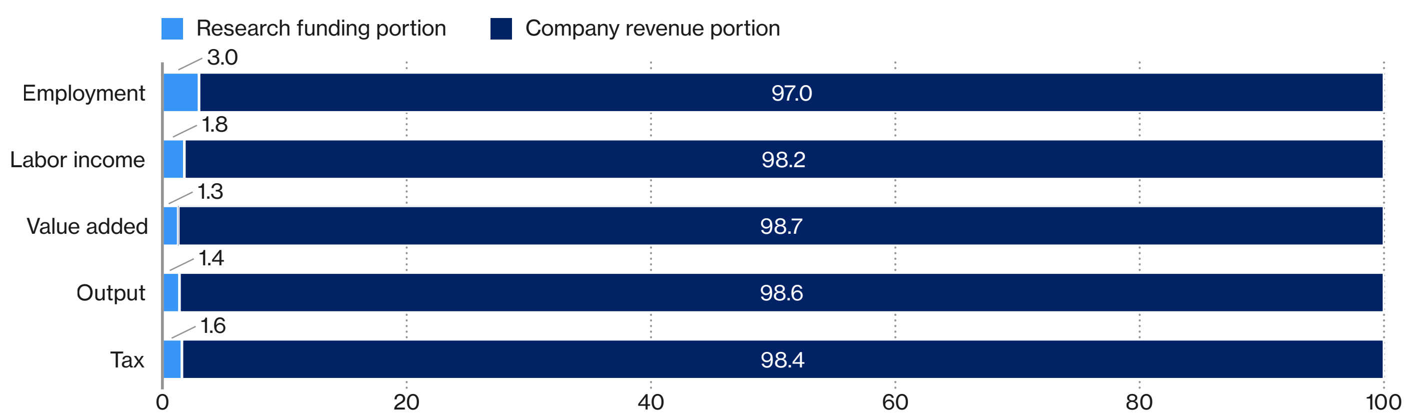
Company revenue still accounts for most jobs, GDP, and tax contributions across the economy, far outpacing the impacts generated by public research funding in 2035. (See Chart 8.) Canada's long-term economic gains from genomics will depend heavily on strengthening industry capacity and commercialization pathways, as company revenue continues to represent the largest share of genomics' total economic impact.

While public research funding remains foundational to Canada's genomics sector, its relative contribution to the sector's overall economic impact is projected to decline by 2035 as commercial activity expands. In 2025, research funding accounted for 4.0 per cent of all genomics-related employment impacts, 2.5 per cent of GDP impacts, 3.6 per cent of tax impacts; by 2035, these shares are projected to fall to 3.0 per cent, 1.3 per cent, and 1.6 per cent, respectively. Canada's long-term economic gains from genomics will increasingly depend on the scale and competitiveness of its private companies. Strengthening the pathways that convert publicly funded research into high-growth companies will therefore be essential to sustaining the sector's expanding economic footprint.

**Chart 8**

Company revenue accounts for most of total genomics sector economic impact in 2035

(per cent)




Source: Signal49 Research.

# Further ahead: Technologies and opportunities to 2050

Genomics technologies are already beginning to function as persistent, system-level infrastructure rather than stand-alone research or diagnostic tools, and this shift is accelerating. Permanent sequencing and analytic capabilities are now embedded in hospitals, public health agencies, and research centres. Beyond health, biodiversity genomics initiatives such as the Centre for Biodiversity Genomics[42] and global efforts like the International Barcode of Life[43] and the Earth BioGenome Project[44] are establishing continuous, large-scale sequencing systems that function as enduring infrastructure for monitoring and cataloguing life on Earth. Governments are investing in shared genomic infrastructure across health, agriculture, and environmental domains. Foresight from the Wellcome Sanger Institute and Wellcome anticipates a future where continuous genome sequencing, multi-omics profiling, and molecular sensing are embedded across health systems, food systems, and natural environments at population scale.[45] This trajectory reflects a fundamental change in how genomics is used and governed, rather than incremental technical improvement alone.

In the next 25 years, genomes could be monitored over time, allowing changes to be detected early and intervention to happen ahead of disease, system failure, or environmental degradation. In healthcare, this approach enables anticipatory and preventive models in which genomic insight integrates routinely into screening, risk stratification, and treatment decisions across the life course.[46] Instead of slow and expensive drug development, scientists could simulate ideas before real-world testing, shortening development timelines and decreasing late-stage failures.[47]

In environmental genomics, large-scale environmental DNA (eDNA) sampling across marine, forest, and microbial ecosystems could allow identification of novel bioactive molecules from organisms that previous methods could not access.[48] In synthetic biology, genome-scale design and AI-guided validation may make it possible to reliably engineer organisms for medical, industrial, and environmental applications. As a result, synthetic biology could move beyond experimental platforms into expanded industrial and tightly regulated applications.[49]

42 Centre for Biodiversity Genomics, BIOSCAN.

43 International Barcode of Life, Home page.

44 Earth BioGenome Project, "Sequencing Life."

45 Wellcome Sanger Institute, *Sanger Genomics Futures Series;* Wellcome, *Genomics: navigating the future.*

46 Wellcome, *Genomics: navigating the future;* Green and others, *"Strategic vision for improving human health at the forefront of genomics."*

47 Wellcome Sanger Institute, *Sanger Genomics Futures Series;* McCafferty, *"A new AI strategy to power genomic science at Sanger";* McGuire and others, *"The road ahead in genetics and genomics."*

48 Wellcome Sanger Institute, *Sanger Genomics Futures Series;* McGuire and others, *"The road ahead in genetics and genomics."*

49 Wellcome Sanger Institute. *Sanger Genomics Futures Series;* Green and others, *"Strategic vision for improving human health at the forefront of genomics";* McGuire and others, *"The road ahead in genetics and genomics."*

Artificial intelligence (AI) is already central to these transformations, and its role is expanding rapidly. AI systems are now used to integrate and analyze large-scale biological data, linking information on DNA, proteins, chemicals, patients, and the environment. By 2050, continued advances are expected to make AI-enabled biological interpretation faster and more widespread, supporting real-time, system-level decision-making at population scale. Instead of just analyzing data after the fact, AI could help scientists predict how cells and molecules will behave in near real time.[50] These capabilities speed up research and discovery across medicine, agriculture, and bio-manufacturing.[51]

Genomics is also anticipated to underpin climate and sustainability efforts by 2050. It supports approaches to biologically degrade plastics, design low-carbon bio-production pathways, and deliver climate-resilient food security.[52] Advances in computing, including quantum computing, push these capabilities even further. They allow scientists to model protein behaviour and gene regulation in ways that are not possible today, opening new areas of biological understanding.[53]

Overall, by 2050, genomics is likely to operate in concert with AI and quantum computing, forming an integrated technological fabric in which biological sensing, prediction, and design are continuously informed by advanced computation and learning, and embedded across everyday systems. These systems will span multiple sectors of society and underpin improvements in health, productivity, and sustainability.

50 McCafferty, "A new AI strategy to power genomic science at Sanger."

51 Wellcome Sanger Institute, *Sanger Genomics Futures Series;* McCafferty, "A new AI strategy to power genomic science at Sanger."

52 Wellcome Sanger Institute, *Sanger Genomics Futures Series;* Wellcome. *Genomics: navigating the future;* Green and others, "Strategic vision for improving human health at the forefront of genomics"; KPMG, *2025 Futures Report.*

53 McGuire and others, "The road ahead in genetics and genomics"; KPMG, *2025 Futures Report.*

# One science, many sectors

Genomics is a powerful, enabling technology that can strengthen multiple Canadian industries, making them more sustainable, resilient, and productive. Increasingly embedded across health, agriculture, and natural-resources, genomics is improving decision-making, increasing productivity, and enabling new forms of value creation. These sectors employ millions of Canadians and make up a large share of Canada's GDP and exports. Examining how genomics is being applied within these sectors demonstrates its potential beyond labs and start-ups, delivering tangible economy-wide benefits.

## Precision health transformation

### Scale of the sector

The health sector is a cornerstone of Canada's domestic economy. In 2025, it employed 2.93 million people (13.9 per cent of national employment) and generated $175.5 billion in GDP (7.5 per cent of total output).[54] Although it is not export-oriented, its scale and centrality to population well-being make its performance vital to long-term prosperity.

### Scale of the challenge

Canada's health system is increasingly strained. Our population is aging, with the number of seniors now outnumbering children and projected to comprise more than a fifth of Canadians by the end of the decade. At the same time, shortages of doctors and nurses mean that millions of Canadians do not have access to primary care. Rapidly rising healthcare costs are growing faster than the overall economy, further straining public finances and threatening the sustainability of the system.[55] The healthcare sector needs new approaches that improve patient outcomes, prioritize prevention, and promote equitable health outcomes.

### Scaling solutions

Genomics offers a powerful way forward. Using genomics technologies, healthcare can shift from reacting to illness after it appears, to predicting risk, catching disease earlier, and tailoring treatment to individual patients. Advances in genome sequencing, now far faster and cheaper than a decade ago, make it possible to use DNA and other biological data at scale.[56]

Genomics is already improving healthcare in tangible ways, including the following:

- **Earlier detection:** Genomics supports precision diagnostics, such as non-invasive prenatal screening, carrier screening, and blood tests that can detect certain cancers earlier.[57]
- **Better identification of health risks:** Risk can be determined more precisely, allowing clinicians to focus attention on patients and to target interventions. [58]
- **More efficient drug development:** Using genomics technologies, new medicines take less time to develop, can be designed more deliberately, and are more likely to work.[59]

Some of the most visible progress has been in the development of new treatments for serious diseases. Gene- and cell-based therapies are now being used to address the underlying causes of certain conditions rather than just treating symptoms, offering new hope for patients with inherited disorders, cancers, and other complex illnesses.[60]

54 Signal49 Research's analysis of Statistics Canada data (Table 12-10-0166-01; Table 36-10-0434-06; Table 14-10-0202-01). Monetary figures are in 2017 constant dollars.

55 KPMG, *Healthcare Horizons Revisited.*

56 Chui and others, *The Bio Revolution.*

57 Chui and others, *The Bio Revolution.*

58 Chui and others, *The Bio Revolution.*

59 Thomas, Rigett, and Pope, *Driving Value from Genomics in Life Sciences.*

60 Deloitte, "xTech Futures."

Over the next decade, the convergence of genomics, AI, and synthetic biology is expected to transform health systems by decentralizing diagnostics, enabling targeted therapies, improving R&D productivity, and addressing an estimated 45 per cent of the global disease burden with technologies scientifically feasible today.[61]

This transformation will support shorter clinical pipelines, more individualized therapies, enhanced population-level disease forecasting, and, ultimately, a shift toward longer, healthier lifespans.[62]

## Company spotlight: AbCellera

**Primary sector:** Healthcare
**Location:** Vancouver, B.C.
**Size:** 501–1,000 employees
**Established:** 2012
**Website:** http://www.abcellera.com

**AbCellera is a biotech company that searches immune cells to find antibodies that could become new medicines. We spoke with Carl Hansen, Chief Executive Officer, to understand how genomics underpins the company's mission and the broader challenge of scaling biotech in a global market. He emphasized that long-term growth requires a mix of sustained capital, world-class science, and the ability to compete against much larger players.**

**Signal49:** What challenges do you face?

**Carl Hansen:** The challenge, not just for us, but for the country and for genomics, is that not enough serious work goes into the translation and building of companies. Often, it's because the company side, or ideas, are too small, and they'll never scale and stay. To capture the value of [genomics], you need to build a company at scale because healthcare and genomics is not a Canadian market, it's a global market, and you need to compete against the biggest companies in all jurisdictions [including the U.S. and China]. But Canada has never had a biotechnology company that got to scale, so the challenge is how do you get a company from where we are to [be] an anchor company. ... The biggest challenge that I face is, 'How do you keep the lights on and the capital flowing and the competitive position going long enough to get to that critical mass where the thing now is sustainable in the long term?'

**Signal49:** What are the tangible benefits and value for Canada that we are realizing from using genomics?

**Carl Hansen:** In our firm, it's been the capital that's attracted to the country. To date, it's probably equity capital and revenue approaching $2 billion. From the beginning, it's the jobs and the tax base. We've put up infrastructure here, so there are 450,000 square feet of advanced lab space right here that would not exist without us. We built that from scratch, and it's helped to create, in my view, what is quickly becoming a hub for this kind of work that has the real potential to bring together the strengths we have in genomics. We have hospitals, we have advanced therapeutics, and the infrastructure works together to create these synergies.

Right now, there are gene therapies that were developed in the last five years or so – kids who were completely blind can get these therapies and walk away, and [these same] kids who couldn't see anything can now navigate a maze. There are cancer patients who were condemned to death and now can get immunotherapies – and when it works, you come back into the hospital, your CAT scan is clean, and you go home to your family. There are people with completely debilitating autoimmune conditions who are condemned to suffering forever, and they get drugs and [can then] function just like you and me. And that's all within the last 10–20 years; [this is where] this sector delivers.

61 Chui and others, *The Bio Revolution.*
62 Deloitte, "xTech Futures."

## Company spotlight: Epitopea

**Primary sector:** Healthcare
**Location:** Montreal, Q.C.
**Size:** 11–50 employees
**Established:** 2021
**Website:** https://www.epitopea.com/

**Epitopea develops new classes of off-the-shelf cancer vaccines to reach broader patient populations. We spoke with Steven Klein, Chief Business Officer, and Alan Rigby, Epitopea's Chief Executive Officer, about how the company is leveraging genomics to reshape immuno-oncology. While the underlying science has been decades in the making, they note how the sector continues to face persistent challenges, from shifting investment cycles to the long timelines required for platform technologies to reach maturity.**

**Signal49:** How are you using genomics?

**Alan Rigby:** We're creating a differentiated form of a personalized cancer vaccine. [It] allows us to address a much larger patient population, entire subtypes of cancer patients with a single off-the-shelf product.

**Steven Klein:** We have a unique positioning of integrating both genomics and proteomics into the discovery of our proprietary antigens that help develop these off-the-shelf therapies. Genomics is a core tool for us to use internally to build products to treat patients.

**Signal49:** What challenges do you face?

**Alan Rigby:** It's funding – the tides are changing, and there's gaining momentum in the M&A universe of biotech and pharma, but there's never enough capital.

**Steven Klein:** I would add that some of the early research that led to Epitopea was funded by Génome Québec – so there was an important outcome of the contribution of Génome Québec to the origins, at least the early success, of developing the technology in the academic setting.

**Alan Rigby:** Twenty-five years later, 20 years later at least, and we're seeing it play out in real time. So maybe there's an underlying element here – be patient with your investments. They do play forward. It's just maybe a little bit of time to get there.

**Signal49:** What are the tangible benefits and value for Canada that we are realizing from using genomics?

**Steven Klein:** Getting these technologies into the clinic better and earlier, with a better diagnosis of patients, and being able to stratify those patients for inclusion into clinical trials for treatment. It's an in-house tool to help us develop new products, stratify patients at least early on in our trials, which helps us demonstrate the value of our products. [Genomics also offers] a way to intervene early, treat, and take action, especially if there's a history of a specific type of cancer.

### Scaling new peaks

In Canada, health has the strongest near-term potential for genomics adoption and commercialization with applications already well established across prevention, diagnostics, therapeutics, personalized medicine, and infectious-disease surveillance. Genome Canada launched the Canadian Precision Health Initiative (CPHI) in 2025 with approximatively $81 million in Government of Canada investment, and over $100 million more expected in co-investment, to integrate genomics into personalized care.[63]

Sustained investment in skilled workers, modern health-system infrastructure, and interoperable data systems will be important for realizing this potential. Continued progress can build on federal initiatives such as the National Strategy for Drugs for Rare Diseases, the Biomanufacturing and Life Sciences Strategy, and the Pan-Canadian Health Data Strategy.[64]

63 Genome Canada, "Canada launches CA$200M genomics data initiative to drive precision health and economic growth."
64 Innovation, Science and Economic Development Canada, "Pan-Canadian Genomics Strategy."

## Company Spotlight: ProteinQure

**Primary sector:** Healthcare
**Location:** Toronto, Ont.
**Size:** 11–50 employees
**Established:** 2018
**Website:** https://www.proteinqure.com/

**ProteinQure is a computational drug discovery company that uses AI to help design new medicines. The team combines expertise in mathematics, software engineering, and computational biology to build computer models that show how small proteins behave and how they might work as treatments. In our interview with co-founder Lucas Siow, he highlights the broad applicability of genomics across the economy and its ability to advance personalized healthcare.**

**Signal49:** How are you using genomics?

**Lucas Siow:** When it comes to our lead program, we're going after a specific type of breast cancer called triple negative breast cancer, [including] patients who don't express certain genomic or protein markers ... And then, when [we] get to real patients or clinical trials, [we're] looking at how to identify patients, predict who will respond, [and] measure responses using these technologies.

**Signal49:** How does genomics give you a competitive advantage?

**Lucas Siow:** In the drug discovery world, there's a lot of papers. When you go after diseases that have human genetically validated targets, your chance of success is much higher. If you start with these diseases where the underlying genetic driver is well known, your chance of success in clinical trials is much higher ... [Genetic medicines are] very potent, not too expensive to manufacture, very specific, and well tolerated, so it's pretty powerful.

**Signal49:** What challenges do you face?

**Lucas Siow:** We're going through things that everybody goes through—access to capital, access to talent. We're one of the only Toronto companies ever to run a cancer clinical trial in Canada and finding people with experience doing that is basically impossible.

**Signal49:** What are the tangible benefits and value for Canada that we are realizing from using genomics?

**Lucas Siow:** Genomics is broadly applicable, so it's not just the initial vertical you enter—you do create positive spillover into other industries like agriculture, mining, and industrial processes. [In healthcare] we are learning to address a lot of diseases [and] identify intervention pathways ... [And while] we're pretty far away from that in other areas, like [a precision approach to] mental health ... you will have a more customized approach, so when you go to get treated, they'll figure out exactly which one is right for you, given your genomic data.

## Reimagined agri-food systems

### Scale of the sector

Agriculture and agri-food play a relatively large role in Canada's economy, with 606,500 workers (2.9 per cent of employment), $85.7 billion in GDP (3.7 per cent) in 2025. With $82.4 billion in exports, it accounted for 14.6 per cent of all goods exported in the same year.[65]

### Scale of the challenge

The Canadian agriculture and agri-food sector faces a growing set of challenges and risks that threaten productivity, resilience, and long-term competitiveness. Climate change is increasing exposure to extreme weather, shifting precipitation patterns, increasing temperatures, and expanding pest and disease pressures, all of which disrupt growing seasons and raise the risks of floods and droughts.

65 Signal49 Research's analysis of Statistics Canada data. Monetary figures are in 2017 constant dollars.

At the same time, our ability to respond is constrained. Financial pressures, aging infrastructure, and shortages of skilled workers limit research and innovation capacity. Protecting agricultural data, research, and intellectual property has also become more complex in a global environment where large datasets and cybersecurity matter more than ever. Together, these challenges underscore the importance of sustained investment in agricultural science and innovation that allow the sector to adapt and remain competitive.[66]

## Scaling solutions

Genomics and synthetic biology are driving a new era of productivity, sustainability, and resilience in agriculture. Genomics uses genetic information from plants, animals, and microbes to improve how food is grown and produced. It allows farmers and researchers to develop crops and livestock that perform better under challenging conditions while reducing environmental impacts.

Genomic applications that improve resilience, monitor disease, and support sustainable food production are becoming increasingly important as climate pressures grow.

Genomics is already delivering practical benefits for the agricultural sector, including the following:

- **Faster crop and livestock breeding:** Reading plant and animal DNA lets breeders select useful traits, such as drought tolerance and disease resistance, faster and more accurately than with traditional methods.
- **Improved crop yields, resilience, and nutrition:** Precision gene-editing technologies such as CRISPR allow small, targeted changes to a plant's existing genes, to improve performance without introducing foreign DNA.[67]
- **Reduced environmental impacts:** Engineered soil and plant microbes support nutrient uptake and stress tolerance, lowering reliance on fertilizers and pesticides and cutting greenhouse-gas emissions.[68] Genomics also enables the development of cultured meat, plant-based proteins, and fermentation-derived ingredients that use far less land, water, and energy than conventional livestock farming.[69] Canadian firms, such as Advanced AgriScience, are already using synthetic biology to engineer specialized microbes that help crops withstand frost and other environmental stressors, reducing dependency on fertilizers, while maintaining stable yields.

Over the next decade, genomic innovations in breeding, microbial engineering, and cellular agriculture are expected to transform food systems by boosting yields, reducing environmental impact, and increasing resilience to climate-driven disruptions.[70]

## Scaling new peaks

Agriculture and agri-food show strong potential for genomics adoption, particularly in improving crop and livestock resilience, pathogen surveillance, and disease monitoring, capabilities that are increasingly important under climate change. A more streamlined regulatory environment, building on recent transparency measures under Health Canada's Novel Food Regulations, as well as improved laboratory infrastructure to support research translation and commercialization,[71] could help scale the benefits of genomics for the agricultural sector.

66 Agriculture and Agri-Food Canada, "Agriculture and Agri-Food Canada's 2024–25 Departmental Results Report."
67 Deloitte, "xTech Futures."
68 Deloitte, "xTech Futures."
69 Chui and others, *The Bio Revolution;* Deloitte, "xTech Futures."
70 Chui and others, *The Bio Revolution.*
71 Innovation, Science and Economic Development Canada, "Pan-Canadian Genomics Strategy."

## Company spotlight: PathoScan

**Primary sector:** Agriculture
**Location:** Saskatoon, Sask.
**Size:** 2–10 employees
**Established:** 2022
**Website:** https://www.pathoscan.com/

**Pathoscan develops real-time pathogen detection tools for agriculture, bringing genomics directly into farmers' hands. By detecting the genomic "fingerprints" of threats before symptoms appear, Pathoscan gives growers the ability to intervene early and protect yields.**

**We spoke with Tayab Soomro, co-founder of Pathoscan, about how the company is using genomics to transform disease monitoring in agriculture and beyond. He explains that, while the underlying science has existed for decades, adoption in the sector remains limited as many growers remain attached to long-standing methods. Changing these mindsets requires time, trust, and direct engagement.**

**Signal49:** How does genomics give you a competitive advantage?

**Tayab Soomro:** We have developed a device that can do pathogen testing in real time. So instead of farmers having to send the samples out to the lab [and] waiting for the results to come back—it usually takes around two to three weeks—they can get the results within 20 to 30 minutes. It significantly reduces the time it takes for the results [to] get [to] farmers for their crop testing, and so they can start applying fungicides right away. The goal of Pathoscan is to democratize pathogen testing for farmers.

**Signal49:** What challenges do you face?

**Tayab Soomro:** One of the biggest challenges that we face is changing minds. Farming is a very emotional business and often giving the data and the results—while those are really important—are not enough. What we found out is that continued presence and conversations [with] farmers have helped us. But a lot of preconceived notions often hinder our growth. Unless there is a perception change, none of these technologies are going to improve anything.

**Signal49:** What are the tangible benefits and value for Canada that we are realizing from using genomics?

**Tayab Soomro:** Genomics technologies have allowed [early] detection to be possible. [Previously], you [could] only detect [issues] visually ... And by the time symptoms appear, it's already too late ... [Also], in certain areas where antimicrobial resistance is really an issue, without genomics you can't really get to that. These different areas have different benefits, but ultimately the acceleration of results allows us to have noticeable impacts on different areas, like food security, [and] all the improvements that we're seeing are within five to six years, which otherwise would take quite longer.

# Environmental sustainability

## Scale of the sector

Canada's natural resource sector remains a keystone of our national economy. In 2025, the sector employed 279,600 people (1.3 per cent of national employment), generated $119.9 billion in GDP (5.1 per cent), and produced $191.4 billion in exports—33.8 per cent of all Canadian goods exports.[72] The long-term competitiveness of the sector is critical to sustaining Canada's economic and export strength.

## Scale of the challenge

Canadian resource industries face growing pressure to remain internationally competitive while meeting higher expectations for emissions reduction, biodiversity protection, and environmental accountability.[73]

As global markets demand cleaner, lower-carbon resource production, genomics offers powerful tools to sustain competitiveness. Applications such as eDNA monitoring, microbial bioremediation, and bio-based extraction methods will enhance environmental performance, reduce costs, and support responsible resource development, preserving the sector's role as a major driver of Canada's economic and export strength.

## Scaling solutions

Genomics is helping resource industries meet these challenges by allowing companies to understand what's happening in the environment, to efficiently fix environmental damage, and to extract resources in cleaner, cheaper ways. Genomics is helping the natural resource sector by methods including the following:

- **Detecting environmental changes sooner:** Genomics techniques allow precise monitoring of biodiversity, detection of invasive species, real-time tracking of ecological change, and assessment of ecosystem health.[74] These technologies support targeted conservation strategies and early warning systems for environmental degradation.[75]
- **Improving environmental remediation:** Engineered microbes can break down plastics, degrade petroleum hydrocarbons, neutralize industrial toxins, and remediate contaminated soils far more efficiently than conventional chemical or mechanical methods.[76] Canadian companies, such as Genecis Bioindustries, and Pond Technologies, are already applying these technologies to clean up pollution and rehabilitate mine sites.[77]
- **Extracting resources more sustainably:** Techniques such as biomining use engineered microbes to extract critical minerals with less energy and fewer emissions than traditional mining.[78] Other genomic technologies are used to de-risk offshore oil drilling,[79] to access difficult-to-extract reserves using microbial enhanced oil recovery,[80] and to reduce biological corrosion to natural resource infrastructure.[81]
- **Improving environmental resilience:** Genomics is part of a broad biotechnological revolution that, it has been shown, could reduce greenhouse-gas emissions by an estimated 7 per cent to 9 per cent globally by 2040–2050, using applications already feasible today.[82] Genomics-enabled technologies can specifically support carbon capture, sustainable energy production, and emissions reduction.[83]

72 Signal49 Research's analysis of Statistics Canada data. Monetary figures are in 2017 constant dollars.
73 Carlin and other, *Climate Risks in the Metals and Mining Sector.*
74 USGS (United States Geological Survey), "Battling Invaders."
75 Chui and others, *The Bio Revolution.*
76 Deloitte, "xTech Futures."
77 Saravanan and others, "$CO_2$ bio-mitigation using genetically modified algae and biofuel production towards a carbon net-zero society."
78 Genome British Columbia, "An Overview of Genomics in British Columbia's Mining Sector."
79 Genome Atlantic, "Omics project takes de-risking NS's offshore to next phase."
80 Nakutnyy, "Microbial Enhanced Oil Recovery (MEOR)."
81 Genome Canada, "Breaking Down Corrosion."
82 Chui and others, *The Bio Revolution.*
83 Deloitte, "xTech Futures."

## Company Spotlight: Decodomics

**Primary sectors:** Environment and natural resources
**Location:** Calgary, Alta.
**Size:** 2–10 employees
**Established:** 2024
**Website:** https://www.decodomics.com/

**Decodomics analyzes and interprets microbial DNA present in industrial and environmental systems. We spoke with Gabrielle Scheffer, founder and CEO, to discuss how Decodomics uses genomics and its impact on the natural resource sector. Despite the advantages of new technologies, Scheffer observes that uptake remains limited as some organizations remain attached to long-standing methods.**

**Signal49:** How are you using genomics?

**Gabrielle Scheffer:** What we do is help, mainly energy companies, as well as environmental-sector organizations, understand how the microorganisms in their systems can influence their operations. For example, we've created a risk-score based on metagenomics insights to assess microbial corrosion of industrial infrastructure. It provides simplified actionable information, so, even if a company doesn't want to look at the description of all 250 genes, they can simply refer to this score for cost-benefit analysis before proceeding with an action. It's easy for them to see and understand without in-depth knowledge of microbiology, metagenomics, or bioinformatics.

**Signal49:** How does genomics give you a competitive advantage?

**Gabrielle Scheffer:** If you're looking at millions of different bacteria in the system, you're looking at more than 100 different genera, maybe thousands of different species, and if you're looking at only one biomarker, you don't get a complete picture. That's where we get our competitive edge: we're able to go much further than [traditional methods] without a significantly higher cost.

**Signal49:** What challenges do you face?

**Gabrielle Scheffer:** Since people are so used to existing tests, they're hesitant to move toward newer methods like genomics, even though they're more accurate. This could be due to inertia, a lack of understanding, or even a lack of example.

**Signal49:** What tangible benefits and value for Canada are realizing from using genomics?

**Gabrielle Scheffer:** Companies don't have to take on as much risk because they're being proactive and comprehensive with metagenomics by looking at biological signatures rather than waiting for issues to happen ... On the clean-up side of things, microbial applications are also much more environmentally friendly. For example, bioremediation using bacteria already in the soil, and adding nutrients to stimulate them, can be far less disruptive than digging up the soil or doing other mechanical work. And genomics helps guide and validate that process.

## Scaling new peaks

In Canada, near-term opportunities for genomics adoption are strong in environmental and green-economy applications, particularly in biomonitoring, ecological assessment, bioremediation, climate mitigation, and bio-based manufacturing.

Targeted investments in eDNA testing capacity, workforce training for environmental practitioners such as fishers and foresters, and clear intellectual-property standards could help accelerate commercialization.[84]

84 Innovation, Science and Economic Development Canada (ISED), "Pan-Canadian Genomics Strategy."

## Company Spotlight: eDNAtec

**Primary sector:** Environment
**Location:** St. John's, Nfld.
**Size:** 11–50 employees
**Established:** 2015
**Website:** https://www.ednatec.com/

**eDNAtec is a Canadian genomics company using advanced eDNA technologies to understand the health of our ecosystems and the species that live in them. We spoke with Dr. Mehrdad Hajibabaei, co-founder, who explained that, while genomic science has matured rapidly over the past two decades, widespread adoption still lags. For Hajibabaei, shifting the culture around genomics use requires rigorous validation, trust-building, and clear communication.**

**Signal49:** How are you using genomics?

**Mehrdad Hajibabaei:** Our company uses and develops genomics technologies to understand changes in the environment … The name of the company indicates eDNA, and the aim is to have a diagnostic system to understand the health of our environment and ecosystems and the species that live in the environment.

**Signal49:** How does genomics give you a competitive advantage?

**Mehrdad Hajibabaei:** We are bringing environmental genomics to the next level of decision-making. [Especially] with our clients in the energy sector, they're telling us that the evidence that [we] provide needs to be able to withstand a court case … we have had some really interesting cases where the information that we provided had been used in very serious decisions in terms of land use management [or] licensing a company to utilize a natural resource.

**Signal49:** What challenges do you face?

**Mehrdad Hajibabaei:** There is some conservatism when it comes to newer technologies. Genomics is [inherently] different than traditional [methods] … On the uptake side of things, the time from a new technology to maturation that I've seen is usually about 25 years. For genomics, we are not so far off. I think the other thing is that when it comes to expanding companies, we have a lot of interesting incentives, grants, and some catalysts, but the capital environment for raising a high-tech start-up and growing it is almost non-existent in Canada, especially when it comes to a sector like genomics (outside of its medical applications).

**Signal49:** What tangible benefits and value for Canada are we realizing from using genomics?

**Mehrdad Hajibabaei:** A lot of our projects have employed and created highly skilled [and specialized] jobs. We have been working with various oil and gas and energy companies in terms of giving them information [that] is used directly [to assess] their environmental footprint. We've worked a lot with [government agencies], like the Department of Fisheries and Oceans … We have a multi-year project with the Nunavut fisheries associations and with the Nunavut community groups, [where] we brought genomics to their high schools.

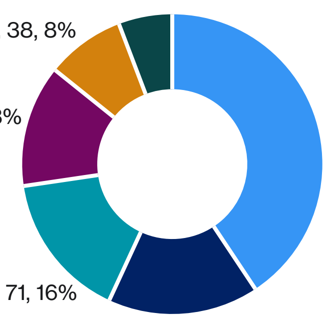
# Diversified strength across Canada

Canada's diverse set of regions each has distinct economic, social, and health priorities that shape the ways genomics delivers value on the ground. Regions also differ in their strengths across research, development, and industry, from academic genomics and clinical translation to agri-food innovation and environmental applications. These differences create specific regional areas of focus where genomics aligns most closely with local needs and capabilities. Recognizing and building on these regional strengths allows Canada to advance genomics in ways that respect place, accelerate adoption, and translate national and regional investment into meaningful impact.

While Canada's 450 genomics companies are found across the country, the sector is highly concentrated in Ontario, Quebec, and British Columbia (see Chart 9) with sectoral company strengths aligned with regional priorities and needs.

Canada's regional genome centres connect Canada's national genomics strategy with regional capacity and needs, helping to align federal investments with regional priorities. Each centre has its own strategic foci, tools, resources, and expertise to advance genomics research and adoption.

**Chart 9**
Regional breakdown of genomics companies in Canada
(number and percentage of companies)




Source: Signal49 Research.

## British Columbia

**Genome centre:** Genome BC

**Focus areas:** Health genomics; agriculture/agri-food; forestry; fisheries/aquaculture; mining/energy; environmental genomics; data science

B.C.'s genomics ecosystem includes several integrated platforms, with Canada's Michael Smith Genome Sciences Centre providing substantial sequencing and analytical capacity. The province also hosts specialized hubs such as the BC Centre for Disease Control for pathogen genomics and the University of Victoria Genome B.C. Proteomics Centre, along with activity in wastewater genomics, eDNA tools, and precision health applications. This ecosystem positions B.C. as a leader in high throughput sequencing, multi-omics platforms, and commercialization pathways that have produced globally competitive biotech firms.[85]

85 Genome British Columbia, *Annual Report 2024–2025*; Genome British Columbia.

## Alberta

**Genome centre:** Genome Alberta

**Focus areas:** Agriculture, agri-food and one health; energy, natural resources, and environmental sustainability; precision health

Alberta has a strong capacity in generating and analyzing large-scale genomics datasets. This supports big-data/AI integration, improved productivity and competitiveness of agriculture producers, enhanced environmental stewardship and natural resources, and improved patient outcomes and health care delivery. Alberta is also home to The Metabolomics Innovation Centre, a world-leading facility and repository for metabolomics datasets. Genome Alberta supports genomics solutions for end-users' needs through science, technology and application development, collaborations and partnerships.[86]

86 Genome Alberta, *Annual Report 2024–2025;* Genome Alberta.

## Manitoba and Saskatchewan

**Genome centre:** Genome Prairie

**Focus areas:** Agriculture and agri-food; environmental sustainability; precision health

The Prairie region supports genomics activities in crop resiliency, grassland and bison genomics, and related environmental applications. Key institutions include the Global Institute for Food Security, which provides large-scale sequencing capacity; the Saskatchewan Food Industry Development Centre's precision-fermentation facility for industrial biotechnology; and the University of Saskatchewan's Crop Development Centre, which contributes to plant breeding through sequencing and genetic analysis of major Prairie crops. The Churchill Marine Observatory uses genomics to study responses to oil spills in Arctic sea-ice conditions.[87]

87 Genome Prairie, *Annual Report 2024–2025;* Genome Prairie.

## Ontario

**Genome centre:** Ontario Genomics

**Focus areas:** Precision health; biomanufacturing; food innovation; environmental genomics; agriculture; critical minerals and mining

Ontario's strengths reflect the province's diversified economy. It operates across diverse value chains rather than in silos. Ontario's commercialization strength is a key differentiator. Organizations such as the BioCreate Accelerator supports SME growth in food, cleantech, and health.[88] Major health-genomics institutions including SickKids, the Children's Hospital of Eastern Ontario, and the Princess Margaret Cancer Centre are located in Ontario, and the province holds considerable agri-food genomics capacity at the University of Guelph.

88 Ontario Genomics, 2024–2025 *Annual Report;* Ontario Genomics.

## Quebec

**Genome centre:** Génome Québec

**Focus areas:** Precision Health; agriculture, environment/One Health; technology and data platforms

Génome Québec manages its own high throughput sequencing platform, which serves researchers in Quebec and across Canada. The province's genomics infrastructure includes the Quebec Genomic Data Centre and Genovalia, cloud computing environments for storing and analyzing genomic data, and the McGill Genome Centre that provides integrated services across genomics, proteomics, metabolomics, and bioinformatics. The province also houses AReNA, a major hub in RNA technology and therapies, and IVADO, a research, training, and knowledge mobilization consortium in AI.[89]

89 Génome Québec, *Annual Report 2024-2025* and Génome Québec.

## Atlantic Canada

**Genome centre:** Genome Atlantic

**Focus areas:** Aquaculture, fisheries, forestry, agriculture/agri-food; environmental monitoring.[90]

The region offers expertise in salmon, oyster, and mussel genomics, along with world-leading marine eDNA and biosurveillance platforms.  It also includes biomanufacturing and fermentation capacity at the Verschuren Centre, as well as key clinical genomics assets like IWK/Dalhousie rare disease diagnostics. Genome Atlantic acts primarily as an applied genomics catalyst, connecting industry end-users with scientific expertise and infrastructure.

90 Genome Atlantic, *Annual Report 2024–2025;* Genome Atlantic.

# Achieving a genomic-enabled future in Canada

The global economy is accelerating toward a genomics-driven future, where biotechnology underpins innovation across health, agriculture, the environment, and broader society. Canada holds a strong position to lead this next wave with world-class science, trusted institutions, and a public commitment to equity and evidence-based decision-making. Realizing this opportunity requires deliberate action. Canada must plan for the long term, sustain funding across cycles, and build capacity in both infrastructure and people. A whole-economy approach matters because investments in genomics do more than advance research. They strengthen health systems, support sustainable food and agriculture, enable environmental stewardship, create resilient jobs, and future-proof Canadian society in an increasingly data- and biology-powered world.

Appendix A

# Methodology

## About the research

We sought to assess the economic contribution of genomics in Canada both in 2025 and out to 2035. Our work integrates economic modelling, technology landscape analysis, patenting activity analysis, and real-world case studies to produce an evidence-based view of how genomics drives value today and how much more it can generate by 2035.

The research followed a structured, multi-stage approach. We began with a comprehensive scan of global and domestic genomics technologies, drawing on publications from research institutions, industry associations, government agencies, and market intelligence firms. These insights were verified through consultations with regional genome centres and the Canadian Genomics Strategy.

To map the size and structure of Canada's genomics economy, we constructed a national inventory of genomics-related companies using a list of genomics creator companies, developed by Genome Canada in collaboration with Innovation, Science and Economic Development Canada (ISED). We supplemented this list with a targeted search of CB Insights' database[1] and validated it through expert review by regional genome centres. We then translated these technologies into measurable economic value by applying industry-specific shocks to Signal49 Research's proprietary input-output model, producing estimates of employment, GDP, labour income, and tax revenue under current and projected adoption scenarios.

## Estimating global genomics market size

We conducted a structured scan of publicly available genomics market research reports using targeted internet search queries (e.g., "genomics market size forecast"). Our objective was to produce an independent synthesis of global market size and growth trajectories for genomics. Reports were considered only if they were published by recognized market intelligence firms or reputable financial/industry analysts with a verifiable track record in life-sciences markets and forecasting the global market.

We then screened search returns against five pre-defined criteria to ensure data quality and comparability:

- **Identity transparency:** The report discloses corporate identity and has no relationship or funding from life sciences sector.
- **Accuracy:** The report provides internally consistent figures across summary, tables, and exhibits.
- **Methodological transparency:** The report describes data sources, estimation techniques, and forecast assumptions.
- **Segment coverage:** The report provides revenue breakdowns for major genomics segments (e.g., consumables/reagents/kits, instruments and platforms, software/bioinformatics, services/NGS).
- **Timeliness:** The reports were published or updated in 2024 or 2025.

We terminated collection after identifying 10 qualified reports and saturation had been achieved (i.e., additional sources were not materially changing the central tendency of estimates).

Among the 10 reports, three provide forecasts to 2035; the remaining forecasts extend to 2030–2034. The following is the list of market research firms included in our analysis:

- Fortune Business Insights
- Future Market Insights
- Global Market Insights
- Grand View Research
- IMARC Group
- Market Research Future
- Markets and Markets
- Precedence Research
- Roots Analysis
- Straits Research

For each report, we extracted the base-year revenue, end-year revenue, and compound annual growth rate. In instances where a report provided both the compound annual growth rate and endpoints but not the market size for in-between years, we calculated them using the available values. We computed range (minimum and maximum) and median values for total market size. We prioritized medians over means to reduce sensitivity to outliers.

1 CB Insights is a comprehensive global database on private companies and investor activity.

## Genomics-related company identification

We identified 450 genomics-related companies using the following steps:

1. developing a national baseline using a list of genomics creator companies, originally developed by Genome Canada in collaboration with Innovation, Science and Economic Development Canada: 98 firms;
2. conducting a targeted business search for “genomics” within CB Insights’ database to identify additional Canadian firms whose activities, products, or technologies explicitly reference genomics, but which may not have been captured in the original national list: 39 firms;
3. sharing the combined list with Canada’s regional genome centres, using the province-level locations. Centres were asked to verify the companies identified in the previous steps, add any additional genomics-related companies operating in their region, and assign each company to one of the four defined categories: 313 firms.

The companies we identified work with genomics in four different ways:

- **primary genomics creators:** organizations whose core business is the development of genomics technologies, platforms, or datasets: 67 companies;
- **diversified genomics creators:** companies that develop genomics solutions alongside other technologies: 33 companies;
- **genomics-driven implementers:** firms that rely heavily on genomics inputs to deliver their products/services: 90 companies;
- **genomics-enabled implementers:** firms that incorporate genomics among broader enabling technologies: 260 companies.

Regional genome centres helped us categorize 268 of the 450 companies. For the remaining 182, we reviewed each company’s public website and business description and categorized them using definitions above.

## Biological sequences analysis

We used the PatSeq Explorer available via The Lens[2] to identify patent-disclosed sequences by country. PatSeq provides consolidated counts of sequence listings associated with patent documents and enables jurisdictional (national) breakdowns.

We queried total holdings and country-level distributions using standardized filters and recorded snapshot counts as of the analysis date (i.e., March 2026). Counts reflect disclosed sequences and may not map one-to-one to distinct inventions; they are best interpreted as a proxy for the intensity of sequence-based intellectual property activity. Country attribution in patents reflects filing jurisdiction, not the country from which the invention originates.

## Venture-capital-backed companies

We used the CB Insights proprietary database to identify venture-backed companies operating in genomics. We applied four filters for this purpose:

- **location:** Canada and other G7 countries for comparison;
- **business description:** keyword “genomics” (including firms focused on sequencing, bioinformatics, and genomic-enabled diagnostics or platforms);
- **industry:** healthcare, agriculture, food and beverages, energy and utilities, environmental services and equipment, industrials;
- **funding status:** VC-backed = true.

## Other evidence

To identify the latest technological progress and market developments, we reviewed materials from the following:

- official government reports and websites (i.e., Government of Canada, U.S. Government);
- reports by United Nations organizations (i.e., World Health Organization, Food and Agriculture Organization);
- peer-reviewed literature on genomics adoption, sequencing cost trajectories, and bioinformatics capacity (i.e., *Nature, Lancet*);
- Genome Canada and regional genome centres;
- university websites highlighting their genomics research.

## Company spotlights

From January to March 2026, the research team scheduled and conducted in-depth, semi-structured interviews with leaders of six Canadian companies that use genomics technology in different applications (i.e., natural resources, agriculture, healthcare, environmental monitoring). We recruited these companies with the help of regional genomic centres.

The semi-structured interview guide was developed based on the research questions, our literature review, and existing team expertise. Our questions were structured around a core set of topics including their organization’s use of genomics technology and the value of genomics for Canadian society.

Interviews lasted approximately 30 minutes to 45 minutes. Interviews were recorded and transcribed, yielding approximately 130 pages (36,606 words) of text. Excerpts from interviews have been edited for clarity.

2 The Lens is a global, open, public-interest platform that provides integrated access to worldwide patent data, scholarly literature, and biological sequence information.

## Identifying genomics-related funding

To estimate genomics-related research funding across different organizations, we accessed project-level funding datasets and included funding for which the following keywords appeared: genomics, bioinformatics, clinical genetics, transcriptomics and proteomics, and molecular and functional genetics and epigenetics. Use of these keywords allowed inclusion of genomics research beyond that which specifically included the word "genomics," which would have led to an under-representation of genomics-related research. While it remains possible that some of the included funding may have been focused on genetics research with limited or no genomics component, this approach represented a middle ground between over-representation and under-representation of genomics funding. In conjunction with the exclusion of some funding due to lack of data availability, the result is a conservative estimate of genomics funding.

For the **Canadian Institutes of Health Research (CIHR)**, we obtained data from the CIHR Grants & Awards Data portal. We then identified genomics-related projects by filtering the Research Categories field using the defined keywords. Associated funding amounts were calculated using the Authority Paid Amount variable.

For the **Canada Foundation for Innovation (CFI)**, we downloaded project-level data from the CFI Funded Projects dashboard. We then identified relevant projects by applying the keyword filter to the keywords field, and funding totals were computed using the CFI Contribution variable. CFI data are organized on a calendar-year basis. We selected 2023, 2024, 2025 in CFI data to generate data comparable to FY 2022–2023, FY 2023–2024, FY 2024–2025 for other datasets.

For the **Natural Sciences and Engineering Research Council of Canada (NSERC)**, we obtained the data from the NSERC Awards Data portal. We then extracted genomics-related projects by applying the keyword filter to the Application Title field, and funding amounts were calculated using the Award Amount variable.

This filtering approach enabled consistent identification and aggregation of genomics-related funding across agencies, despite differences in data structure and classification fields.

## Growth assumptions for research funding and company revenues

Our projections rely on two distinct growth paths that reflect the different dynamics of public investment and private-sector expansion. For genomics-related research funding, we assumed growth consistent with overall federal spending, applying an average annual increase of 2.7 per cent from 2025 to 2035. Under this assumption, current funding levels rise to approximately $467 million by 2035.

For genomics company revenues, we drew on global market projections, which indicate a compound annual growth rate of 16.8 per cent between 2025 and 2035. To remain conservative, we applied a 10 per cent CAGR (Compound Annual Growth Rate) to domestic genomics firms. This assumption captures both the expected expansion of existing companies and the emergence of new entrants as the sector matures and genomics applications broaden across industries.

## Input-Output (I-O) model

We used Signal49 Research's in-house I-O model to estimate economic impacts. Based on Statistics Canada's 2022 supply and use and I-O tables, we modelled the way a dollar injected into one sector is spent and then circulated through other sectors of the economy, generating waves of economic activity, or so-called "economic multiplier" effects. The model creates a series of multipliers that, in aggregate, describe the economic implications of the original activity.

For direct events entered as industry output (i.e., company revenue), the model applies estimates of each worker's average employment and compensation to show the direct effects on jobs and monetary value figures. It then applies an event's value to national sector-specific production functions and follows them through transaction and payment cycles to estimate the indirect and induced impacts. During each cycle, the procedure removes expenditures to government, savings, and non-domestic purchases (i.e., leakage), so the results reflect only transactions that affect the national economy.

For genomics-related research funding, we modelled impacts as a direct injection into the Higher Education/Government/Non-profit research production functions rather than as business output. The initial shock is distributed into labour income (salaries and benefits for researchers, technicians, trainees, and support staff) and goods and services purchases (e.g., reagents/consumables, sequencing and core-facility services, equipment, professional services) using observed input shares. The model then traces resulting indirect effects through suppliers and induced effects from household spending, removing leakages (taxes, savings, and imports) at each round so only spending that accrues to the Canadian economy is counted. This approach captures the labour-intensive nature of research while reflecting how research institutions' procurement drives supply-chain activity.

Final consumption (or final demand) drives input-output models. Industries increase production to meet the new demand created by directly affected industries. The production of additional goods and services by indirectly affected industries in turn generates new demand in other industries of the economy, and so on. Expressed as a ratio, multipliers summarize this cycle of spending in the economy.

## Key assumptions

Besides essential background information about economic modelling, we include here the assumptions upon which our modelling is based.

The accounting conventions that form the basis of an I-O model and the way our I-O model makes estimations impose assumptions that readers ought to be aware of when interpreting the results.[3] Since some of these assumptions can lead to an overstatement of the impacts, many users of impact models consider the estimates as upper bounds.[4] Our I-O model is based on several assumptions:

- constant returns to scale
- no supply constraints
- fixed commodity input structure
- homogenous sector output
- industry technology assumption

The first assumption is that the production functions are linear, meaning that "if additional output is required, all inputs increase proportionately."[5] Under this assumption, if $1 of new company revenue in the impact area triggers $2 in total economic activity, then $1,000 will trigger $2,000, $1 million will trigger $2 million, and $1 billion will trigger $2 billion. In reality, this might not be the case; a facility already running at maximum output may be unable to expand production unless it makes substantial capital investments, brings on additional staff in a tight labour market, or purchases costly new real estate. These practical constraints influence the relationship between total economic activity and the direct impact. Such operational challenges illustrate the inherently "non-linear" nature of business.[6]

The second assumption is that there are no supply constraints. An industry faces no constraints on its supply of raw materials, and its production levels are restricted only by the market's demand for its goods.[7] In the world of business, rising demand creates scarcity. Similar to how the cost of construction materials increased during the housing sector boom of the mid-2000s, or the way China's rapid economic growth has created scarcities in concrete and energy supply, investing millions of dollars into a specific sector might create short-term shortages in labour, materials, and services.

Third, we assume there is no product substitution in the short term; price shifts do not lead a firm to switch to alternative inputs. Under this framework, it is assumed that economic fluctuations may change an industry's level of output, but not the specific combination of goods and services it uses in production.

However, input-output analysis becomes less reliable when sustained cost increases or supply shortages prompt firms to seek new suppliers or alter their production methods—for instance, by replacing labour with more advanced machinery.[8] Consequently, economic impact analysis can show how spending circulates through the economy at a single moment in time, but it cannot capture how that spending would alter the economy's underlying structure.[9]

The fourth assumption is that sector output is uniform; the industry maintains the same proportional output of all its products, no matter how much it produces overall. It will not boost the production of one item without increasing the output of its other goods in the same ratio.[10]

Finally, the industry technology assumption implies that an industry relies on the same production technology for all the goods it produces. Essentially, it has one main product, and any additional outputs are generated as secondary by-products of that primary production process.[11]

## Multipliers

The small decline in the employment multiplier between 2025 and 2035, alongside stable labour income, GDP, and output multipliers, reflects structural productivity changes rather than a modelling inconsistency. Over this period, the genomics sector is projected to become more capital intensive, with labour income maintaining its share of GDP but increasingly concentrated among high-skilled workers and embedded in capital- and IP-intensive production processes. While overall labour income effects remain stable, these structural shifts reduce the extent to which activity translates into broader job creation, leading to a modest decline in the employment multiplier even as other multipliers remain largely unchanged.

It is important to note that AI raises the value of specialized human judgment within genomics even as it automates routine functions across the supply chain, leading labour to capture a larger share of direct value added while generating weaker indirect and induced employment spillovers.

In addition, multiplier magnitudes are influenced by differences in the composition of spending across scenarios and over time; lower-bound estimates and the current-year profile place a relatively greater weight on research spending, which is more labour-intensive than company revenue, whereas projected impacts increasingly reflect commercial activity with higher productivity.

3 IMPLAN, *IMPLAN Pro Manual: Analysis Guide;* Bureau of Economic Analysis, *RIMS II.*
4 Bess and Ambargis, "Input-output models for impact analysis."
5 Sommers, *Economic Analysis for a Regional Center.*
6 IMPLAN, *IMPLAN Pro Manual: Analysis Guide.*
7 IMPLAN, *IMPLAN Pro Manual: Analysis Guide.*
8 IMPLAN, *IMPLAN Pro Manual: Analysis Guide.*
9 IMPLAN, *IMPLAN Pro Manual: Analysis Guide.*
10 IMPLAN, *IMPLAN Pro Manual: Analysis Guide.*
11 IMPLAN, *IMPLAN Pro Manual: Analysis Guide.*

## Sensitivity analysis

Company-level financials rarely disclose the exact share of revenue attributable to genomics inputs versus other technologies. Our dataset reliably classifies firms by role, creators (pure or diversified) and implementers (genomics-driven or genomics-enabled), but not the precise revenue split attributable to genomics within each firm. To avoid overstating impacts, we modelled low/mid-point/high attribution shares for each segment and report the mid-point results in the main text, with bounds provided below.
(See tables 1, 2, 3, 4.)

Attribution logic by segment:

- **Primary genomics creators (mid-point 70 per cent; range 60–80 per cent):** These firms' products (e.g., sequencing chemistries, assays, platforms, bioinformatics tools) are inherently genomics-based; most revenue is genomics-attributable, but we allow for non-genomics services (custom software, consulting) by capping below 100 per cent.
- **Diversified genomics creators (20 per cent; 10–30 per cent):** These companies create genomics technologies but currently derive the majority of revenue from non-genomics lines (e.g., broader diagnostics, non-omics software, instruments); we therefore assign a conservative attribution share.
- **Genomics-driven implementers (70 per cent; 60–80 per cent):** These are companies whose commercial offerings (therapeutics, trait development, molecular diagnostics) depend materially on genomics data or tools. While downstream activities add non-genomics value, genomics remains a core revenue driver.
- **Genomics-enabled implementers (20 per cent; 10–30 per cent):** These are firms for which genomics is a supporting technology within diversified product lines; attribution is intentionally modest.

Interpreting the bounds:

- The **mid-point** reflects our central judgment regarding the true impacts of genomics in the Canadian economy.
- The **lower-bound** stress-tests a scenario where non-genomics activities are larger than expected or where genomics features are under-monetized.
- The **upper bound** reflects stronger genomics monetization (e.g., faster adoption, successful product launches, or pricing power) without assuming full attribution.

## Lower-bound economic impact results

**Table 1**

Genomics sector supported over 41,000 Canadian jobs in 2025

(monetary figures are in $ thousands)

| Impact type | Employment | Labor income | Value added (GDP) | Output | Tax revenue |
|---|---|---|---|---|---|
| Direct | 16,279 | 2,894,781 | 4,869,879 | 8,148,870 | 1,217,363 |
| Indirect | 12,247 | 939,244 | 1,495,243 | 2,775,828 | 498,057 |
| Induced | 12,782 | 782,816 | 1,675,128 | 2,953,178 | 556,816 |
| **Total** | **41,308** | **4,616,841** | **8,040,249** | **13,877,876** | **2,272,236** |
| *Multiplier* | *2.5* | *1.6* | *1.7* | *1.7* | *n.a.* |

Source: Signal49 Research.

**Table 2**

Genomics sector could support nearly 80,000 jobs in Canada in 2035

(monetary figures are in $ thousands)

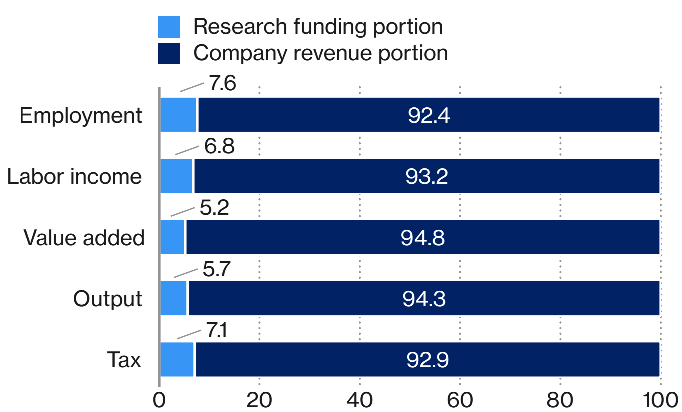
| Impact type | Employment | Labor income | Value added (GDP) | Output | Tax revenue |
|---|---|---|---|---|---|
| Direct | 35,244 | 7,636,987 | 12,338,364 | 20,602,232 | 3,158,003 |
| Indirect | 22,111 | 2,339,260 | 3,722,471 | 6,886,146 | 1,276,454 |
| Induced | 22,574 | 1,954,142 | 4,182,297 | 7,369,015 | 1,429,191 |
| **Total** | **79,929** | **11,930,390** | **20,243,132** | **34,857,394** | **5,863,648** |
| *Multiplier* | *2.3* | *1.6* | *1.6* | *1.7* | *n.a.* |

Source: Signal49 Research.

**Chart 1**

Company revenue accounts for most of total genomics sector economic impact

(per cent)

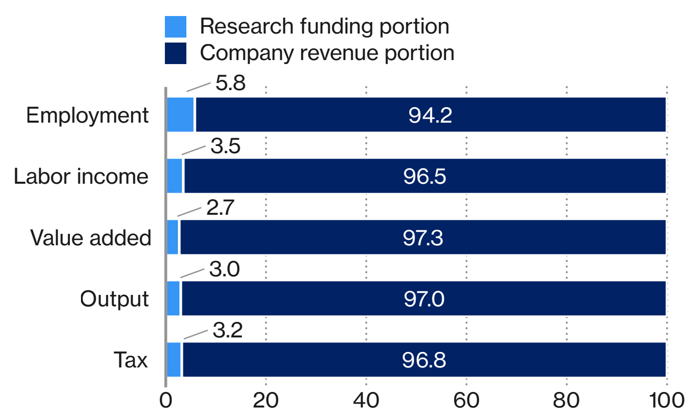



Source: Signal49 Research.

**Chart 2**

Company revenue accounts for most of the economic impact of the total genomics sector

(per cent)




Source: Signal49 Research.

## Upper-bound economic impact results

**Table 3**

Genomics sector supported over 108,000 Canadian jobs in 2025

(monetary figures are in $ thousands)

| Impact type | Employment | Labor income | Value added (GDP) | Output | Tax revenue |
|---|---|---|---|---|---|
| Direct | 38,037 | 7,722,278 | 14,361,552 | 23,722,782 | 3,320,119 |
| Indirect | 34,146 | 2,641,418 | 4,185,640 | 7,665,168 | 1,404,531 |
| Induced | 36,370 | 2,220,868 | 4,731,212 | 8,335,859 | 1,586,186 |
| **Total** | **108,554** | **12,584,564** | **23,278,404** | **39,723,809** | **6,310,836** |
| *Multiplier* | *2.9* | *1.6* | *1.6* | *1.7* | *n.a.* |

Source: Signal49 Research.

**Table 4**

Genomics sector could support nearly 212,000 jobs in Canada in 2035

(monetary figures are in $ thousands)

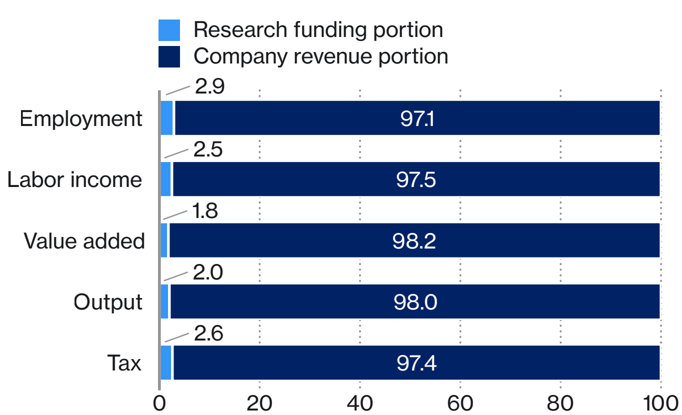
| Impact type | Employment | Labor income | Value added (GDP) | Output | Tax revenue |
|---|---|---|---|---|---|
| Direct | 82,701 | 20,736,414 | 36,864,847 | 60,845,221 | 8,816,120 |
| Indirect | 63,580 | 6,737,678 | 10,674,457 | 19,520,201 | 3,681,368 |
| Induced | 65,621 | 5,670,069 | 12,079,220 | 21,277,862 | 4,162,684 |
| **Total** | **211,902** | **33,144,161** | **59,618,524** | **101,643,284** | **16,660,171** |
| *Multiplier* | *2.6* | *1.6* | *1.6* | *1.7* | *n.a.* |

Source: Signal49 Research.

**Chart 3**

Company revenue accounts for most of total genomics sector economic impact

(per cent)

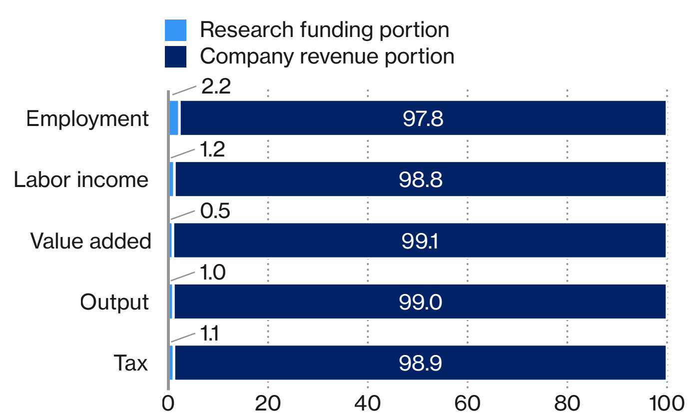



Source: Signal49 Research.

**Chart 4**

Company revenue accounts for most of total genomics sector economic impact

(per cent)




Source: Signal49 Research.

Appendix B

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## Acknowledgements

This research was prepared with financial support from Genome Canada and data from Genome Canada, the regional genome centres, and Government of Canada.

Many Signal49 Research colleagues collaborated to bring this research to life. Alain Francq, Director, MBA, and Eddy Nason, Director, PhD, provided oversight throughout the research process. Zafer Sonmez, Lead Research Associate, PhD, and James Lannigan, Senior Research Associate, PhD, executed the research; Erin Rose, Senior Manager, MA, structured and edited the report, and Dianne Williams, Vice-President, BComm, provided feedback on early drafts. Natasha Delrosario designed this output.

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To cite this research: Sonmez, Zafer, and James Lannigan. *Canada's Genomics Advantage: The Economic Impact of Genomics in Canada.* Ottawa: Signal49 Research, 2026.

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PUBLICATION P-02190-K5H0V8
PRICE: Complimentary

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