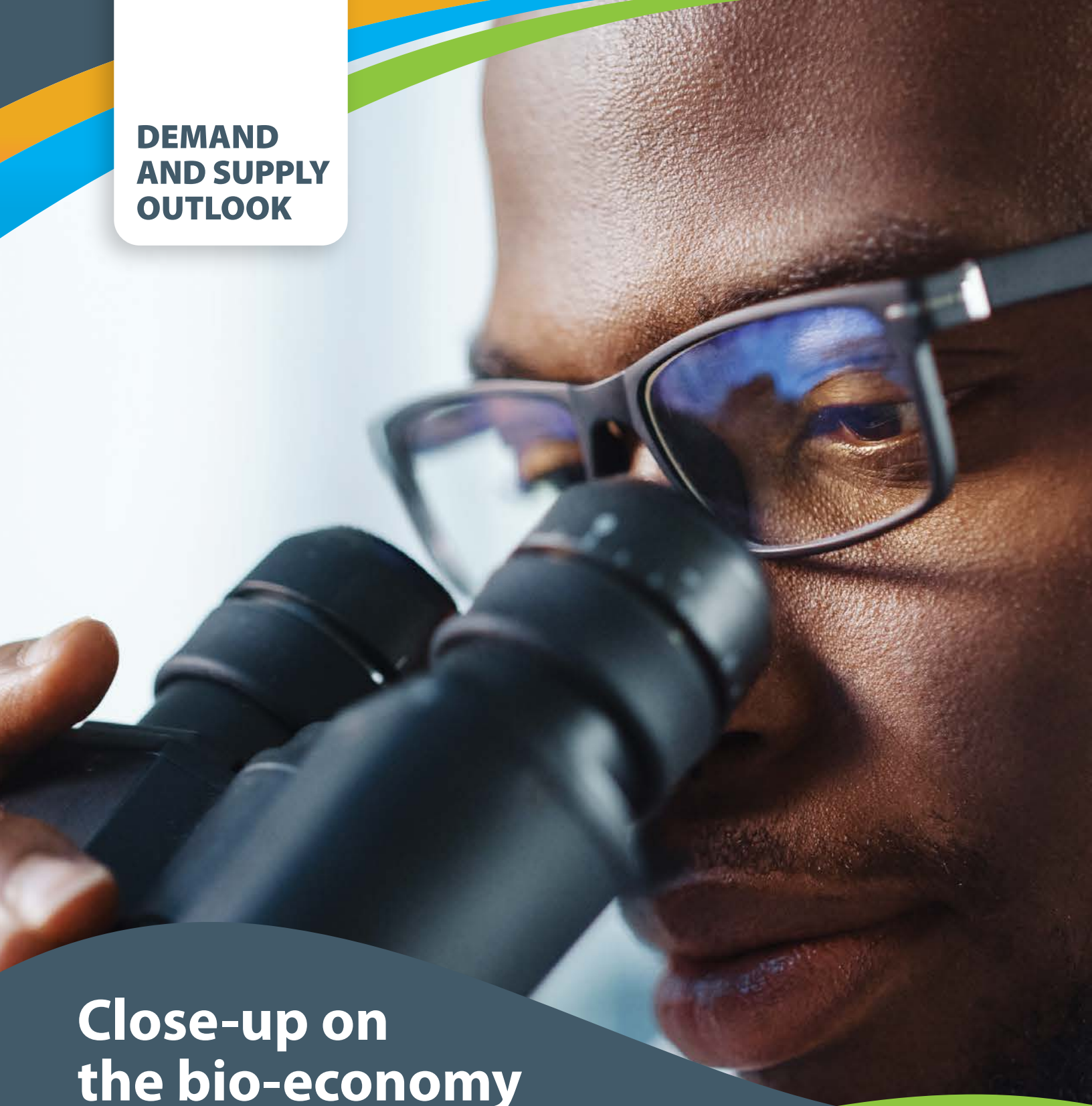
DEMAND AND SUPPLY OUTLOOK



Close-up on the bio-economy

LABOUR MARKET INTELLIGENCE

BioTalent™ Canada

Igniting the bio-economy's brainpower

BioTalent Canada

BioTalent Canada supports the people behind life-changing science. Trusted as the go-to source for labour market intelligence, we guide bio-economy stakeholders with evidence-based data and industry-driven standards. We are focused on igniting the industry's brainpower, bridging the gap between job-ready talent and employers, and ensuring the long-term agility, resiliency and sustainability of one of Canada's most vital sectors.

Recently named one of the 50 Best Workplaces in Canada with 10–50 employees and awarded a Great Place to Work® Certification 2021, BioTalent Canada practices the same industry standards it recommends to its stakeholders. These distinctions were awarded to BioTalent Canada following a thorough and independent analysis conducted by Great Place to Work®.

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About this report

This demand and supply outlook gives a detailed view of anticipated employment and hiring needs in Canada's bio-economy to 2029 along with the expected supply available to bio-economy employers. As part of BioTalent Canada's 2021 series of labour market intelligence (LMI) reports, it helps provide the perspective bio-economy organizations need to find, recruit, train and retain talented teams based on real, meaningful understanding of the labour market. Its insights are based on surveys, stakeholder roundtables and interviews, an environmental scan and extensive data analysis.

What's new in 2021

This is the first time BioTalent Canada has included demand and supply projections as part of its LMI research, thanks to new data sources and analyses not available for the previous national LMI studies conducted in 2008 and 2013.[1] These include:

- **Bio-economy labour market outlooks** based on econometric models that estimate hiring requirements in combination with talent supply projections
- **Supply projections** for domestic and international student graduates, internationally educated professionals, demographic shifts, and more
- **Larger sample sizes** for more reliable data
- **An enhanced definition of the bio-economy** derived from standardized classification systems and focused on bio-economy occupations within the highest quality data sets

This new series also includes projections and findings specific to the impacts of **COVID-19**. The primary employer survey closed in March 2020, providing a pre-pandemic baseline to compare against additional perspective gathered throughout 2020 and 2021. This has enabled a rapid assessment of the pandemic's consequences for the bio-economy labour market, including economic recovery impacts in forecast models.

1 *BioTalent Canada's previous two LMI studies were Sequencing the Data (published in 2013) and Splicing the Data (published in 2008).*

Other reports in the series

The *Close-up on the bio-economy* LMI series is published as part of BioTalent Canada's mission to provide bio-economy stakeholders with valuable, evidence-based labour market intelligence and job-ready human resources.

It also includes:

- A **National Report**
- **Regional spotlights** (Atlantic Canada, Quebec, Ontario, Prairies, Western Canada)
- **Metro hub spotlights** (Greater Montreal, Greater Toronto Area, Metro Vancouver)
- Research briefs on topics such as bio-economy education and work-integrated learning

Visit biotalent.ca/LMIStudy to download these and other LMI reports, briefs and articles.

Research partners

The following researchers contributed to the development of this research and report:

- DPM Research Inc.
- Prism Economics & Analysis Inc.
- EKOS Research Associates Inc.
- Ipsos

Message from the President and CEO

When demand exceeds supply with respect to goods and services, prices rise. That's a fundamental economic principle. But what happens when demand exceeds supply with respect to talent? That's a far more concerning development, and one Canada's bio-economy is facing.

This Demand and Supply report is a key component of BioTalent Canada's largest and most comprehensive Labour Market Information (LMI) study ever. And for good reason. The bio-economy cannot reach aggressive forecasts for industry talent demand outlooks without a deep understanding of the current—and expected—supply resources or recommendations aimed at tapping into underserved talent pipelines.

Canada is a melting pot. It's one of the most diverse countries in the world. It's also home to some of the best and brightest people on Earth. Recruitment and retention strategies have come a long way. Companies—large and small—in other industries have come up with innovative ways to make themselves attractive to youth, newcomers, women, Indigenous and people with disabilities.

So, why do many employers in the bio-economy use antiquated recruitment methods? Most employers surveyed for this report lacked dedicated HR expertise. And the number of bioscience companies that only recruit through their own network of personal and professional contacts is staggering. We need to cast a much wider net.

This report digs deep. It forecasts out to the end of the decade and reveals some very lofty talent supply numbers the bio-economy will have to reach to remain sustainable. Much in the same way that BioTalent Canada recommends that employers leave no stone unturned to find talent, this report left no stone unturned to unearth the data.

This report—and all-encompassing LMI—are coming out at the right time. COVID-19 is accounted for in all the data and projections. Industry learned some real lessons since the pandemic and those lessons are reflected in the recommendations.

For example, there's a real need for Canada's bio-manufacturing sector to level up its talent recruitment. The ability for Canada to develop and produce its own vaccinations is paramount to our country's capacity to respond quickly to another pandemic. This report details the ways that sector—and others—can be more proactive and less reactive.

Formulating the plan is easy. Executing it is the real work. But this report lays the foundation for future industry success. Our thanks to the organizations, individuals and associations who gave so generously of their time and expertise to make this, and the host of related reports released as part of a series, possible.

Rob Henderson,
President and CEO, BioTalent Canada

Executive summary

Canada's growing bio-economy will need as many as **65,000 additional workers by 2029** to meet hiring demand. Companies will be challenged to fill those positions due to a highly competitive labour market, relatively low awareness of bio-economy careers and, in many cases, an ongoing lack of HR capacity or capital to attract and retain candidates.

The demand story

Canada's bio-economy will need **new workers in all four primary sub-sectors** of bio-health, bio-industrial, agri-bio and bio-energy, with most new hires required in bio-health. Of the approximately 65,000 additional workers needed by 2029, three-quarters are to replace people leaving the workforce. Hiring related to expansion and growth will fluctuate over the forecast period.

Employers will be looking for a wide range of skills, including "soft" professional and interpersonal skills. Most jobs in the bio-economy require **some form of post-secondary education or training**, even in less scientific areas such as manufacturing or logistics. Overall, employers' top pool of candidates is graduates from biological and biomedical sciences programs, followed by those with engineering qualifications.

Nearly two-thirds of employers surveyed by BioTalent Canada said they have **difficulty recruiting or retaining qualified staff due to a lack of skilled, experienced talent**, especially those in Atlantic Canada. These issues are likely made more difficult by the lack of dedicated human resources staff in most bio-economy companies — just 30% have a formal HR department. As well, **bio-economy employers compete for talent** among themselves, with other sectors for candidates with technical skills, and with companies across the economy for non-technical skills.

The majority of hiring needs are to replace people leaving the workforce.

The supply story

If conditions do not change, supply will not be sufficient to meet bio-economy labour demand over the coming decade. While **labour shortages** are expected for all job functions, they are expected to be **most severe in three areas**: manufacturing and production, distribution and logistics, and management, finance and administration.

The declining proportion of youth in the Canadian population overall means there is **less domestic supply of students to enroll in bio-economy-related post-secondary programs**. That puts more importance on the **growing proportion of international students**. Between 2012–2013 and 2016–2017, international enrolments in Canadian undergraduate bio-economy-related degree programs climbed by 73%. Yet less than 30% of international students go on to become permanent residents, and **today internationally educated professionals (IEPs) and recent immigrants make up just a small percentage of the bio-economy workforce**.

The **low mobility** of Canadian university graduates and generally **low awareness** of bio-economy careers also affects the bio-economy labour supply. Greater outreach to students in relevant programs could help address both, as **many graduates currently report working in jobs unrelated to their studies** and might be willing to relocate for more suitable work that today they don't even know exists.

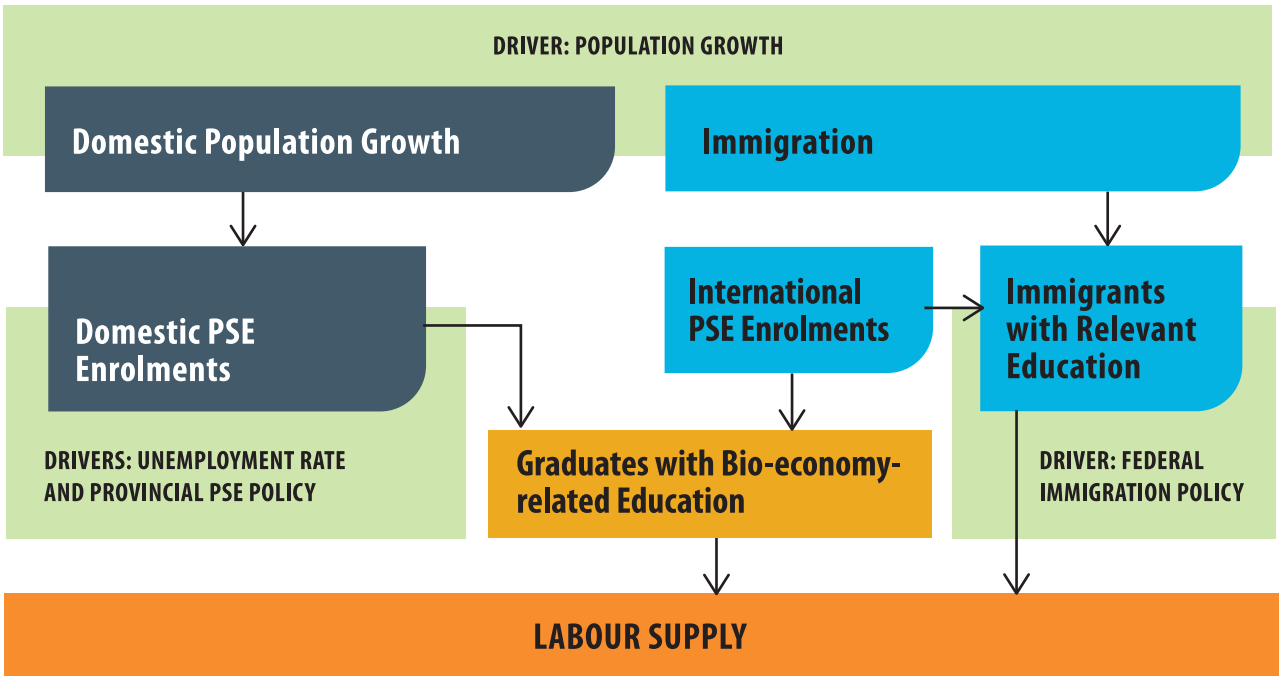
If conditions do not change, supply will not be sufficient to meet bio-economy labour demand.

Recommendations

To address the labour needs of the bio-economy to 2029, based on the findings of this LMI study, BioTalent Canada recommends the following:

1. **Boost work-integrated learning** by incorporating it into more programs
2. **Diversify recruitment** and human resources practices to reach a broader and more diverse talent pool
3. **Create a wage subsidy program for immigrants** to reduce the perceived risk of hiring immigrants
4. **Forge pathways for international students and IEPs** to integrate international talent into the labour market
5. **Support reskilling initiatives** to expand the talent pool
6. **Foster bio-economy mobility** to expand the talent pools for companies not located near educational hubs
7. **Raise awareness of bio-economy career opportunities** through greater outreach to students and graduates

Where the bio-economy labour supply comes from

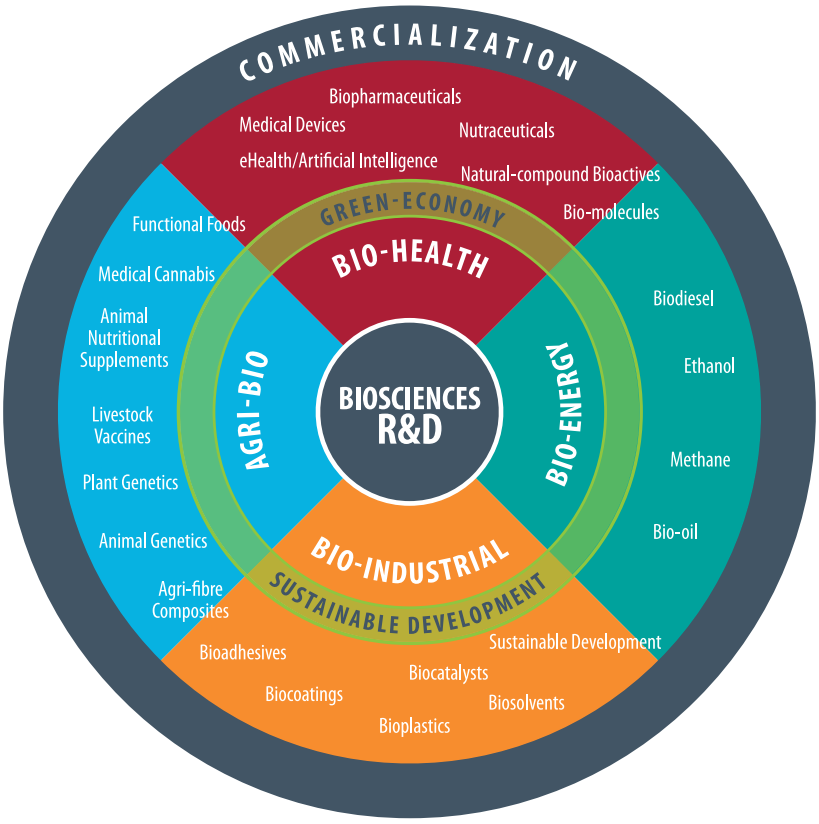


DEFINING THE BIO-ECONOMY

The bio-economy today

The bio-economy is defined as the economic activity associated with the invention, development, production and use of primarily bio-based products, bio-based production processes and/or biotechnology-based intellectual property. It includes the use of resources from agriculture, forestry, fisheries/aquaculture, organic waste and aquatic biomass.

The field is multidisciplinary in that it cuts across the bio-health, bio-energy, bio-agriculture (agri-bio) and bio-industrial (chemicals and materials) sub-sectors. These four are all rooted in their own foundations of research and development and all have products, processes or intellectual property that are involved in the "green" or sustainable development economy as well, to a greater or lesser extent. The bio-economy sub-sectors share a common objective: the commercialization of resultant bio-products, processes and/or intellectual property.



The **bio-health** sub-sector encompasses the invention, development, manufacturing, commercialization and use of products that improve therapeutics, diagnostics, prevention and health administration, as well as the development and production of nutraceuticals and applications of medical cannabis. Research and development activities contribute to the development of new products, bio-based technologies and intellectual property related to the production of bio-health products and technologies.

The **bio-energy** sub-sector encompasses the invention, development, production, commercialization and use of renewable fuels through the conversion of organic material into heat or power. Research and development activities contribute to the development of new products, bio-based technologies and intellectual property related to the production of bio-energy.

The **bio-industrial** sub-sector encompasses the invention, development, manufacturing, commercialization and use of goods for industrial use, such as bio-chemicals and bio-materials, through the conversion of organic material. Research and development activities contribute to the development of new products, bio-based technologies and intellectual property related to the production of bio-industrial products. Among others, the development and production of biocatalysts are an integral part of this sub-sector.

The **agri-bio** sub-sector encompasses the invention, development, production, commercialization and use of new or modified products resulting from the manipulation, modification or alteration of the natural features of plants and crops, animals and/or other food sources. Research and development activities contribute to the development of new products, bio-based technologies and intellectual property that support improved quality, yield and efficiency in the agricultural sector and food production.

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Demand:
What does the sector need?

Canada's bio-economy is growing and needs a steady supply of new workers to meet demand — as many as 65,000 by 2029 to fill a wide range of roles across all four primary sub-sectors. Many organizations will require workers with diverse skillsets, some highly specialized and technical and others related to the business of the bio-economy and productive team collaboration.

Overall employment in the bio-economy

Employment in Canada's bio-economy is projected to grow by around 1.5% annually between 2021 and 2024[2] to a total of 214,000 workers. Even when other parts of the Canadian economy saw significant job losses during the COVID-19 pandemic, the bio-economy added 8,500 workers in 2020, largely due to strong investment in life sciences as organizations across the country sought ways to fight back against the coronavirus.

Over the medium to longer term, bio-economy employment growth is expected to slow to less than 1.0% annually between 2025 and 2029 due to softer GDP growth and higher interest rates as the post-pandemic economic recovery is completed. **By the end of the decade, the bio-economy is projected to employ more than 223,000 workers**, with each sub-sector undergoing its own pattern of expansion and contraction.

TABLE 1. Employment outlooks by sub-sector

Year	Overall	Bio-health	Bio-industrial	Agri-bio	Bio-energy
% change 2019 to 2020	**+4.3%**	+6.8%	+4.3%	(-1.6%)	(-4.7%)
Employment 2020	▲ **208,000**	▲ 124,000	▲ 44,000	▼ 26,000	▼ 13,500
Employment 2024	▲ **214,000**	▲ 126,000	▲ 45,000	▲ 29,000	▲ 14,000
Employment 2029	▲ **223,000**	▲ 131,000	▲ 47,500	▲ 30,000	▼ 13,500

Source: BioTalent Canada Modeling and Projections (2020)

2 *This study considered three time periods for its economic forecasts: immediate (to explore pandemic-related changes between 2019 and 2020), short term (2021 to 2024) and medium/longer term (2025 to 2029).*

Employment demand by sub-sector

Bio-health

Employment grew faster in bio-health than any other sub-sector in 2020 because of increased pharmaceutical and medicine manufacturing. Additional employment demand was generated by hospitals and other organizations conducting clinical trials and related research activities. In total, employment was up by 6.8% in 2020, reaching 124,000 jobs.

Even with a slight contraction of 1.1% in 2021, employment will remain above pre-pandemic levels throughout the forecast period (to 2029), with modest 1.0% annual growth expected between 2022 and 2024. **Stronger employment growth will be seen over the medium/longer term**, approximately 1.5% annually from 2025 to 2029 due to continued increases in health spending as Canada's population ages. The bio-health sub-sector is projected to employ some 126,000 workers by 2024 and more than 131,000 by 2029.

Bio-industrial

Employment in the bio-industrial sector grew by 4.3% in 2020 to 44,000 workers, primarily to support increased demand for personal care and household cleaning products during the COVID-19 pandemic. As the economy recovers, employment is expected to return to pre-pandemic levels in 2021. This will be followed by **healthy growth of 2.4% annually between 2022 and 2024** due to anticipated increased demand for bio-based products such as dyes and pigments. Over the medium/longer term, employment growth of 1.2% annually is projected between 2025 and 2029 for a total of 47,500 workers by the end of that period.

Agri-bio

Agri-bio employment fell by 1.6% in 2020, mainly because of contractions in the aquaculture industry caused by reduced demand for seafood from restaurants and cruise ships during the pandemic. Demand should return to pre-pandemic levels in 2021 as the economy re-opens, with **annual employment growth of 2.2% expected until 2024** as the market for products such as biopesticides and organic fertilizers increases. Weaker employment growth of 1.2% annually is projected between 2025 and 2029. Agri-bio employment is expected to reach 29,000 workers by 2024 and more than 30,000 workers by 2029.

Bio-energy

Bio-energy employment fell by 4.7% in 2020, the largest contraction of any sub-sector. This was caused mostly by employment losses in oilseed processing, which is a key component of biodiesel production. Temporary plant closures and restricted operating capacity due to the COVID-19 pandemic limited domestic biofuel production in the first half of 2020. Some facilities shifted to producing hand sanitizer, which reduced their profits.

While the sub-sector is expected to make a partial recovery in 2021, **employment growth will be below 0.5% annually until 2024 and is projected to decline by 0.5% annually in the back half of the decade** due to minimal growth in demand for biofuels and other bio-based energy sources, which face steep competition from natural gas, wind and solar energy.[3] As electric vehicles become price-competitive with conventional vehicles, demand will fall for ethanol as a fuel source. Bio-energy employment is expected to reach 14,000 workers by 2024 before falling back below 13,500 by 2029.

By the end of the decade, the bio-economy will employ more than 223,000 workers.

3 *Canada Energy Regulator.* Canada's Energy Future 2020. *https://www.cer-rec.gc.ca/en/data-analysis/canada-energy-future/2020/index.html*

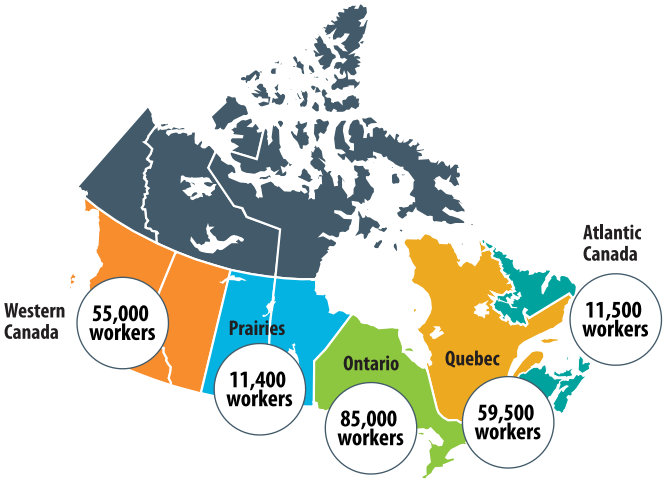
Employment demand by region

Bio-economy employers are located across the country. This report uses the following regional breakdown:

- Atlantic Canada (New Brunswick, Newfoundland and Labrador, Nova Scotia, Prince Edward Island)
- Quebec
- Ontario
- Prairies (Manitoba, Saskatchewan)
- Western Canada (Alberta, British Columbia)

All but Atlantic and Western Canada will see a downturn in bio-economy employment in 2021 due to the economic impact of the COVID-19 pandemic, followed by moderate to healthy growth for the rest of the forecast period.

FIGURE 1. Demand forecasts for 2029



- **Atlantic Canada:** While no significant downturn is expected for 2021, the region will see only modest employment gains to 2029, projected at 0.7% each year. More than **11,500 workers** will be employed in the Atlantic bio-economy by 2029.
- **Quebec:** After a dip in 2021, employment in Quebec's bio-economy is projected to grow annually at 1.0% to 2024. That rate will fall to 0.7% in the back half of the decade following a contraction in 2025, with total employment reaching **59,500 workers** by 2029.
- **Ontario:** Moderate employment gains will be seen after the downturn in 2021, with 1.3% employment growth expected annually from 2022 to 2024. This will fall to 1.1% for the 2025–2029 period, with total employment surpassing **85,000 workers** by the end of the decade.
- **Prairies:** Although the Prairie provinces will see a significant downturn in bio-economy employment in 2021 — dropping 10.1% from 2020 — annual employment growth is estimated at 1.7% between 2022 and 2024 and at 1.1% for the 2025–2029 period. Total employment is expected to reach **11,400 workers** by 2029, recovering back to 2020 levels.
- **Western Canada:** No significant downturn is expected in 2021 and annual employment growth is estimated at just under 2.0% between 2021 and 2024. This will fall to 1.2% annually over the longer term and nearly **55,000 people** will be working for Western bio-economy employers by 2029.

For more detailed regional employment projections, see our series of regional LMI spotlights at biotalent.ca/LMIStudy.

What employers want from graduates

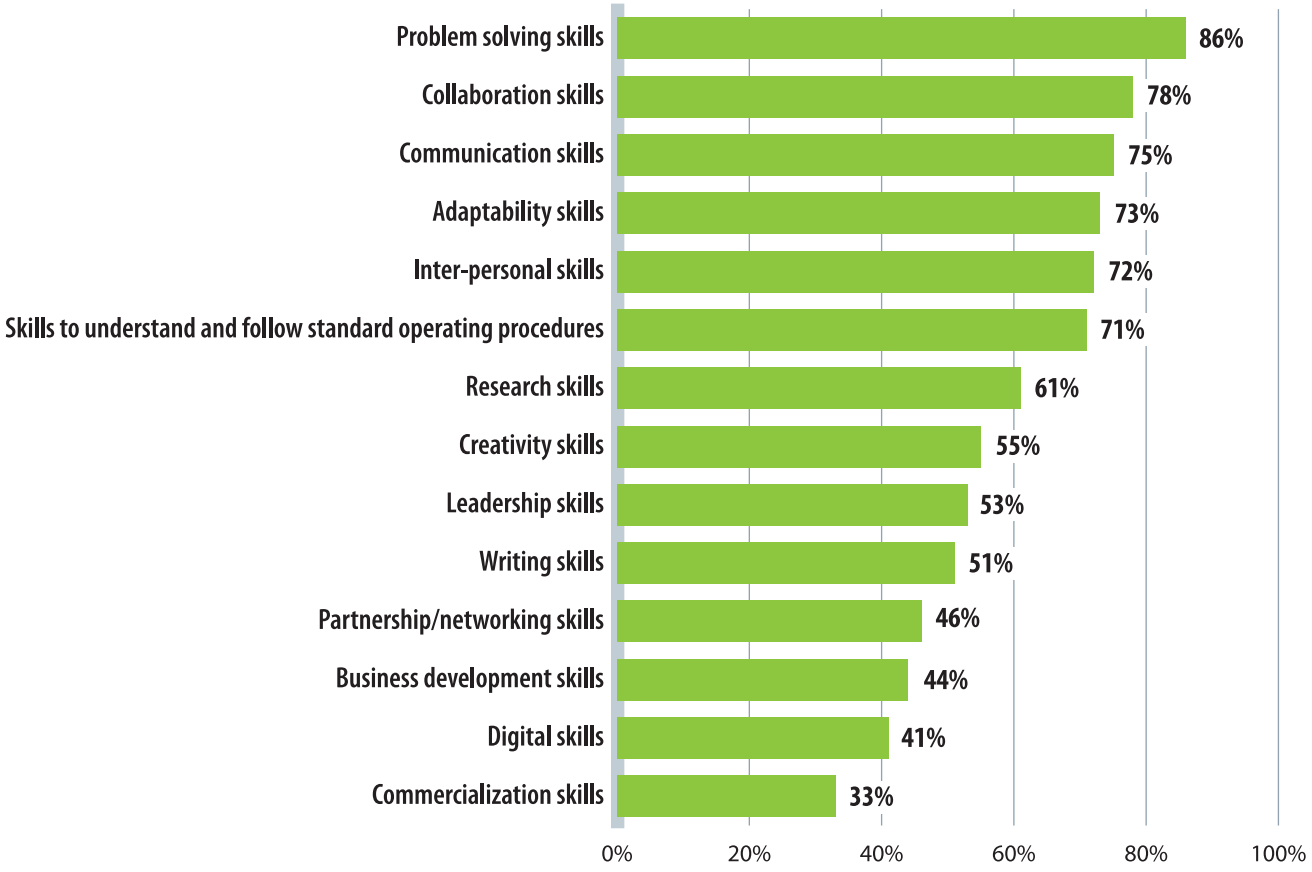
As the bio-economy grows, employers will be looking for people with a wide range of skills. According to BioTalent Canada's 2020 employer survey, approximately two-thirds (67%) of **bio-economy organizations seek graduates from biological and biomedical sciences programs**. Around half also look for workers with engineering qualifications (53%) and multi- or interdisciplinary backgrounds (45%).

This indicates a need for people with specialized technical/research skills as well as those who understand

the broader business context. Finding people with the right sets of skills seems to be a top challenge for the sector. Specifically, bio-economy employers need three types of skills:

- **Soft skills:** Almost one-third of employers surveyed (30%) said there is a lack of qualified candidates with practical/non-academic skills — the essential skills for success such as problem solving, collaboration and communication that can be harder to teach than technical skills.
- **Technical skills:** Employers reported two distinct kinds of technical skills gaps: those due to insufficient post-secondary training of new graduates and those in existing employees who do not keep up to date with new technologies or knowledge related to their occupation.
- **Business skills:** Companies looking to grow and commercialize innovations said it is important for workers (especially those in R&D roles) to have strong business-related knowledge and skills, which help them see the bigger picture and understand what's driving their work.

FIGURE 2. Skills rated very important for bio-economy organizations



Source: BioTalent Canada Survey of Employers (2020)

More than three-quarters of employers seek candidates with problem solving, collaboration and communications skills, which can be harder to teach than technical skills.

Companies' needs vary by discipline and also level of specialization. **Most jobs in the sector require at least a university undergraduate degree.** In the 2020 survey of bio-economy employers, roughly two-thirds said they require an undergraduate degree for positions in IT (71%), management, finance and administration (69%), and legal and regulatory affairs (64%). In some functional areas, post-graduate education is often also essential — including R&D (required by 63% of employers) and legal and regulatory affairs (40%).

Even for functional areas that rely less on advanced scientific education, many employers still require post-secondary education. In manufacturing and production, 23% of employers look for an undergraduate degree and 38% expect a college or trade school diploma. For distribution and logistics jobs, 55% of employers require a college or trade school diploma and 45% want their workers to hold an undergraduate degree (51%). **There is little opportunity for people with only a high school education to find a position** in the sector except for jobs in distribution, logistics, manufacturing and production, where approximately one-third of companies (31%–34%) say a high school diploma is sufficient. This may change going forward, however, as the need for talent in bio-manufacturing increases and supply decreases, which could lead employers to re-evaluate their requirements.

Most jobs require post-secondary education, even for functional areas that rely less on advanced scientific education.

Hiring requirements

There are two main types of labour demand in the bio-economy:

- **Expansion demand**, which is driven by growth in bio-economy industries
- **Replacement demand**, which is driven by the need to replace people leaving the workforce[4]

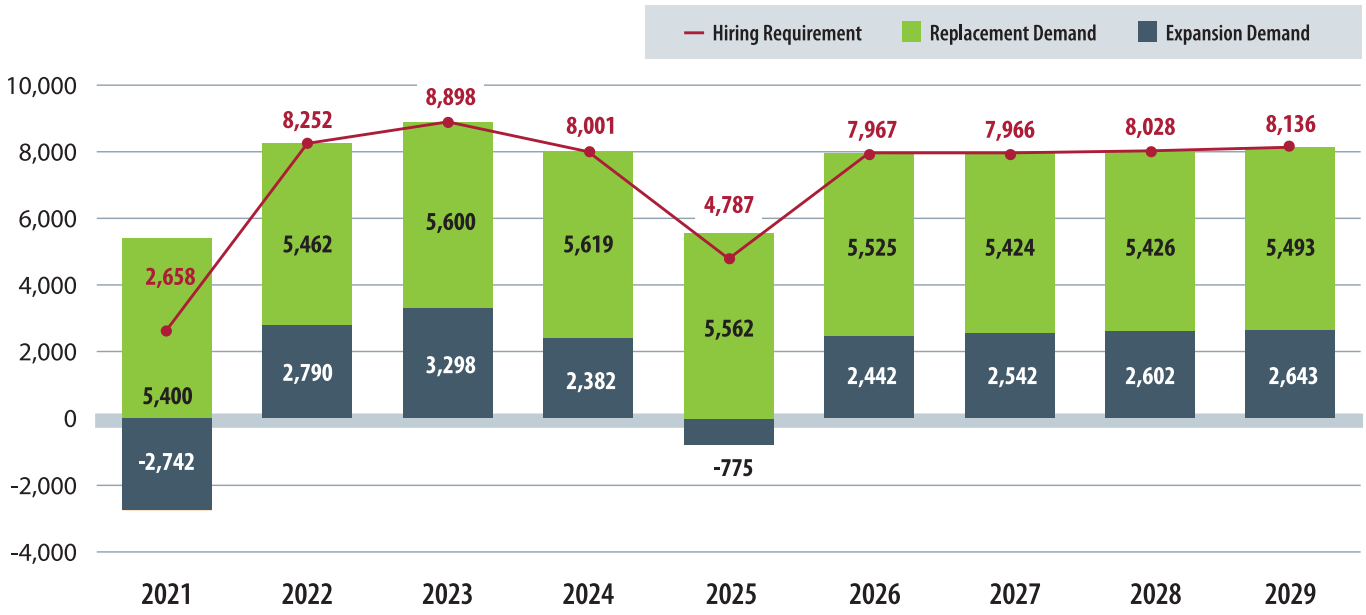
Taken together, these make up the total labour demand: the number of job openings across bio-economy organizations nationally, which this report refers to as hiring requirements.

The approximately 65,000 additional workers needed by the bio-economy between 2021 and 2029 are mainly the result of replacement demand, which makes up more than three-quarters of total hiring requirements. The largest proportions of hires will be for roles in manufacturing and production (25%), R&D (21%), and management, finance and administration (17%).

Expansion demand is projected to be weakest in 2021 as the bio-economy contracts to pre-pandemic levels and will likely dip again in 2025 as the post-pandemic economic recovery brings about higher interest rates, prompting many bio-economy employers to cut costs and reduce their spending, including on labour.

4 *This measure includes people leaving the workforce due to retirement or death, but does not account for workers exiting as part of turnover.*

FIGURE 3. Hiring requirement outlook by demand type



Source: BioTalent Canada Modeling and Projections (2020)

Three-quarters of all new hires will be to replace people leaving the bio-economy workforce.

Hiring requirements by sub-sector

Expansion and replacement demand will be experienced differently across the bio-economy's four sub-sectors.

Bio-health

Approximately **36,000 new workers** will be needed in bio-health over the forecast period, nearly 80% of those to replace exiting workers. The hiring requirement is projected at more than 4,000 workers in each year except 2021, when employment is expected to contract following 2020's expansion, and 2025, when rising interest rates will limit the sub-sector's growth.

One-quarter (25%) of bio-health job openings will be for R&D roles, with the next most-needed being management, finance and administration functions (16%) and manufacturing roles (14%).

Bio-industrial

The bio-industrial sub-sector will require **14,500 new workers** between 2021 and 2029, with 75% of those new hires to meet replacement demand. There will also be significant expansion demand in the short term as the sub-sector rebounds from an employment contraction in 2021 and bio-based products gain market share. Weaker long-term employment trends will limit expansion demand in the latter half of the decade. Replacement demand is expected to remain stable at roughly 1,200 workers each year over the forecast period.

Two-fifths (40%) of the job openings among bio-industrial employers will be for manufacturing and production roles, one of the highest shares among the four sub-sectors. Just 15% of job openings will be for R&D roles — reflecting bio-industrial's distinct occupational distribution within the bio-economy.

Agri-bio

In the agri-bio sub-sector, **11,000 new workers** will need to be hired between 2021 and 2029. While nearly two-thirds (63%) of the total hiring requirement over that period will come from replacement demand — the lowest share of any sub-sector — expansion demand will drive hiring requirements in the short term as bio-based products gain market share, peaking in 2023. However, weaker employment trends over the longer term will limit expansion demand over between 2025 and 2029. Replacement demand will remain stable at about 800 people leaving the workforce annually.

Approximately one-third (35%) of the job openings in this sub-sector will be for manufacturing and production roles. Nearly one-quarter (23%) will be for management, finance and administration roles, one of the highest shares of any sub-sector.

Bio-energy

The bio-energy hiring requirement is the smallest of the four sub-sectors at just **3,300 new workers** to be hired between 2021 and 2029, virtually all to fill replacement demand. Expansion demand will produce nearly 300 job openings in 2021 as employment rebounds post-pandemic, but fewer than 100 expansion-related job openings are expected each remaining year to 2024, after which expansion demand will turn negative as employment falls from peak levels. Replacement demand is also expected to decline to a low of 345 workers to be replaced by 2029.

More than one-third (39%) of bio-energy job openings will be for manufacturing and production roles, mostly between 2021 and 2024. Openings for R&D roles are projected to rise later in the decade, especially between 2027 and 2029, ultimately accounting for roughly one-fifth (19%) of the total hiring requirement over the forecast period.

The bio-manufacturing gap

COVID-19 highlighted a significant gap in the Canadian bio-economy: bio-manufacturing and processing capacity. Canada was initially unable to produce sufficient personal protective equipment (PPE) to meet its needs and had no domestic capacity to develop and manufacture vaccines. Commitments have been made to build facilities to remedy this, but those facilities will require skilled people to operate them — a supply of talent does not currently exist.

Estimates suggest Canada will need an additional 16,140 bio-manufacturing workers by 2029 (5,160 in bio-health manufacturing alone), even without taking into account expansion growth due to recently announced investments. Only 25% of those positions will be fillable by predicted supply during this time period.

To fill the shortages, the bio-economy will need to develop new strategies, such as training workers from other sectors and more actively recruiting from outside traditional labour pools, including people from demographic groups under-represented in the bio-economy such as Indigenous persons, newcomers to Canada and persons with disabilities.

Canada will need an additional 16,140 bio-manufacturing workers by 2029. The predicted supply of bio-manufacturing talent represents less than 25% of that demand.

Hiring requirements by region

The hiring requirements projected at the national level also apply to each region across Canada, with most new hires needed to replace people leaving the workforce, especially for manufacturing and production roles.

- **Atlantic Canada:** Approximately **3,300 additional workers** will be needed in the Atlantic bio-economy by 2029, with replacement demand making up more than three-quarters of the hiring requirement. The largest proportion of new hires will be for manufacturing and production roles (31%), followed by positions in management, finance and administration (22%).
- **Quebec:** Roughly **15,500 additional workers** will be needed in Quebec by 2029, with 85% of the hiring requirement driven by replacement demand. The largest proportion of new hires will be for positions in manufacturing and production (25%) and R&D (20%).
- **Ontario:** About **24,500 new workers** will have to be hired in Ontario by 2029, more than three-quarters of which will be to replace people leaving the workforce. Manufacturing and production roles make up the largest proportion of new hires (24%) followed by R&D (21%).
- **Prairies:** The hiring requirement for the Prairies is estimated at **2,500 additional workers** by 2029, although this total rises to 3,400 if the severe employment downturn expected for 2021 is excluded from the analysis. Replacement demand makes up approximately two-thirds of the hiring requirement, with R&D roles a similar proportion of new hires (23%) as manufacturing and production (23%).
- **Western Canada:** In the West, some **18,000 new workers** will need to be hired by 2029 — only two-thirds (64%) of this requirement stems from replacement demand. Manufacturing and production (25%) and R&D (20%) are the functional areas in which most new hires will be needed.

For more detailed regional hiring requirement projections, see our series of regional LMI spotlights at biotalent.ca/LMIStudy.

Top HR challenges

Bio-economy employers surveyed by BioTalent Canada identified their main recruitment- and retention-related issues as:

40%
Lack of qualified candidates with required specialized skill sets or experience

36%
Insufficient capital or resources to pay competitive wages to attract and retain qualified candidates

30%
Lack of qualified candidates with practical/non-academic skills

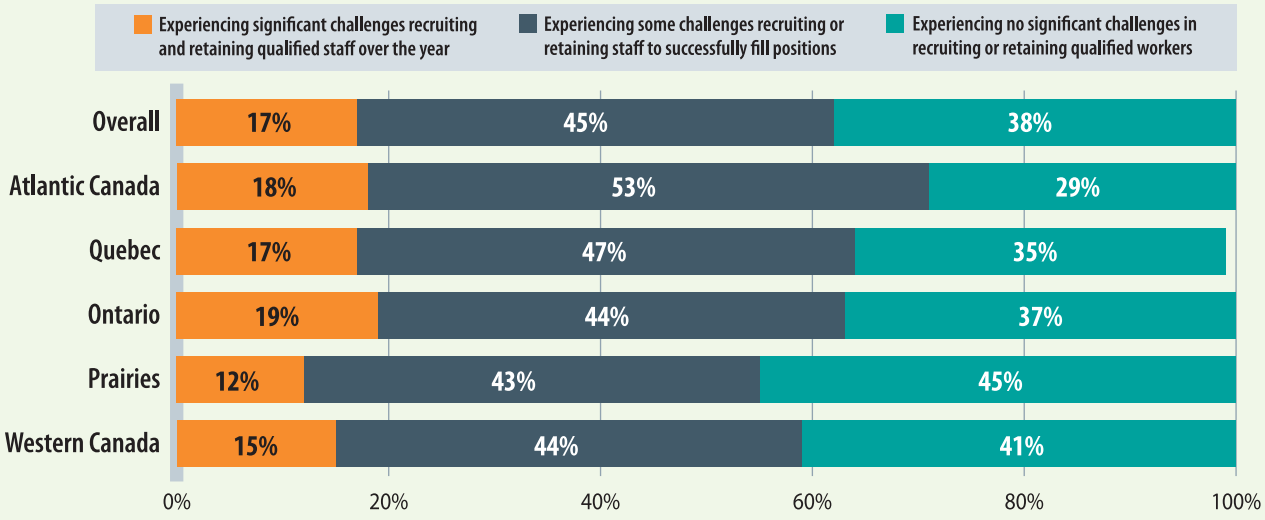
16%
Loss of candidates and employees to large, well-known organizations

13%
Lack of applicants

More than half (56%) reported management-level skills and labour shortages, while 61% reported skills and labour shortages in research and technical areas. These issues are likely made more difficult by the lack of dedicated human resources staff in most bio-economy companies — just 30% have a formal human resources department.

Nearly two-thirds (62%) of employers said they have difficulty recruiting or retaining qualified staff due to a lack of skilled, experienced talent. Atlantic Canada had the highest proportion of firms (71%) reporting some or significant challenges recruiting and retaining qualified staff. Alberta had the lowest (44%). Employers from the Atlantic and Prairies regions said businesses in rural areas have more challenges recruiting talent unless they have established a direct pipeline with nearby post-secondary institutions.

FIGURE 4. Challenges in recruiting or retaining workers by region



Source: BioTalent Canada, Survey of Employers 2020

Applied Biological Materials

Solving the skills shortage from within

What's the best way to bring new employees up to speed on a vast product portfolio or build a technically knowledgeable team of sales reps in a business undergoing double-digit growth? For Applied Biological Materials of Richmond, BC, the answers come from within. The company has tapped its senior managers to mentor new hires and enlisted its own scientists to head up customer-facing functions.

Company profile: Applied Biological Materials

Location: Richmond, BC

Employees: 130

Sub-sector: Bio-health

Applied Biological Materials among one of the largest biotech companies in British Columbia, with a catalogue of more than 5 million products and services distributed by 90-plus partners worldwide. Its long-term international partnerships with prestigious universities and R&D organizations enable the company to drive discoveries on a global scale.

Q: Tell us about your business: what's the focus of your work?

LILY LI, FINANCE AND HUMAN RESOURCES ASSISTANT: We produce technologies for the life sciences research and biotechnology industries. We supply materials needed in molecular biology, polymerase chain reaction (PCR), next-generation gene sequencing, gene expression vectors and viruses, CRISPR, contract research and more. Our aim is to be a one-stop shop for research labs around the world, helping them reduce their operating costs without jeopardizing quality. We've been recognized as one of the top-25 fastest-growing companies in British Columbia. We've seen a 30% average annual growth rate since we incorporated in 2004.

"Many of our mentors have shifted from management back into training."

Q: What positions do you most need to fill to maintain that growth?

LL: We need more people in the lab doing the technical work because our portfolio is so extensive. We also need people with skills that suit our proprietary production processes, and who can make sure our products meet our quality controls. We get a lot of candidates on the research side, but it's been difficult finding people with skills on the production side. We also need people with sales and marketing skills — but who understand life sciences and the value of our products.

Q: What's been your approach to finding the kinds of candidates you need?

LL: Our current strategy is to shift some of our more extroverted and customer-oriented product experts into sales and marketing roles. On the technical side, we've been pairing new hires with senior staff who can mentor them to develop the skills we expect once they've finished their probationary period. We're finding hands-on learning is more effective than having new hires just read product documentation.

Q: In addition to technical expertise, are there interpersonal or soft skills you look for?

LL: The ability to collaborate and communicate across departments is critical. We look for evidence of those skills in the first recruitment cycle for a new position. Time management and attention to detail are also key. Customers expect their orders to be filled quickly and staff work on multiple orders at the same time.

Q: How important is solving the talent challenge your ongoing success?

LL: Very. Not having the right people can cause potential production delays or impact our ability to get production quality up to the right level, which would prevent our customers from carrying out their own life-changing research.

Q: Are there other challenges that keep you up at night?

LL: We interview a lot of candidates but even after we hire people, we may not be sure they're going to work out in our organization. Beyond just finding people with skills and the right credentials, it's also a real challenge to find people who will fit our culture, which is fast-paced and emphasizes innovation.

Supply: What's available to employers?

To meet the demand for new workers, bio-economy employers turn to two main sources of labour: graduates from Canadian post-secondary institutions and newcomers to Canada, including immigrants and international students. Yet the supply of potential workers from these sources is always in flux due to population growth, education trends, demographic shifts and other factors.

Canada's labour force

The Canadian labour force — the total number of people available, able and willing to work — has been growing steadily and is projected to reach 21.8 million people by 2029. The pandemic caused a short-term spike in national unemployment, from 5.7% in 2019 to 9.5% in 2020, but this **may have a positive impact on the bio-economy**. When unemployment is high, people often choose to stay in or return to university, which could add to the potential supply of new graduates to fill open bio-economy jobs.

Demographics affecting the labour market

Youth (under 25 years old)[5] have always been critical to the labour supply as they represent future enrolments in bio-economy-related educational programs and the next generation of skilled workers. Yet the youth share of Canada's population has been declining steadily over the past two decades and will likely continue to do so, falling from 33% in 2000 to an expected 26% in 2029, in line with decreasing fertility rates. This is concerning for the future bio-economy because **a strong supply of youth is needed to age into the workforce and replace older workers**, whose numbers are growing as quickly as the youth share of the population is shrinking.

5 *The definition of "youth" varies depending on the source. While BioTalent Canada defines "youth" as under 30, the source data for this report defines youth as under 25.*

The working-age population (25 to 54 years old) has also declined since 2000 but, unlike with youth, is projected to remain stable at around 40% over the next decade. The population share of individuals aged 55 and older climbed from 22% in 2000 to 32% in 2019 and is expected to reach 34% by 2029.

As the youth share of Canada's population falls, people aged 55 and older will make up approximately one-third of the labour market by 2029.

Main sources of labour for the bio-economy

Because the bio-economy requires highly skilled and often specialized labour, **it currently depends on post-secondary education for nearly all its talent.** Prospective workers may come from two distinct sources:

- **Canadian graduates** completing degrees at the undergraduate, master's and doctorate levels in programs relevant to the bio-economy
- **Newly arrived immigrants** (permanent residents) with relevant education credentials or international students who can become immigrants after working in Canada

Temporary foreign workers (TFWs) are not included in this analysis as they are typically a last resort for companies unable to recruit locally.

Key labour source: Canadian graduates

The bio-economy relies heavily on the post-secondary sector and its ability to provide future employees with the necessary knowledge and skills. As such, enrolment trends and changes in program offerings are key to the sector's success over the long run.

Enrolment trends

Post-secondary enrolments at Canadian colleges and universities increased **by 28% between 2008–2009 and 2018–2019**, rising from 1.35 million to 1.72 million students.[6] This growth is not expected to be sustained, however, given that Canada's university/college-aged population (20 to 24 years old) is shrinking, falling from 10.0% of the overall population in 1981 to 6.6% in 2018. The continued climb in enrolments has been driven in part by more international students attending Canadian schools — and in the decades to come, post-secondary institutions will increasingly depend on the children of future immigrants moving through Canada's education system.

Women in post-secondary education

The percentage of women enrolled in all fields of post-secondary education remains high, at 55% in 2018–2019, with women making up at least half of enrolment in short-cycle tertiary education, undergraduate degrees and master's programs. While they make up only 49% of doctoral or equivalent programs, that has increased by two percentage points since 2008–2009. The numbers are similar in bio-economy-related university programs. Women's enrolment in college-level STEM-H programs has also remained stable at around 50%.

6 *Enrolment figures in this report exclude any post-secondary education that does not lead to a degree, diploma or certificate.*

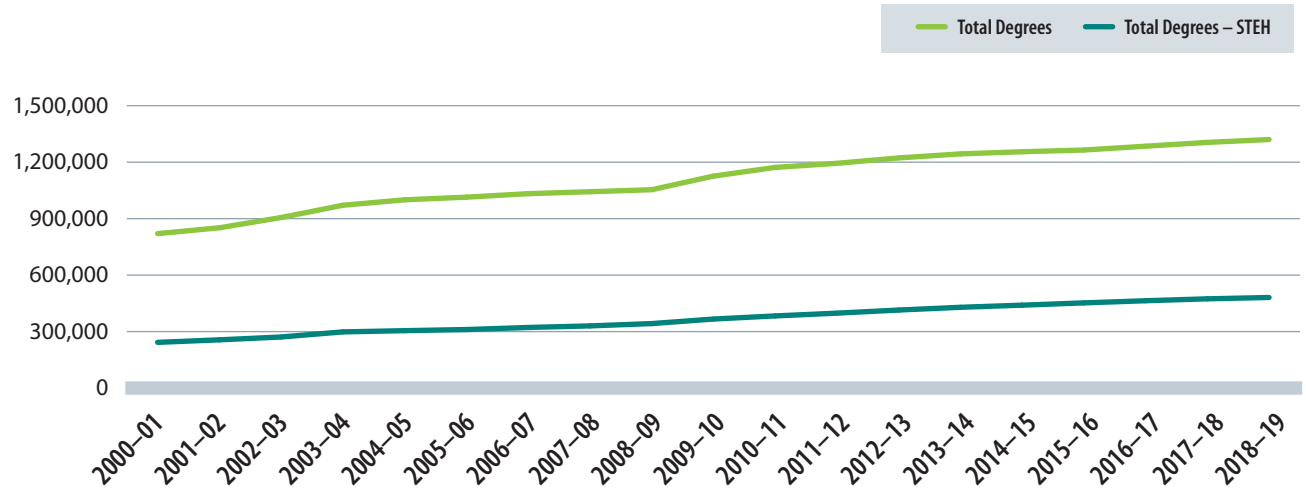
At the university level, enrolment in all science, technology, engineering and health (STEH) degree programs nearly doubled between 2000–2001 and 2018–2019, from 242,850 to 481,239 students.

In the 2016–2017 academic year, nearly 200,000 students were enrolled in programs related[7] to the bio-economy: 152,676 at the undergraduate level, 29,625 at the master's level and 15,276 at the doctorate level. (Generally, the four core areas of study considered to be related in any way to the bio-economy are: physical and life sciences and technologies; architecture, engineering and related technologies; agriculture, natural resources and conservation; and health and related fields.) While most programs in these areas are rooted in traditional disciplines such as biology and chemistry, others are associated with business, law or the social sciences, reflecting the broad range of skills needed by today's employers.

At the college level, more than 156,000 students were enrolled in STEM-H (science, technology, engineering, mathematics and health) programs in the 2018–2019 academic year, most of which are closely related to the bio-economy.[8] **Overall, STEM-H enrolment in Canadian colleges increased by 15% between 2014–2015 and 2018–2019.**

Climbing enrolment numbers are driven in part by a growing proportion of international students in Canadian schools.

FIGURE 5. Enrolments in all degree programs vs. bio-economy-related programs (all ages and immigration status)



Source: Statistics Canada, Table: 37-10-0112-01

Enrolment in all degree programs has increased steadily over the past two decades, including the science, technology and engineering programs that supply the bio-economy.

7 *Some programs are considered "closely related" to the bio-economy (e.g., biomathematics, bioengineering) while others are only "somewhat related" (e.g., materials sciences, nanotechnology).*

8 *Excluding those in Quebec, which are offered by Cégep as three-year technical diplomas and cannot be distinguished from two-year diplomas leading to university programs. For this reason, Quebec has been excluded from this analysis.*

Enrolment in bio-economy-related university programs is heavily concentrated in Ontario. In 2016–2017, the province accounted for 35% of bio-economy-related master's and 36% of PhD program enrolments. Quebec had the second-largest share (30% and 29%, respectively). At the undergraduate level, most bio-economy-related program enrolments were in Ontario (48%), followed by Western Canada (26%). Given that graduates tend to continue living near where they went to school, the heavy weighting of Ontario could leave other regions shorter on supply.

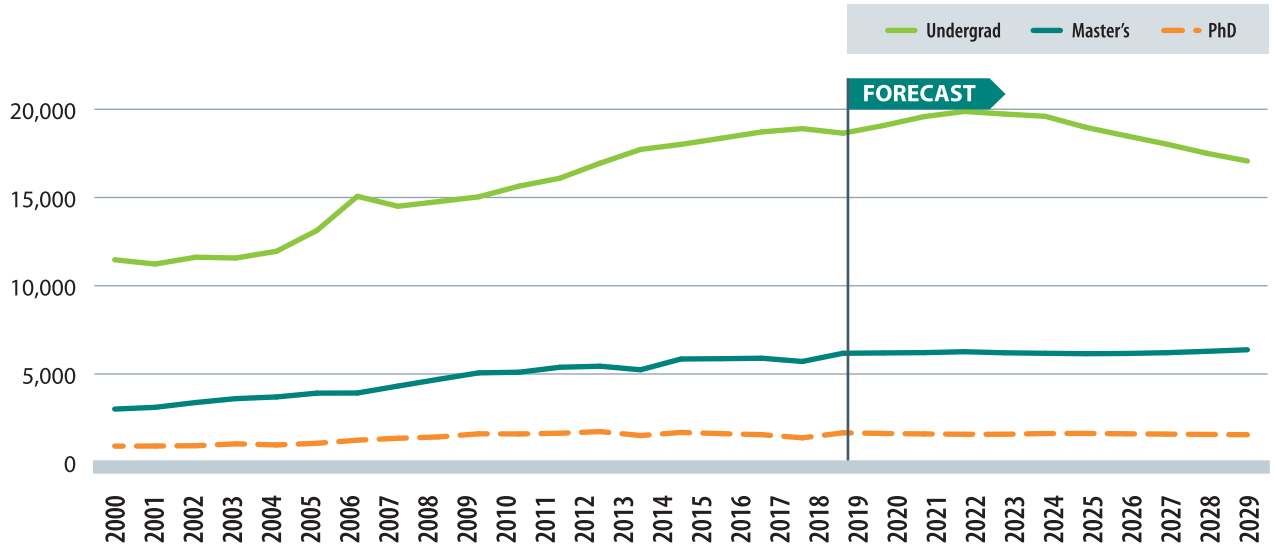
Supply outlook by study level, program area and region

For bio-economy employers looking to hire highly skilled people, the number of graduates coming out of university and college programs may be more immediately relevant than the number of enrolments. However, as Canada's post-secondary-aged population shrinks and with domestic post-secondary enrolments expected to decrease as well, **domestic university undergraduate degree completions are expected to decline by 14% between 2022 and 2029**, while master's and doctorate degree completions will remain stable or decrease slightly over that same period.

Given the diversity of the bio-economy, employers will need to recruit people from across all four core areas of study. When looking at degree completion rates (and therefore the potential supply of labour) in these programs:

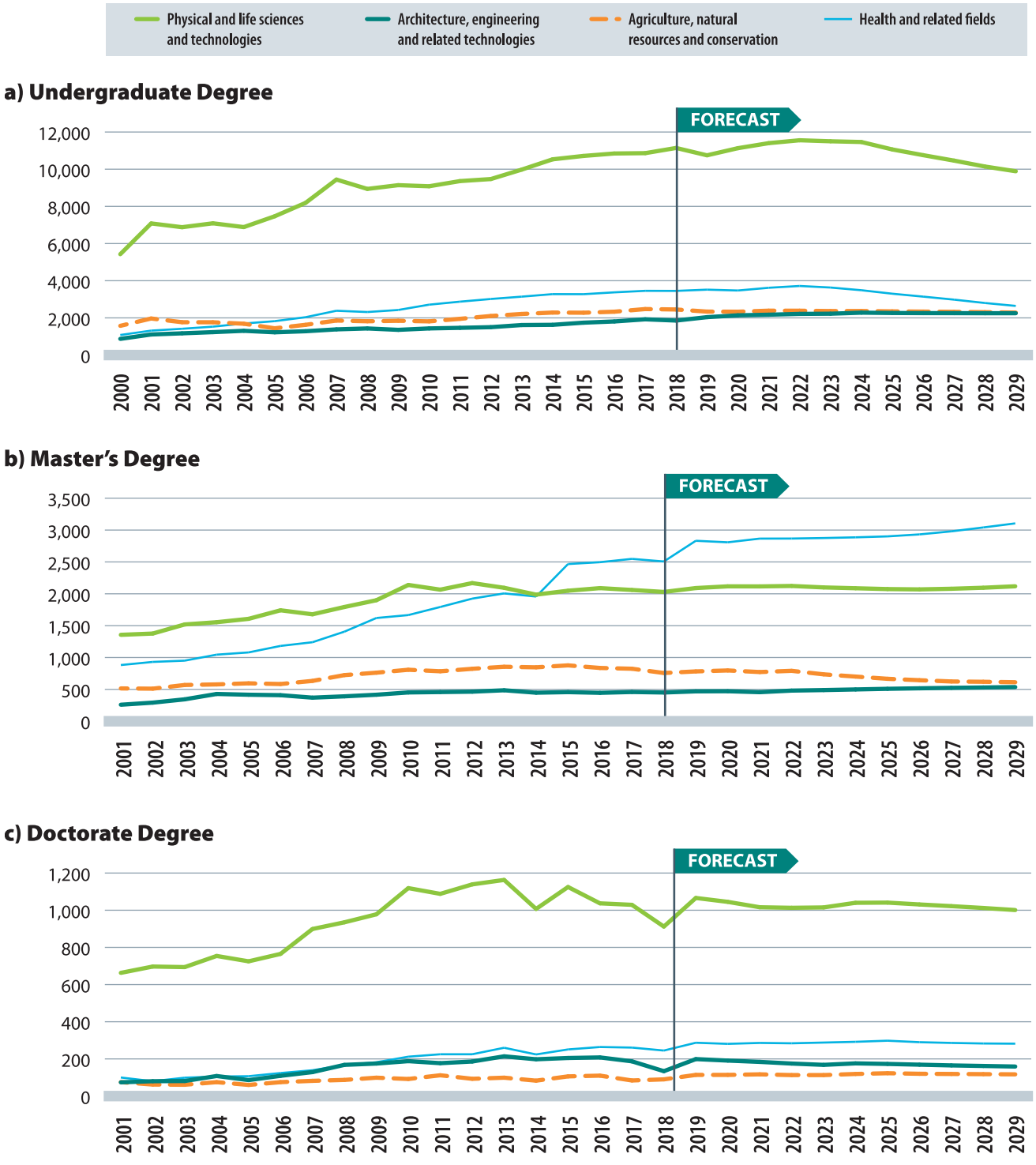
- The vast majority of domestic degree completions at the undergraduate level will come from physical and life sciences programs, although the number of completions in this area and also in health-related fields is expected to decline compared to 2018 levels.
- Most of the domestic completions of master's degrees will come in health-related programs, which surpassed physical and life sciences in 2015 and is projected to rise steadily over the forecast period.
- At the PhD level, most domestic degree completions will come from physical and life sciences programs, with completions in all program areas expected to be relatively stable over the forecast period. Any variations from year to year will not be very large given the overall small number of PhD students.

FIGURE 6. Domestic degree completions by study level



Source: BioTalent Canada Modelling and Projections (2020)

FIGURE 7. Domestic degree completions by program area



Source: BioTalent Canada Modeling and Projections (2020)

The majority of domestic degree completions will come from physical and life sciences programs.

Where will these graduates come from across Canada? As shown in Table 2, **most undergraduate and post-graduate programs relevant to the bio-economy are offered by institutions in Ontario and Quebec**, with the geographic distribution being relatively more balanced only for agriculture-related programs.

TABLE 2. Programs relevant to the bio-economy by province/region

Program area/ Level of study	# of programs offered	West	Prairies	Ontario	Quebec	Atlantic
Physical and life sciences and technologies Undergraduate	550	19%	7%	42%	18%	14%
Physical and life sciences and technologies Post-graduate	360	14%	8%	39%	28%	11%
Architecture, engineering and related technologies Undergraduate	70	27%	5%	38%	23%	5%
Architecture, engineering and related technologies Post-graduate	75	8%	8%	38%	38%	8%
Health and related fields Undergraduate	30	7%	11%	46%	21%	14%
Health and related fields Post-graduate	55	16%	5%	47%	24%	7%
Agriculture, natural resources and conservation Undergraduate	170	20%	16%	26%	25%	13%
Agriculture, natural resources and conservation Post-graduate	70	16%	16%	30%	22%	15%

Source: BioTalent Canada program data, 2019

Worker mobility after graduation

While employers need to attract graduates from all regions to fill job vacancies, most students are not eager to move to other parts of the country once they graduate. While this limited graduate mobility benefits companies located near post-secondary institutions, it may present hiring challenges for those with few universities or colleges nearby.

Based on a 2015 analysis, **90% of Canadian university graduates stay and work in the region where they studied**. The only exception is Atlantic Canada: 70% of graduates remained, while 11% moved to Ontario and 13% to the Western provinces or territories. This is primarily because higher salaries are available elsewhere and there is a perceived lack of career opportunities in Atlantic Canada.

As well, Atlantic Canada recruitment campaigns often emphasize lifestyle factors such as smaller communities that are well-suited to raising families, while younger workers tend to prioritize greater urbanization. In general, Ontario tends to attract the most graduates from other regions, likely due to the existing concentration of economic activity there.

A very small number of graduates (less than 1%) move to another country for employment. Graduates from agriculture and physical/life sciences programs are somewhat more likely to move abroad, with 2.6% and 1.5% of graduates, respectively, securing employment outside of Canada. This suggests international competition is higher for graduates from these programs — meaning Canadian bio-economy employers may need to work harder to attract and retain them.

Low mobility and an overall lack of awareness of job opportunities in the bio-economy may contribute to the finding that **many graduates of bio-economy-related university programs (particularly undergraduate programs) report that their job, three years after graduation, is only "somewhat" or "not at all" related to their program of study**. While 78% of graduates in health and related fields say their work is "closely" related to their studies, just 44% of agriculture graduates and 27% of physical and life sciences graduates can say the same. Master's degree graduates report only slightly higher levels of employment relatedness than undergraduates.

These findings suggest graduates find it difficult to successfully transition from education to career. Wage-subsidy programs to entice mobility and increased promotion of bio-economy occupations could lead to more graduates finding work in their fields.

Many graduates from bio-economy-relevant university programs say their current job is not closely related to their field of study.

Work-integrated learning

Work-integrated learning (WIL), such as co-op, work placements, internships and clinical placements that combine practical work experience with formal in-class training, has emerged as an effective mechanism to develop some of the key skills students, recent graduates and other new hires may not possess — and also overcome other challenges faced by employers:

- Companies that take part in WIL programs gain the opportunity to **train emerging talent in the soft and technical skills** needed in their specific workplaces. When students participate in multiple co-op placements, they develop their skills over time while gaining exposure to different work environments, improving their ability to adapt to the needs of different employers.
- Participation in WIL programs allows employers to **build connections with students** that may give them an edge in the competition for labour when those students graduate and enter the market.
- WIL opportunities that bridge multiple regions may help **mitigate the mobility challenges** noted above by creating connections between students and employers in regions other than those where they studied.

While student satisfaction is usually high and most students who participate in WIL say it helped them find a job, **the percentage of students who participate in WIL varies widely across fields and levels of study**. More than three-quarters (84%) of university undergraduate students in health and related fields have participated in a work placement, but only 18% of PhD students in the same fields have done so at their level. Just 27% of undergraduate students in physical and life sciences programs report participating in WIL.

Costs are often cited as a barrier, along with work permits and regulations for international students. Universities that are not located within large centres of bio-economy activity can also find it challenging to place students in suitable opportunities.

A quarter of students in physical and life sciences programs say they've had the benefit of WIL.

TABLE 3. Proportion of 2015 graduates who participated in a work placement by level of study

Field of study	Undergraduate	Master's degree	PhD
Health and related fields	84%	74%	18%
Architecture, engineering and related technologies	65%	19%	14%
Agriculture, natural resources and conservation	42%	41%	14%
Physical and life sciences and technologies	27%	18%	11%

Source: Statistics Canada, National Graduates Survey 2018

Employer-provided training

Companies of all sizes have reduced on-the-job training in recent years because they don't tend to retain employees as long as they used to, so investments in staff development could end up being lost.[9] As well, managers and senior staff may have limited time to offer informal training to employees. To provide the training their workers need, **bio-economy employers may consider low-cost online offerings or partnerships with industry associations that provide training and leadership development services tailored to the bio-economy**, such as BioTalent Canada,[10] Bioscience Association Manitoba, or the Canadian Centre for Women in Science, Engineering, Trades and Technology.[11]

Training people from other sectors and from local populations may also help address talent shortages. In Thunder Bay, Ontario, for example, First Nations-led forestry companies provide training in mechanical harvesting and heavy equipment operations at their sawmills, which in turn produces sources of biomass to power mills and fuel for communities. In the West, the oil and gas sector competes for labour with the bio-economy but can also be a source of talent — especially with the downturn in that sector prompting individuals to apply for work in other fields.

Key labour source: Immigrants

National population growth is made up of two components:

- **Natural population growth**, which is the difference in the number of births versus deaths
- **Net migration growth**, which is the difference in the number of immigrants versus emigrants

Since 1995, Canada's population growth has fluctuated only slightly, between 0.9% and 1.2% annually — but has changed significantly in its nature. In 1995, net migration accounted for less than half of total population growth. By 2019, it was 82% and the latest projections suggest it will reach 86% by 2029. Given this, **immigration will be key to meeting labour demand in the bio-economy**. Yet currently **only 9% of bio-economy workers are recent immigrants (arrived in Canada within the last five years) and 17% are internationally educated professionals (IEPs)**. This suggests an opportunity to expand recruitment from these populations.

9 *PEI BioAlliance. (2015).* PEI BioAlliance HR Strategy 2020. *https://peibioalliance.com/wp-content/uploads/2018/05/BioScienceHumanResourceStrategy.pdf*

10 *BioTalent Canada. (n.d.).* Essential Skills for the Bio-economy Training Program. *https://www.biotalent.ca/courses/essential-skills-for-the-bio-economy-training-program/*

11 *WinSett Centre. (n.d.).* Women in Leadership Program. *https://www.winsett.ca/programs/leadership-program/leadership-program-pdf*

By 2029, roughly 39,000 immigrants holding bio-economy-related degrees will be admitted into Canada each year.

The number of immigrants aged 15 years or older admitted to Canada each year will continue to grow, reaching approximately 272,000 by 2029, up 17% from 2020. Of those, 111,500 will hold a degree of any kind, including some 39,000 with bio-economy-related degrees — a pool of highly skilled talent that can help fill projected labour shortages. Immigrants can also obtain education after arriving in Canada, providing another pool of labour for the bio-economy.

The federal government is constantly assessing and modifying Canada's immigration policies and programs to attract talent and meet the country's labour needs. When immigrant admissions fell by roughly 9% in 2020 due to COVID-19 travel restrictions and processing delays, the government revised its annual targets, seeking to increase admissions between 2021 and 2023 to make up for the shortfall. **Canada currently aims to have 60% of immigrants in the "economic class"** — that is, people who have desirable skills and the potential to contribute to the country's economy.

International students: Enrolment and graduation trends

Among those in the "economic class" of immigrants are international students, with the federal government's pre-pandemic international education strategy (2019) aiming for 450,000 to be in the country by 2022. Between the 2012–2013 and 2016–2017 academic years, **the number of international students in Canadian undergraduate bio-economy-related degree programs climbed by 73%**. Over that same period, domestic enrolments grew by just 1%. As a result, the proportion of international students in these programs increased from 7% to 11%.

Even larger increases have been seen at the post-graduate level. In 2016–2017, 39% of all PhD students enrolled in bio-economy-related programs were international — a share that has likely risen in the years since. That said, international student enrolment is moderated by provincial caps as well as limits in available institutional capacity/space.

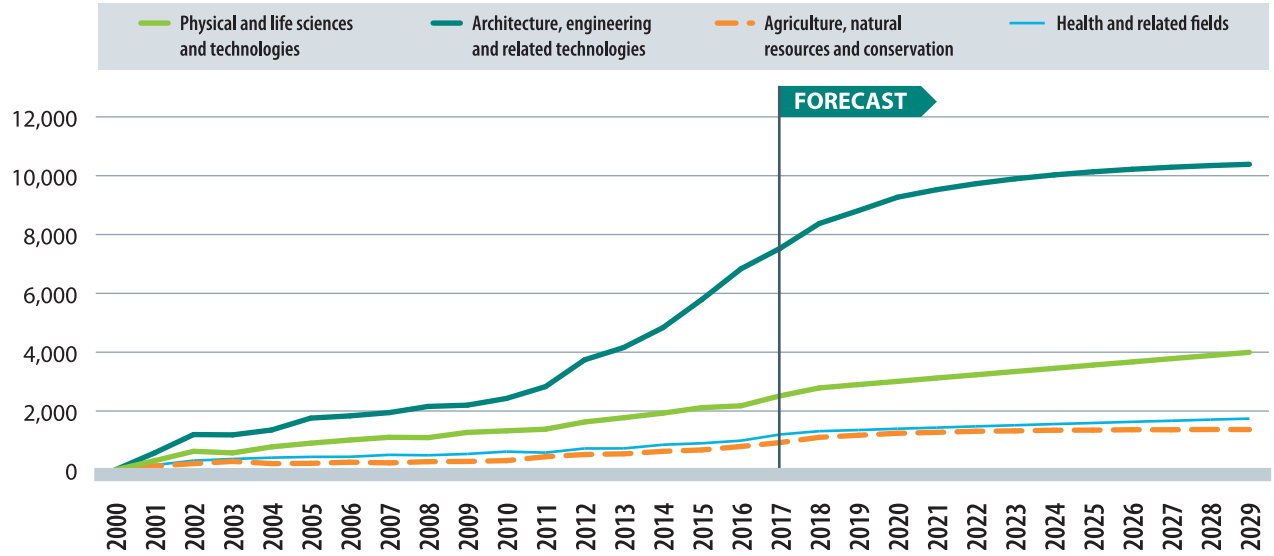
The impact of COVID-19

International student enrolment dropped by as much as 30% between the 2019–2020 and 2020–2021 academic years due to the travel restriction brought on by the pandemic, resulting in 65,000 fewer international students in the country.

At the college level, the share of international students enrolled in STEM-H programs has more than doubled in recent years, rising from 10% in 2014–2015 to 23% in 2018–2019. In Ontario, international student enrolments almost tripled over that same period while domestic enrolments decreased slightly.

In addition to enrolments, **international student graduates from Canadian post-secondary institutions are expected to increase each year** during this forecast period as well. All programs relevant to the bio-economy will see sustained increases in the number of international graduates produced, especially those in architecture, engineering and related technologies.

FIGURE 8. International graduates by program area



Source: BioTalent Canada Modeling and Projections (2020)

Among programs relevant to the bio-economy, most international graduates will come from architecture and engineering.

International students: Work permits and immigration status

It is expected that some international students will become permanent residents of Canada. The Post-Graduation Work Permit Program (PGWPP) launched in 2005 allows students who have graduated from eligible Canadian post-secondary institutions to obtain open work permits. In 2008, the Canadian Experience Class immigration stream was created to allow students' educational and work experience in Canada to be considered as selection criteria for permanent residence.

As a result of these programs, the number of immigrants with post-secondary education as well as previous study and work permits increased by 40% between 2010 and 2014 compared to the previous four years. Yet **only three in 10 international study permit holders become permanent residents** within 10 years, with the proportion of students who do so increasing by level of study: 30% of Bachelor's degree holders; 50% of Master's degree holders; and 60% of PhD graduates.[12] International students who obtained a work permit had a much higher rate of transitioning to permanent residency than those who did not (60% compared to 40%).

12 *Statistics Canada (2021). International students as a source of labour supply: Transition to permanent residency.* Economic and Social Reports. *Volume 1: no. 6.*

Competition for talent

All four sub-sectors of the bio-economy will be **competing for highly skilled workers among themselves and with companies in other STEM sectors**. The battle will be especially intense over candidates with specialized technical credentials such as degrees in chemical engineering, biotechnology, medicine, biology and the life sciences. Bio-economy organizations will also be competing against all segments of the broader economy for workers with non-technical skills in fields such as human resources, marketing and logistics.

Table 4 lists different types of bio-economy organizations — using labels from the North American Industry Classification System (NAICS) — and the larger sectors they are competing with that need people with similar skills, education and experience.

Increased competition for talent may lead to increased poaching of talent, especially from smaller start-ups. While it is easy to poach people from within the broader industrial sector in which a company operates, there are also opportunities to recruit job seekers with experience from other sectors who have the same or similar degrees, core competencies and transferrable skills. However, some sector- or company-based training to up-skill or re-skill people is required to facilitate this approach.

TABLE 4. Sectors competing with the bio-economy for talent

Bio-economy industry	Broader sector needing similar talent
▸ Aquaculture	▸ Farming (e.g., pig, sheep, goat, poultry, egg production)
▸ Biomass power generation	▸ Utilities
▸ Animal food manufacturing ▸ Wet corn milling (ethanol and oilseed processing)	▸ Food manufacturing
▸ Particle board and fibre mills ▸ Pulp, paper and paperboard mills ▸ Miscellaneous wood product manufacturing	▸ Wood product manufacturing ▸ Paper manufacturing
▸ Measuring, medical and controlling devices manufacturing	▸ Computer and electronic product manufacturing
▸ Medical equipment and supplies manufacturing	▸ Hospitals
▸ Testing laboratories ▸ R&D in physical, engineering and life sciences	▸ Professional, scientific and technical services
▸ Medical and diagnostic laboratories	▸ Ambulatory health care services
▸ Universities	▸ Educational services ▸ Hospitals ▸ Professional, scientific and technical services

Source: Census data, 2016

Labour market ratings

If present conditions do not change, labour supply will not be sufficient to meet bio-economy demand. **In many sub-sectors, there will be two job openings for every candidate by 2022.** By the end of the decade that could grow to a 4:1 gap in some cases.

Overall labour market ratings by job category are calculated by comparing hiring requirements in each forecast year to the number of expected new bio-economy workforce entrants in the same year. A three-tiered rating scale shows the severity of the hiring challenges:

Level 1

Labour supply is **greater than 75%** of labour demand.
Low to moderate labour shortages are expected.

Level 2

Labour supply is **between 25% and 75%** of labour demand.
Moderate to serious labour shortages are expected.

Level 3

Labour supply is **less than 25%** of labour demand.
Serious to severe labour shortages are expected.

TABLE 5. National bio-economy labour market ratings outlook by job function

Job function	2021	2022	2023	2024	2025	2026	2027	2028	2029
Manufacturing and production	3	3	3	3	3	3	3	3	3
Distribution and logistics	3	3	3	3	3	3	3	3	3
Management, finance and administration	2	3	3	3	2	3	3	3	3
Quality control and assurance	1	2	3	2	2	2	3	3	3
Marketing, business development and sales	2	2	2	2	2	2	2	2	2
Legal and regulatory affairs	2	2	2	2	1	2	2	2	2
Research and development	1	2	2	2	1	2	2	2	2
Information technology	1	2	2	2	1	2	2	2	2
Other	1	2	2	2	2	2	2	2	2
Overall	**1**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**3**

Source: BioTalent Canada Modeling and Projections (2020)

Table 5 shows that **manufacturing and production, management, finance and administration, and distribution and logistics are expected to face the most serious labour shortages throughout the forecast period**. It is notable that management, finance and administration are also "hot spots" in the forecast, as this means bio-economy companies will have to become "employers of choice" to compete with other sectors for generalized, non-scientific talent.

These ratings consider the shares of new workforce entrants who have chosen occupations in the bio-economy in the past and assumes that a similar share will choose occupations in the bio-economy during the forecast period. Given that assumption, some of the shortages could be mitigated by more active recruitment efforts among new graduates from relevant fields.

These efforts will not be enough to fully address the shortages, however, and additional strategies, such as recruiting skilled immigrants and looking beyond traditional pools to attract candidates with a wider variety of backgrounds, will be required.

Labour market ratings by sub-sector

All four sub-sectors of the bio-economy are expected to experience difficulties meeting labour demand over the forecast period, although the shortages faced in some sub-sectors will be less severe than in others.

Bio-health

Overall labour shortages in bio-health are projected to be less severe than those of other sub-sectors, mainly due to high historic rates of workforce entrants for R&D-related roles. Nearly two-thirds (61%) of bio-health employers have faced some form of recruitment challenges, including 15% who reported significant challenges.

TABLE 6. Bio-health labour market ratings outlook by job function

Job function	2021	2022	2023	2024	2025	2026	2027	2028	2029
Manufacturing and production	3	3	3	3	1	3	3	3	3
Distribution and logistics	3	3	3	3	1	3	3	3	3
Quality control and assurance	2	3	3	2	1	3	3	3	3
Management, finance and administration	2	2	2	2	1	3	3	3	3
Marketing, business development and sales	2	2	2	2	1	2	2	2	2
Research and development	1	2	2	2	1	2	2	2	2
Legal and regulatory affairs	1	2	2	2	1	2	2	2	2
Information technology	1	2	2	2	1	2	2	2	2
Other	1	2	2	2	2	2	2	2	2
Overall	**1**	**2**	**2**	**2**	**1**	**2**	**2**	**2**	**3**

Source: BioTalent Canada Modeling and Projections (2020)

Bio-industrial

Bio-industrial employers are expected to experience consistent and severe labour shortages, with supply covering less than one-quarter of demand over the forecast period. Among employers who engage primarily in bio-industrial business activity, 60% have experienced recruitment challenges, with 22% reporting significant challenges.

TABLE 7. Bio-industrial labour market ratings outlook by job function

Job function	2021	2022	2023	2024	2025	2026	2027	2028	2029
Manufacturing and production	1	3	3	3	3	3	3	3	3
Distribution and logistics	1	3	3	3	3	3	3	3	3
Information technology	1	3	3	3	3	3	3	3	3
Quality control and assurance	1	3	3	3	2	2	3	3	3
Management, finance and administration	1	3	3	3	2	2	2	2	3
Marketing, business development and sales	1	2	3	2	2	2	2	2	2
Research and development	1	2	2	2	2	2	2	2	2
Legal and regulatory affairs	1	2	2	2	2	2	2	2	2
Other	1	3	3	3	3	3	3	3	3
Overall	**1**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

Source: BioTalent Canada Modeling and Projections (2020)

Agri-bio

Agri-bio employers are also likely to experience difficulties meeting labour demand over the forecast period, including a distinct challenge related to filling marketing, business development and sales roles. Approximately one-half (52%) of employers in this sub-sector reported recruitment challenges, with 13% saying they were significant.

TABLE 8. Agri-bio labour market ratings outlook by job function

Job function	2021	2022	2023	2024	2025	2026	2027	2028	2029
Manufacturing and production	3	3	3	3	3	3	3	3	3
Management, finance and administration	3	3	3	3	3	3	3	3	3
Distribution and logistics	3	3	3	3	3	3	3	3	3
Marketing, business development and sales	3	3	3	3	3	3	3	3	3
Quality control and assurance	2	3	3	3	2	2	2	2	2
Legal and regulatory affairs	3	2	2	2	2	2	2	2	2
Information technology	2	2	2	2	2	2	2	2	2
Research and development	1	2	2	2	2	2	2	2	2
Other	2	1	2	1	1	1	1	1	1
Overall	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**3**

Source: BioTalent Canada Modeling and Projections (2020)

Bio-energy

The relatively weak projections for the hiring requirement in the bio-energy sub-sector translate to less severe labour shortages over the forecast period, with supply expected to meet between 25% and 75% of demand every year after 2021. Yet three-quarters (75%) of employers reported experiencing some form of recruitment challenges, including 11% saying theirs were significant.

TABLE 9. Bio-energy labour market ratings outlook by job function

Job function	2021	2022	2023	2024	2025	2026	2027	2028	2029
Distribution and logistics	3	3	3	3	2	2	2	2	2
Manufacturing and production	3	2	3	2	2	2	2	2	2
Research and development	1	2	2	2	2	2	2	3	3
Marketing, business development and sales	3	2	2	2	2	2	1	2	1
Quality control and assurance	1	2	2	2	2	2	2	2	2
Legal and regulatory affairs	2	2	2	2	2	2	2	1	2
Management, finance and administration	2	2	2	2	2	2	1	1	1
Information technology	1	2	2	2	1	1	1	1	1
Other	3	2	2	2	2	2	2	2	2
Overall	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**

Source: BioTalent Canada Modeling and Projections (2020)

Zymeworks

Embracing diversity to spur innovation

For Zymeworks, culture is key to innovation. With a People strategy focused on diversity and rooted in the neuroscience of collaboration, the Vancouver-based pharmaceutical company is demonstrating how businesses can address important social issues in the workplace and generate innovative ideas at the same time.

Company profile: Zymeworks

Location: Vancouver

Employees: 460

Sub-sector: Bio-pharmaceutical

Zymeworks (NYSE: ZYME) is a clinical-stage biopharmaceutical company dedicated to developing next-generation multifunctional biotherapeutics. Its suite of therapeutic platforms and its fully integrated drug development engine enable precise engineering of highly differentiated product candidates.

Q: Tell us about your business: What's the focus of your work?

KATHRYN O'DRISCOLL, CHIEF PEOPLE OFFICER: Zymeworks is a clinical-stage biopharmaceutical company that engineers and develops antibody-based therapies. Our goal is to develop powerful new solutions to treat cancer and other serious illnesses. We currently have two therapies in clinical development for the treatment of HER2-expressing cancers, including biliary tract, gastric and breast cancer. Zymeworks' mission is to enable patients to return home to their loved ones, disease-free. We also want to provide a fantastic workplace for our people. Our culture is the soul of our company. It inspires us to be better people in our lives and work.

"The beauty of an open culture is that it's where ideas come from."

Q: What HR challenges do you face in operating?

KO: There's so much investment in biotechnology medicine today that the competition for talent is extreme. And when you're scaling up in preparation for commercialization of your first medicine, like we are, every skill set is necessary – IT, project management, even hiring recruiters. We also need people for scientific positions — medical directors and experts in clinical trials management and regulatory affairs. It's a challenge to integrate new functions into our culture, partly because people in different roles and from different backgrounds are motivated by different things. Our culture and mission bring us together.

Q: How important is diversity to your people strategy and culture?

KO: It's vital. We're really focused on finding people who are going to thrive in our culture and resonate with our values. We build our values into everything we do — how we interview and onboard people and how we make decisions. Culture is the way things get done. So when we're hiring, we ask ourselves, is this someone who's going to enhance our culture?

Q: How do you operationalize that commitment to diversity?

KO: In numerous ways. Last year we launched a Culture Team to carry our values forward. Our initial goal was to have eight people. We had more than 20 applicants and decided to welcome them all to the team. Our commitment to values helps us surface issues in our community and industry that need attention. We launched an event on Juneteenth 2020 as a day of Reflection and Learning, for example. We brought in a speaker who focuses on cancer in the Black community to discuss the limited clinical trial data available on Black individuals. That sparked people to come forward to find ways to diversify our own clinical trials; we now we have a team working on that.

Q: Do you see momentum building around those kinds of initiatives?

KO: We've since launched three different groups – a Women's Initiative at Zymeworks (WIZ), which curates speakers and sponsored a viewing of the film *Black Men in White Coats*, which deals with the dearth of Black physicians. There's ZAPI – the Zymeworks' Asia-Pacific Islanders employee group, that formed in response to the anti-Asian hate that arose during the pandemic. Our ZymeHope group meets once a month and brings in a therapist to talk about managing grief and loss, which is an unusual offering for a company. It's been amazing to see the impact of these three new employee-driven groups.

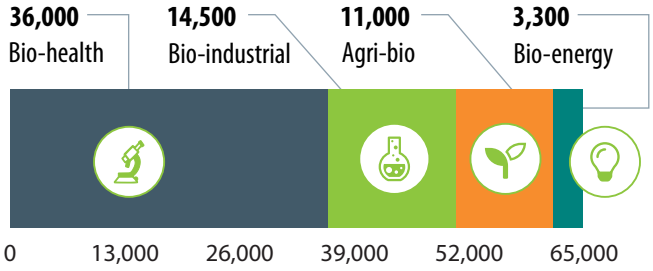
Q: What's your growth plan? Where are the areas of opportunity for your business?

KO: We're focusing on growth and scale. We grew 35% last year and expect to continue a similar trajectory into the foreseeable future. The processes we had when we were smaller don't work as well anymore. We need to build for the future we envision. We're standing up entirely new functions, including sales and marketing and building out our medical science liaison teams. We expect to hire 100 people this year. We must nurture our culture as we grow. We embrace scientific inquiry. We're innovating with our people like we do in our labs. And we're grounding that innovation in research to ensure that what we do scales and makes sense for people and our mission.

Demand and supply in the bio-economy

DEMAND

65,000 more workers
needed by 2029



Employees will need a broad range of technical, business and soft skills

Skills rated very important by employers

- Problem-solving **86%**
- Collaboration **78%**
- Communication **75%**
- Adaptability **73%**
- Inter-personal **72%**
- Understanding and following SOPs **71%**
- Research **61%**
- Creativity **55%**
- Leadership **53%**
- Writing **51%**
- Partnership/networking **46%**
- Business development **44%**
- Digital **41%**
- Commercialization **33%**

Some roles will be especially hard to fill to 2029

- **Manufacturing and production**
- **Distribution and logistics**
- **Management, finance and administration**

Employers struggle to find and win talent

- **Lack of qualified candidates with specialized skills or experience (40%)**
- **Lack of capital to pay competitive wages to attract and retain qualified candidates (36%)**

SUPPLY

Most candidates need a university undergraduate degree or higher

Level of education required during recruitment by company functional area

College diploma or trade school

Distribution and logistics
55%

Manufacturing and production
38%

University post-graduate degree

Research and development
63%

University undergraduate degree

Information technology
71%

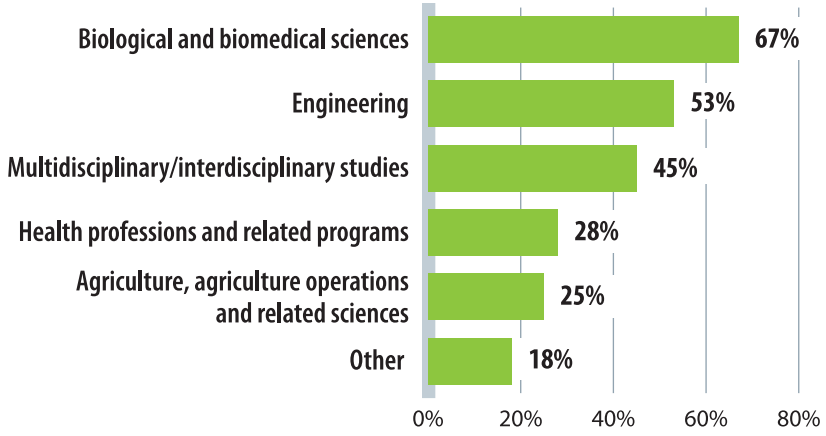
Management, finance and administration
69%

Legal and regulatory affairs
64%

Marketing, business development and sales
57%

Quality control and assurance
50%

Employers hire from many fields of study



90%

of graduates stay and find work in the regions where they studied*

The student population is becoming more international

The post-secondary-aged segment of the Canadian population is declining

Undergraduate degree completions by domestic students are expected to decline by 14% between 2021 and 2029

The international student population in undergraduate bio-economy-related programs rose from 7% of enrolments in 2012 to 11% in 2017

** With the exception of Atlantic Canada, where this number drops to 70%.*

Implications and recommendations

Canada's bio-economy continues to grow and is expected to employ more than 223,000 workers by 2029. As many as 65,000 new workers will have to be hired by the end of the decade, mostly to replace older employees leaving the workforce — with nearly half of the jobs to be filled being manufacturing and production or R&D roles. Yet companies will be challenged to fill those positions due to an aging population and a highly competitive labour market.

Most jobs in the sector require at least a university undergraduate degree, with graduates from biological and biomedical sciences programs in high demand. Yet the bio-health, bio-industrial, agri-bio and bio-energy sub-sectors will be competing as well as with companies in other STEM sectors for the same pool of technical talent. At the same time, many companies struggle to find well-rounded talent with the soft skills to complement their technical skills.

To meet the demand for new workers, the bio-economy relies on graduates from Canadian post-secondary institutions and on the immigration of internationally educated professionals (IEPs). The declining youth share of Canada's population puts even more importance on the growing proportion of international students. The number of immigrants coming to Canada each year is also on the rise, but only a small percentage of bio-economy workers are recent immigrants or IEPs, suggesting an opportunity to expand recruitment from these populations.

Closing the gap between demand and supply will take a concerted and coordinated effort, leveraging a wide range of potential tools, actions and strategies. **Complete recommendations appear in the *Close-up on the bio-economy National Report at biotalent.ca/LMIStudy*.**

Those specifically related to demand and supply are:

1. Boost work-integrated learning

Specific credentials are often only one piece of what makes someone a highly qualified candidate. Practical skills not necessarily learned in the context of a degree program can also be critical. Incorporating work-integrated learning (WIL) into post-secondary education can help build those skills, improve retention, and promote graduate mobility, among other benefits — yet today a significant proportion of students do not participate in WIL programs, particularly at post-graduate levels. As costs are often cited as a barrier, along with work permits and regulations for international students, additional support for and promotion of WIL programs, including non-school-affiliated programs such as apprenticeships, could increase participation and strengthen the sector. BioTalent Canada's Student Work Placement Program could play a key role in developing additional WIL capacity and has placed more than 5,000 students since its inception — many of whom were hired on permanently after the placement was complete.

2. Diversify recruitment and human resources practices

Workforce diversity has been abundantly proven to deliver business benefits including improved financial results and enhanced innovation, yet representation of visible minorities, recent immigrants and internationally educated professionals (IEPs) remains low in the bio-economy, and numbers of Indigenous workers and workers with disabilities are even lower. This may be partly because most companies tend to hire through personal connections and employee referrals, limiting the scope of their networks. If companies are serious about diversity and inclusion — and solving their labour shortages — they must expand their recruitment streams and adopt new, more inclusive HR practices and methodologies. Some companies may benefit from a turnkey HR solution that would help them reach a larger talent pool by taking diversity and the latest HR practices into account for recruitment.

3. Create a wage subsidy program for immigrants

Immigrants remain under-represented in the bio-economy labour market. Wage subsidies have proven effective at increasing representation of other under-represented groups and so could be effective in this case as well. Wage subsidy programs such as BioTalent Canada's BioReady Paid Internship Program can help reduce perceived risk and encourage bio-economy companies to take advantage of the skills, knowledge and fresh insights immigrants bring.

4. Forge pathways for international students and internationally educated professionals

Based on Canada's forecasted population growth, domestic talent will not be enough to fill anticipated labour demands. That makes it critical to ensure international students and IEPs can be integrated seamlessly into Canada's talent pool and labour market. This requires removing policy barriers that inhibit immigration as well as issues around skills and credential recognition and more. That includes making WIL programs more open and easily accessible to international students. The Government of Canada took action in winter and spring 2021 on these fronts by opening up new pathways to permanent residency for international students and extending work permits for international students.

5. Support additional skills development and reskilling initiatives

Many jobs in the bio-economy, including in the most in-demand areas such as manufacturing and management, do not necessarily require advanced STEM or health backgrounds, and skills from other sectors are often transferrable to these jobs. Reskilling, training and entry-level certification programs would enable the bio-economy to recruit from other industries, helping to alleviate some of the most severe labour shortages. Targeted training programs, such as BioTalent Canada's Essential Skills and Technical Skills Fundamentals, can ensure new employees can quickly gain the skills required by employers. These strategies can also help employers develop promising candidates into ideal employees with tailored training in the exact skill mix required for specific positions. Post-secondary institutions might develop innovative programs and approaches to address the sector's skills gaps: technical programs emphasizing job-readiness and professional development; soft skill programs; programs to meet region-specific needs; and additional support via non-credit courses.

6. Foster bio-economy mobility

The tendency of bio-economy graduates to remain in the regions where they studied presents serious hiring challenges for companies not located near post-secondary institutions. More research is needed to understand what keeps graduates from looking further afield, and initiatives to incentivize greater mobility, such as wage subsidies and inter-provincial WIL opportunities, should be considered.

7. Raise awareness of bio-economy career opportunities

Surveys have shown that the general Canadian population, including post-secondary students and graduates of STEM programs, have low to moderate awareness of the bio-economy or occupations in it. This affects the sector's ability to compete for talent. Outreach is needed so prospective workers understand the connections between STEM and other fields and the bio-economy. Employers should connect with students as early as possible — including those in high school who are just starting to make career-related decisions and those in non-STEM fields of study — through career fairs and networking events. Enhanced partnerships between industry and academia can also serve as pipelines to employment for graduates.

For more information on the labour market conditions and outlook for the bio-economy, see the additional reports in our *Close-up on the bio-economy* LMI series at biotalent.ca/LMIStudy.

A ready mechanism

BioTalent Canada is prepared to support employers that lack the internal human resource capacity for talent recruitment, retention and development. BioTalent Canada has delivered numerous successful programs that have contributed to the growth of Canada's bio-economy labour market and to building a stronger, more sustainable sector. These include:

- Wage subsidy programs, including the Student Work Placement Program, Science and Technology Internship Program – Green Jobs, Science Horizons Youth Internship Program, Career Starter Program and BioReady™ Paid Internship Program
- Job matching platforms, including the bio-economy-specific job board, The PetriDish™
- Programs for internationally educated professionals, including the BioSkills Recognition Program and BioReady™ designation
- Skills courses, including the Essential and Technical Skills Fundamentals courses
- National Occupational Standards, a set of profiles documenting the skills, education and credentials required for specific bio-economy roles, to help employers recruit and retain the right talent, even with limited in-house human resource capacity

Methodology

This labour market study involved both quantitative and qualitative data collection, and included both primary and secondary sources.

The following outlines the primary methods used for this study:

- **Survey of bio-economy companies**, conducted between January and April 2020, with 573 bio-economy employers. The margin of error for a total sample of n=573 is +/- 4.1%, nineteen times out of twenty
- **Career perceptions survey**, conducted online between December 2020 and January 2021, with 1,531 Canadians from specific sub-groups
- **Stakeholder roundtables**, conducted as a series of three facilitated discussions in November and December 2019, with a cross-section of 119 bio-economy stakeholders
- **Stakeholder interviews**, conducted to collect qualitative data from 138 bio-economy stakeholders from various regions, sub-sectors and organizations
- **Job postings analysis**, analyzing occupational information from 10,826 bio-economy job postings collected between September 2019 and September 2020 from various public job boards and corporate websites
- **Environmental scan**, compiling and reviewing reports and articles on key issues related to the labour market and the bio-economy
- **Analysis of labour and industry data**, compiling and analyzing various databases from Statistics Canada and other agencies
- **Labour market forecasting and projections**, developing national, regional and hub-level models for forecasting hiring requirements, talent supply and future labour market outlooks for the bio-economy

It should be noted that, while most surveys and interviews focused on private sector organizations, forecasting and modelling included workers and potential workers from public, private and education sectors.

Identifying bio-economy occupations

Because the bio-economy is so diverse and touches so many sectors, it can be difficult to isolate and organize specific bio-economy occupations. For this study, the following process was undertaken to develop occupational groupings according to functions, key roles and common job titles:

1. Compiling findings from an initial environmental scan and web search to identify general occupations associated with the bio-economy.
2. Conducting a focused, in-depth literature and web search using search terms from BioTalent Canada's previous work in this area combined with the results of the first step, adapted to capture information specific to each sub-sector, area and function.
3. Conducting a final refined search to identify any missing occupations as highlighted in the job posting analysis.

The main challenge with this approach is that the results of most searches were specific to individual jobs rather than occupations, and details about areas and sub-sectors were not always available. As well, the bio-health sub-sector tended to use different definitions, terminology, job titles and credentials than the other three sub-sectors. For this reason, bio-health was analyzed separately.

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