BIOSCIENCE ASSOCIATION MANITOBA

2022 INDUSTRY PROFILE STUDY

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1.0 **THANK YOU**

We wish to express our gratitude to the survey participants who contributed to the development of this study. I hope you will find your story in the pages that follow and appreciate the role you play in making Manitoba's bioscience community a diverse and fast-growing industry.

This report is designed to profile our unique industry and highlight its successes, challenges, trends, and future direction. In developing this report, we aligned our definitions and terminologies with those used by bioscience associations across the country. This helped us to gather salient data and create a richly dense report that will be used to further our understanding of the industry and prepare us for what is to come.

Manitoba bioscience industry brims with problem solvers who are eager and passionate about providing key solutions to global health, agricultural, food and economic issues. With a stable level of anticipated investment, we can expect this industry to continue to grow.

Thank you to Miles Consulting Services and Probe Research for their excellent work in developing this robust industry report.

For more information, or inquiries, please contact me at kim@biomb.ca

Kim Kline
President
Bioscience Association Manitoba

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2.0 **INTRODUCTION**

BIOSCIENCE

Definition of Bioscience - any of the areas of scientific study that relate to living things.

Synonym of Bioscience - life science, science of life, study of living things, medicine, environmental science, biological science, botany.

MISSION

Bioscience Association Manitoba advances positive socio-economic benefits by fostering connections and innovation, expanding the sector's skills and workforce development, and being the unified voice for all of Manitoba's bioscience stakeholders.

Definition of Mission - an important assignment carried out for political, religious, or commercial purposes.

VISION

Our vision is to cultivate a vital bioscience community that drives socio-economic growth for Manitoba.

Definition of Vision - the ability to think about or plan the future with imagination or wisdom.

Bioscience Association Manitoba (BAM) conducts a bi-annual Industry Profile Study which details key business and workforce indicators related to the bioscience industry in Manitoba using data obtained from the 2022 BAM Industry Survey to organizations ("2022 survey") and Statistics Canada Datasets.

This study corresponds to the 2021 calendar year and is based on the 2022 survey, identical to the previous four (4) bi-annual studies whereby each survey corresponded to the previous calendar year. It is structured using a NAICS classification method similar to recent studies conducted by Battelle, Life Sciences Ontario (LSO) and Life Sciences BC (LSBC).

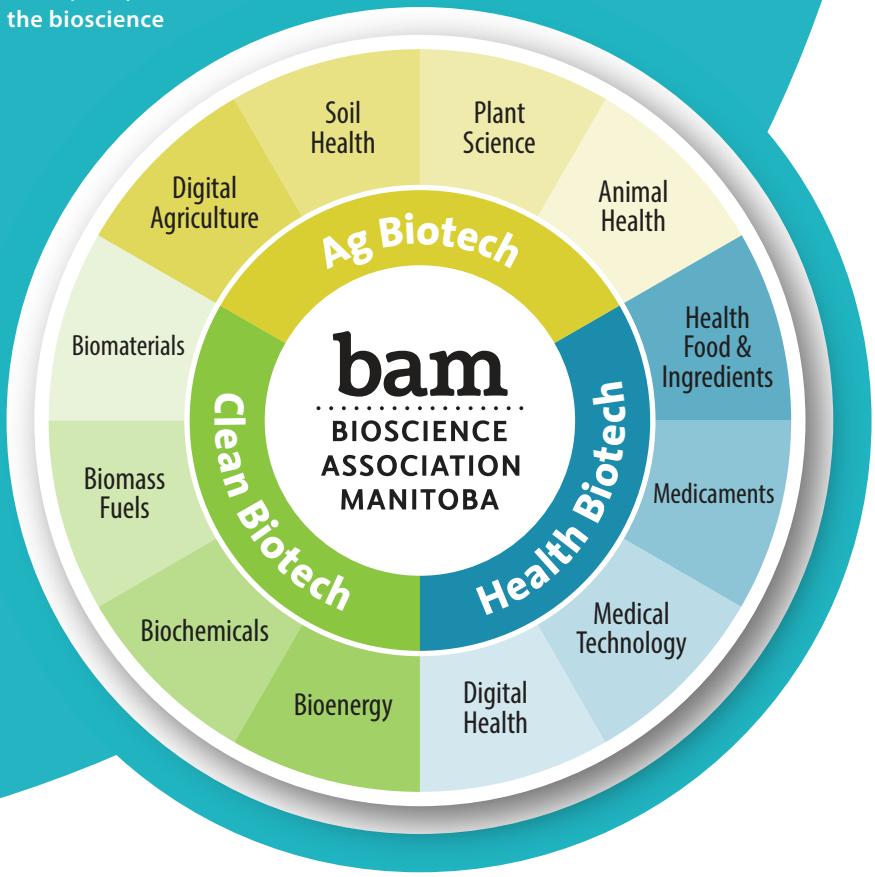
The Manitoba bioscience industry is very large, diverse and highly educated, with many long-standing organizations that have reached or are near the product expansion and maturity stage. Like all previous studies, developing new products, services, processes, expanding market share, and securing government funding to expand businesses are the most frequently reported growth strategies. Mergers and selling of companies are less frequently reported suggesting that the bioscience industry can grow and thrive absent significant mergers and acquisitions.

Supply chain disruptions, managing the regulatory process, and general challenges associated with COVID-19 pandemic are the most frequently reported challenges/obstacles facing bioscience organizations.

Generally, survey respondents seem to lean towards the notion that the Manitoba public and private sector (through programs and loans, etc.) are not supportive of bioscience organizations wanting to scale-up/grow or requiring assistance with the cost of operations.

The Manitoba bioscience industry is becoming "greener". In 2022, 42% of survey respondents indicated they are producing products and/or processes which reduce environmental impacts beyond those produced by the technology currently used. This indicates significant "green" innovation within the industry.

Bioscience Association Manitoba (BAM) uses this graphic to classify the bioscience industry:



Enabling Technology Descriptions

Two key categories of enabling technologies - Advanced Manufacturing and Machine Learning support the growth of the entire bioscience industry in the province as briefly described here:

Advanced Manufacturing involves the use of innovative technology to improve new and existing products and processes to increase the value, productivity, and quality of the work. Technologies include advanced robotics, advanced materials, and 3-D printing. This is also known as Next Generation Manufacturing.

Machine Learning is part of a broader set of technologies including Big Data Analytics, Information Technology and Artificial Intelligence. These technologies apply artificial intelligence to provide systems the ability to automatically learn and improve from experience without being explicitly programmed. Machine learning focuses on the development of computer programs that can access massive quantities of data and use it to learn for themselves[1].

[1] *http://www.expertsystem.com/machine-learning-definition/*

The Bioscience Industry

01 **Clean Biotech**
Includes Bioenergy, Biochemicals, Biomass Fuels, and Biomaterials

02 **Ag Biotech**
Includes Plant Science, Animal Health, Soil Health and Digital Agriculture

03 **Health Biotech**
Includes Healthy Food and Ingredients, Medicaments, Medical Technology and Digital Health

01 The **CLEAN BIOTECH** sector uses materials from or with living organisms to generate new value-added products, with the goal to reduce negative impacts on the environment. Clean Biotech companies work in the areas of renewable fuels, industrial bioproducts and bioremediation technologies.

02 The **AG BIOTECH** sector focuses on developing and commercializing innovations and tools related to agricultural plants or animals for the purpose of increasing yields, production efficiencies and/or impacts and/or improving nutritional profiles. For example, Ag Biotech companies work in the areas of plant genomics, precision agriculture and health treatments for animals.

03 The **HEALTH BIOTECH** consists of companies developing and commercializing innovations that allow for the early identification, prevention and/or treatment of illness and disease. The Health Biotech sector traditionally focuses on treatments, diagnostics, and therapeutics. It now includes functional (healthier for you) foods and ingredients, and natural health products.

[1] *See, 2016 Life Science Association Manitoba Industry Profile Study.*

3.0 **KEY** FINDINGS

There's estimated to be 720 bioscience organizations in Manitoba, an increase from 700 in 2019.

Between 2019 and 2021, total bioscience industry revenues fell by 4.8%, from $10.4 billion to $9.9 billion, possibly due to economic impacts caused by the COVID-19 pandemic and/or weather conditions and drought. The total number of employed persons in the industry declined by 12% from 16,330 to 14,330, also likely due to COVID-19. While Ag Biotech revenues fell, both **Clean Biotech and Research and Development organizations revenue increased significantly.**

Sector Revenue	Ag Biotech	Health Biotech	Clean Biotech	R&D
2021 Revenue	$4.7 B	$4.4 B	$731 M	$104 M
2019 Revenue	$5.4 B	$4.3 B	$626 M	$91 M

THE MANITOBA BIOSCIENCE INDUSTRY EMPLOYS **14,330 individuals**
AND CONTRIBUTES **$5.2 Billion** IN DIRECT PROVINCIAL GDP

KEY PERFORMANCE INDICATORS

720
TOTAL BUSINESSES & ORGANIZATIONS
2019 **700**
Growth **3%**

$9.9 Billion
TOTAL SALES/ REVENUE
2019 **10.4B**
Growth **-4%**

$5.2 Billion
DIRECT PROVINCIAL GDP
2019 **5.6B**
Growth **-7%**

$1.7 Billion
INDIRECT PROVINCIAL GDP
2019 **1.6B**
Growth **7%**

$1.3 Billion
INDUCED PROVINCIAL GDP
2019 **1.1B**
Growth **22%**

$8.2 Billion
TOTAL PROVINCIAL GDP
2019 **8.3B**
Growth **-1%**

$525 Million
CAPITAL RAISED
2019 **356M**
Growth **47%**

$108 Million
R&D EXPENDITURES
2019 **79M**
Growth **36%**

7,658
EMPLOYEES WITH BACHELOR'S DEGREE OR HIGHER
2019 **8,629**
Growth **-11%**

[1] *This report refers to businesses, companies, and other organizations as "organizations".*

Key Findings

The following are the key findings of this report:

- Pharmaceutical and medicine manufacturing (NAICS 3254) exports from Manitoba to the rest of the world is more than $2.3 billion in 2021, by far **Manitoba's largest exporting industry** segment.
- Between 2019 and 2021, Bioscience industry revenues fell by 4.8% compared to the 12% growth between 2017 and 2019, this was likely due to the COVID-19 pandemic.
- The bioscience industry **ranks 4th** among all major industries in Manitoba with respect to direct GDP contribution to the province at **$5.2 billion in 2021**, behind only real estate and rental and leasing, manufacturing, healthcare and social assistance. This is largely driven by a few large Health Biotech companies and one large Ag Biotech subsector.
- Average and median revenue (from the survey sampled organizations) has increased significantly since 2015 indicative of industry growth and success.
- Employment dropped by 12% compared to 2017 and 2019 where employment grew by 14% likely due to COVID-19 pandemic.
- Total sales/revenue of survey respondents is slightly greater than $3 billion in 2021, with just over 50%of that value being derived from sales to the United States. This is an increase from $2.9 billion in 2019. Although the value of sales to the United States is significantly larger than sales within Manitoba, most organizations surveyed sell products or provide services within Manitoba.
- Profitability, measured as earnings before interest, taxes, depreciation and amortization (EBITDA) is on average **increasing within the Manitoba bioscience industry**, measured from the survey responses, with more respondents indicating increasing EBITDA than decreasing.
- More organizations report women, minority, and Indigenous ownership than in the previous survey period (2020).
- Similar to all previous studies, developing new products, services and processes, expanding market share, and securing government funding to expand business are the most frequently reported growth strategies. Mergers and selling of companies are less frequently reported suggesting that the bioscience industry can grow and thrive absent significant mergers and acquisitions.
- Supply chain disruptions, managing the regulatory process, and general challenges associated with COVID-19 pandemic are the most frequently reported challenges/obstacles facing bioscience organizations.
- Generally, survey respondents seem to lean towards the notion that the Manitoba public and private sector (through programs and loans, etc.) are not supportive of bioscience organizations wanting to scale-up/grow or requiring assistance with the cost of operations.
- **The Manitoba bioscience industry is growing in terms of technology readiness levels with more product development at the later stages of the innovation process (TRL-9 for example).**
- **Capital raised per organization has been increasing since 2015.** However, raising capital from friends, family and through debt instruments has become a more frequent source of capital than government and private equity.
- Total R&D expenditures by the industry have remained relatively consistent since 2015. organizations are using company revenues more frequently to conduct R&D rather than government programs and private capital.
- The Manitoba bioscience industry employs 14,330 individuals with an estimated **53% being considered highly qualified professionals (possessing at least a bachelor's degree).**
- The Manitoba bioscience industry is becoming more educated with less than 25% of the workforce possessing a high school diploma as their highest level of educational attainment compared to 27% in 2017.
- Although both recruitment and retention are becoming less of a challenge within the industry, skills shortages amongst newly recruited workers are reported as increasing. The main workforce skills gaps include **critical thinking, leadership, and project management** (top three).

NOTE: the survey forms the basis of this report. Statistics Canada data was used to enhance the sample and overall estimation process. Primarily, to infer statistics regarding the total bioscience industry and economy in Manitoba.

Appendix C: Industry and Subsector Definitions provides a detailed description of the bioscience industry. North American Industry Classification System (NAICS) codes and descriptions are also provided.

4.0 INDUSTRY SURVEY SAMPLE

Industry Survey Respondents

The 2022 BAM Industry Survey resulted in 73 responses from a variety of Manitoba companies and organizations (referred to as "organizations" or "respondents") operating in the bioscience industry. The graphic below provides a detailed description of the sample obtained.

The majority of companies responding to the survey were Health Biotech (57%), followed by Ag Biotech (14%). Within the Health Biotech sector, 21% of the organizations were primarily involved in Medical Technology followed by Health Food and Ingredients.

The abundance of Health Biotech responses in current and previous BAM surveys could be the reason why in previous studies, the Manitoba Health Biotech sector appeared significantly larger than the other sectors. However, once adjusting for the population of organizations in each sector using the business register count data (done in the previous two (2) studies), **Ag Biotech is the largest Manitoba bioscience sector** with respect to the total number of businesses and sales/revenue.

Health Biotech 57%

Digital Health	7%
Medical Technology	21%
Health Food and Ingredients	14%
Medicaments	15%

Clean Biotech 10%

Biochemicals	0%
Bioenergy	3%
Biomass Fuels	3%
Biomaterials	4%

Ag Biotech 14%

Plant Science	1%
Animal Health	5%
Digital Agriculture	4%
Soil Health	4%

Support Org. 19%

5.0 INDUSTRY SALES & REVENUE

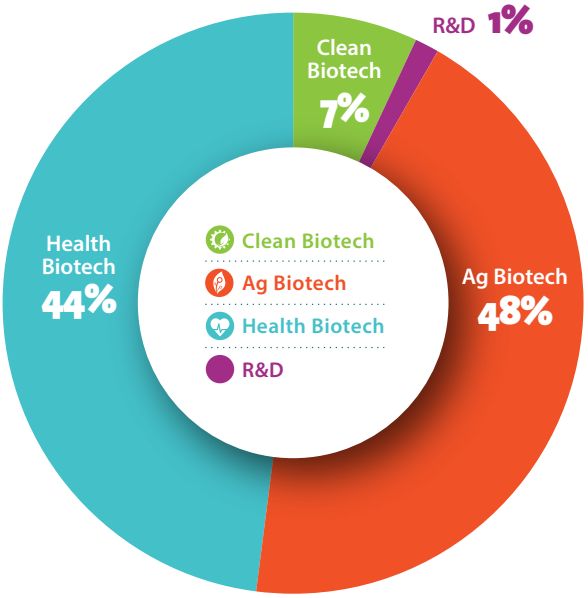
Definition of Revenue - income, especially when of a company or organization and of a substantial nature.

Proportion of Total Revenue by Sector

Total industry sales/revenue in 2021 is estimated at $9,933,046,997. The following graphic presents the proportion of industry sales/revenue by main subsector:

Sector	Total Sales/Revenue	Total Businesses	Revenue per Business
Ag Biotech	$4.7 B	326	$14.4 M
Health Biotech	$4.4 B	254	$17.3 M
Clean Biotech	$731 M	118	$6.2 M
R & D	$104 M	22	$4.7 M

NOTE: For the purpose of analyzing population sales/revenue by sector, a separate category was created for organizations that primarily focus on R&D.

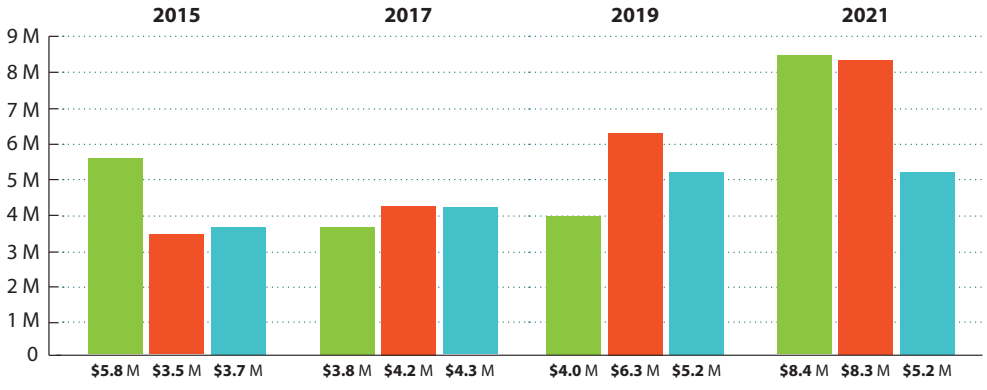


Ag Biotech contributes the largest share of total industry sales/revenue largely due to Manitoba's very large agricultural chemical and other farm supplies wholesale sector. Within **Health Biotech**, a few large companies **contribute over 70% of total sector revenue.**

The following table presents the average and median revenue by sector for the 2015 to 2021 study periods based on the samples obtained from the surveys:

Average Revenue

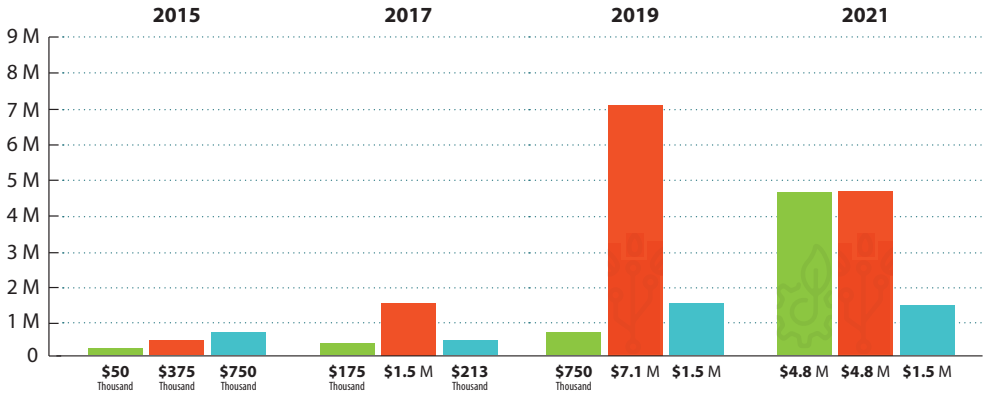
2015, 2017, 2019, & 2021



Clean Biotech
Ag Biotech
Health Biotech

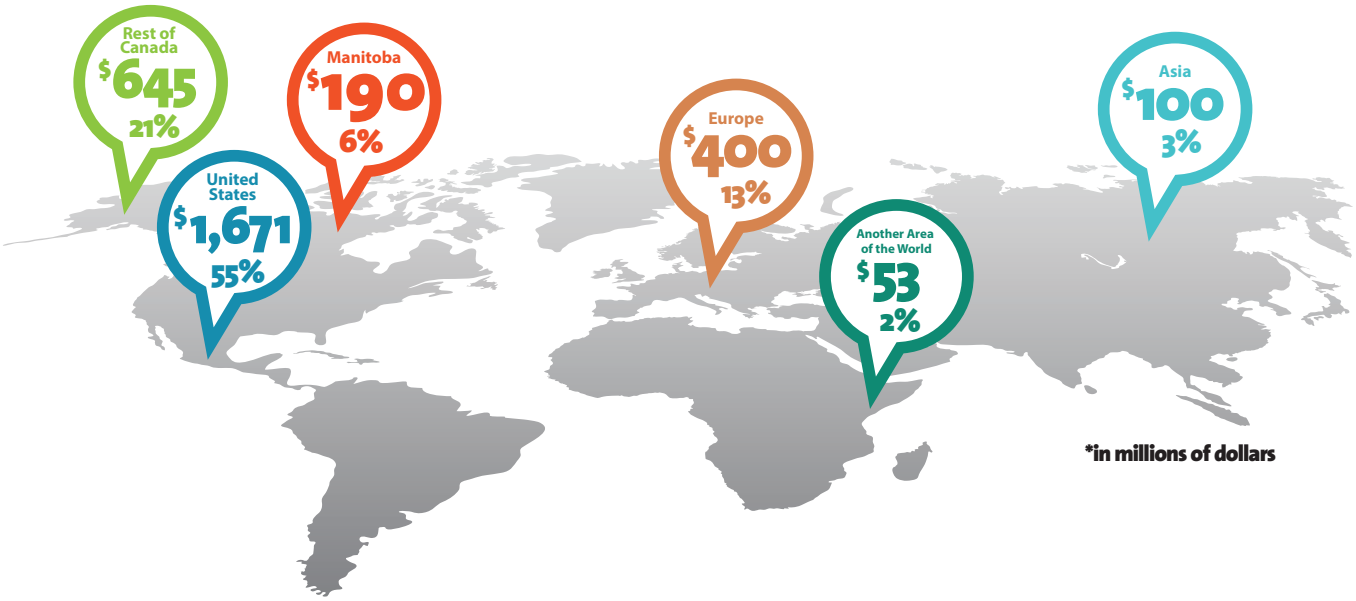
Median Revenue

2015, 2017, 2019, & 2021



5.1 **Exports**

The following graphic presents industry revenue by region of sales.



The United States and the rest of Canada dominate the destination of Manitoba bioscience sales in terms of value. Since 2019, **sales/revenue within Manitoba has increased** with sales to the rest of Canada having decreased.

According to Government of Canada Trade Data Online[3], Manitoba's largest exporting industry segment is pharmaceutical and medicine manufacturing (NAICS 3254) yielding **$2.3 billion in exports** (2021). Oilseed processing (NAICS 3112) is Manitoba's second largest bioscience exporting industry segment with $1.2 billion (2021). **These two bioscience industries account for over 50% of Manitoba's total bioscience manufacturing exports.**

Although yielding lower values of sales compared to other areas, 73% of companies sell their products domestically within Manitoba, an increase from 64% in 2019. Similar to 2019, 67% of companies sell to the rest of Canada while 33% export to the United States which is a slight decrease from 48% in 2019. 64% of companies in the sample that are exporting to Europe are Health Biotech similar to 65% in 2019.

5.2 **Profitability**

Organizations were asked to indicate whether their earnings before interest, tax, depreciation, and amortization (EBITDA) was generally increasing, decreasing, or staying the same between 2019 and 2021 EBITDA is a measure commonly used to analyze organizations accounting profit.

Definition of EBITDA- EBITDA is short for earnings before interest, taxes, depreciation, and amortization. It is one of the most widely used measures of a company's financial health and ability to generate cash.

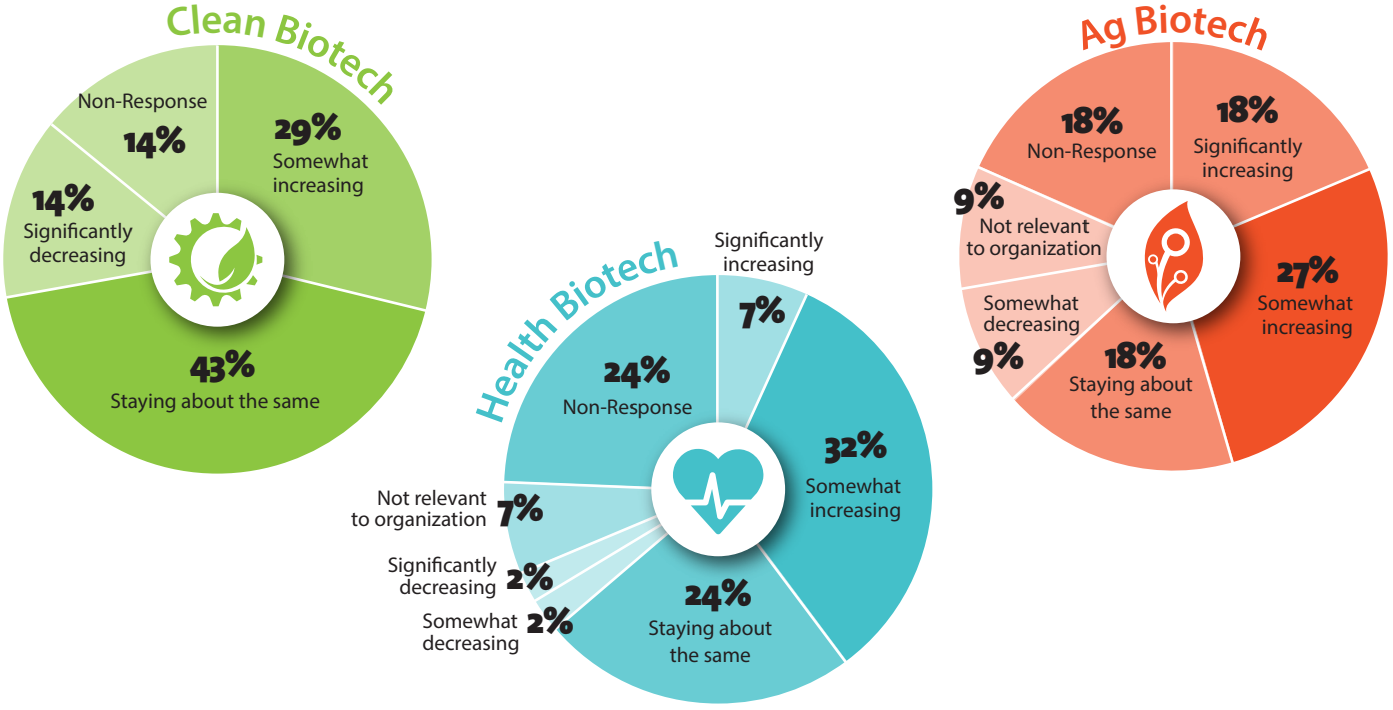
Changes in EBITDA over the 3-year period

EBITDA	2019 to 2021
Significantly increasing	9%
Somewhat increasing	44%
Staying about the same	28%
Somewhat decreasing	4%
Significantly decreasing	5%
Not relevant to organization	11%

[3] *https://ised-isde.canada.ca/site/trade-data-online/en*

Compared to 17% in 2019, only 9% of respondents indicate that their EBITDA is "significantly increasing". 44% of respondents in 2021 indicate that their EBITDA is "somewhat increasing" compared to 41% in 2019. In 2021, 9% indicate that their EBITDA is decreasing (either somewhat or significantly) compared to 16% in 2019. A higher percentage of respondents reported that this is "not relevant to their organization" than in the previous survey.

Changes in EBITDA over the 3-year period by Sector



Ag Biotech companies reported their EBITDA as "significantly increasing" at a higher percentage than the other sectors. Similar across all sectors, "somewhat increasing" is reported between 27% of the respondents (Ag Biotech) and 50% of the respondents (support organization/other) with Clean Biotech (29%) and Health Biotech (32%) in between. 43% of Clean Biotech companies report EBITDA as "staying about the same" with none reporting "somewhat decreasing" and 14% reporting "significantly decreasing". 24% of Health Biotech report EBITDA as "staying about the same", 2% "somewhat decreasing" and also 2% "significantly decreasing". 9% of Ag Biotech companies report EBITDA as "somewhat decreasing" with none reporting "significantly decreasing".

6.0 GROSS DOMESTIC PRODUCT (GDP) IMPACTS

Gross Domestic Product (GDP) using an expenditure approach, measures the market value of all final goods and services produced by an economy or industry within a given boundary and time-period. Using a value-added approach, GDP contributions and impacts are classified under the following three (3) categories:

Direct GDP - The market value of final goods and services produced by the industry less the value of intermediate inputs required to produce the final goods and services.

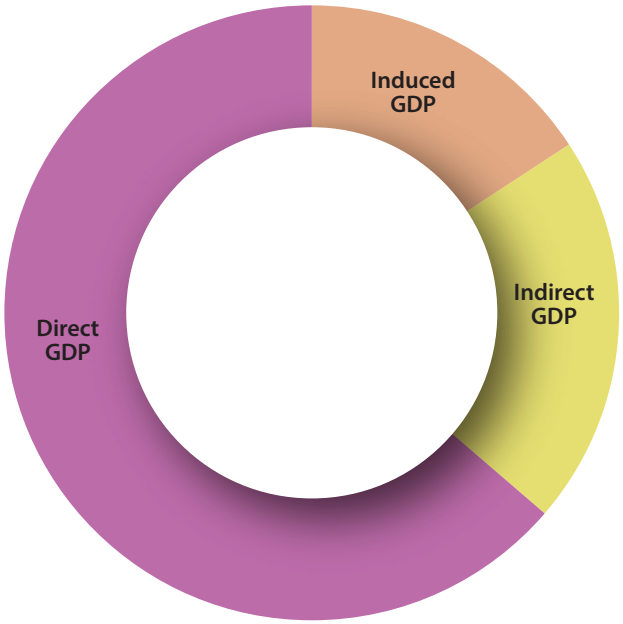
Indirect GDP - The GDP contribution resulting from the inputs supplied required to produce final goods and services. These inputs are supplied by other businesses in the economy through a supply chain network.

Induced GDP (wage effect) - The expansion in economic activity caused by direct and indirect GDP which generates disposable income that individuals and households spend in the economy.

The Manitoba bioscience industry contributed the following direct, indirect, and induced GDP within the province of Manitoba in 2021:

Total Industry GDP in Manitoba

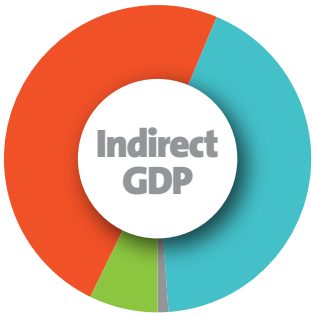
Direct GDP	**$5.2 billion**
Induced GDP	**$1.3 billion**
Indirect GDP	**$1.7 billion**
TOTAL GDP	**$8.2 billion**



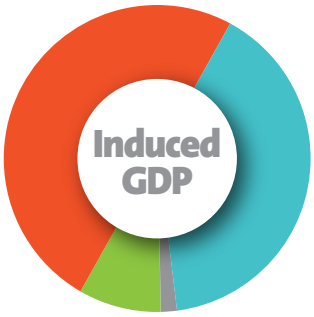
Subsectors

Clean Biotech	**$588M**
Ag Biotech	**$4.1B**
Health Biotech	**$3.5B**
R&D GDP	**$107M**

Clean Biotech	**$342M**
Ag Biotech	**$2.6B**
Health Biotech	**$2.2B**
R&D GDP	**$71M**

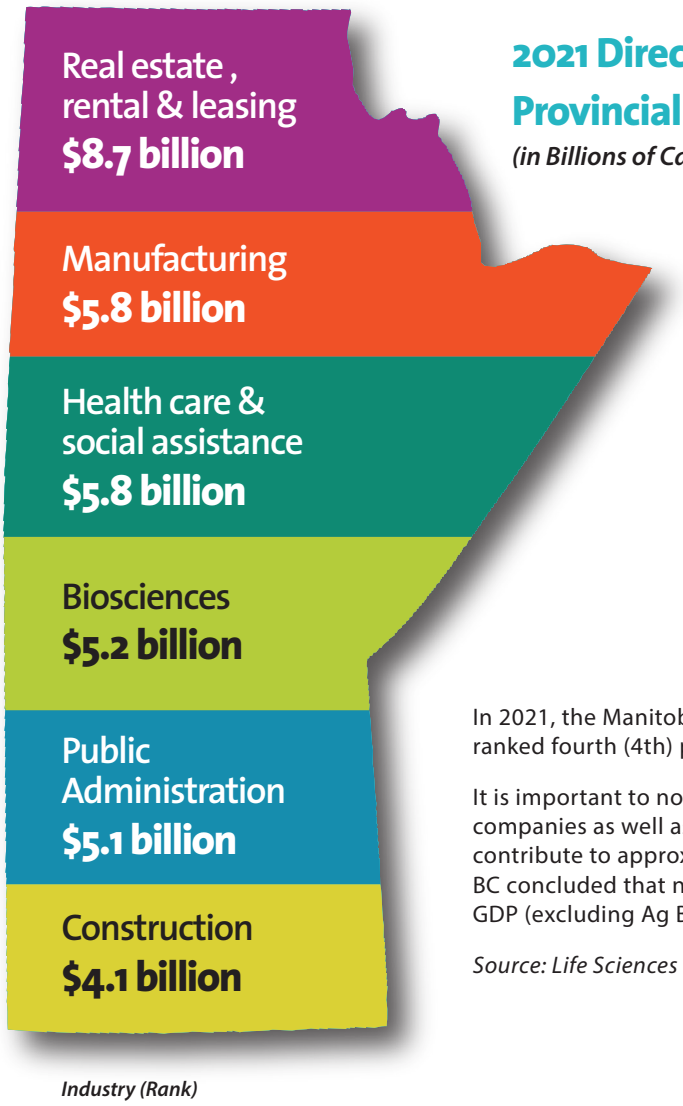


Clean Biotech	**$130M**
Ag Biotech	**$831M**
Health Biotech	**$713M**
R&D GDP	**$15M**



Clean Biotech	**$115M**
Ag Biotech	**$650M**
Health Biotech	**$514M**
R&D GDP	**$21M**

The following table presents the within Province of Manitoba Direct GDP figures for other Manitoba industries:



2021 Direct Provincial GDP

(in Billions of Canadian Dollars)

In 2021, the Manitoba bioscience industry (including Ag Biotech) ranked fourth (4th) provincially in terms of direct GDP.

It is important to note that Manitoba is home to several very large companies as well as one agricultural NAICS category which contribute to approximately 40% of the $5.2 billion GDP. Life Sciences BC concluded that nationally, life sciences are fifth in terms of industry GDP (excluding Ag Biotech).[5]

Source: Life Sciences BC Report (2015)

7.0 **INDUSTRY BY TYPE OF OPERATION**

Bioscience organizations can be grouped as follows based on the nature of the operation:

1. **Service** (43%)
2. **Distribution** (wholesale and retail) (32%)
3. **Manufacturing** (17%)
4. **Processing** (5%)
5. **Research and Development** (3%)

Out of the 720 total bioscience organizations in Manitoba, an estimated 311 are service, 233 are distribution, and 119 are manufacturing with only 34 and 22 being processing and research and development respectively.

The following table presents the number of companies and organizations by each subsector and type:

Sector	Research and Development	Service	Distribution	Manufacturing	Processing	Total
Clean Biotech	2	72	2	27	17	120
Health Biotech	18	121	61	54	17	272
Ag Biotech	2	118	170	38	0	328
Total	**22**	**311**	**233**	**119**	**34**	**720**

While Clean Biotech and Health Biotech tend to be weighted more towards providing services, Ag Biotech organizations are weighted more towards being involved in distribution.

7.1 **Ownership**

The Manitoba bioscience industry demonstrates growth and diversity in terms of ownership characteristics. Respondents were asked to indicate whether or not their organization was whole or in part -- woman, minority, or Indigenous owned.

23% of Manitoba bioscience organizations are either whole or in part woman owned compared to 20% reported in the previous survey. 14% are minority owned, and 7% Indigenous owned compared to 12% and 7% in the previous survey.

Year	Demographic	Yes	No	Prefer not to answer
2019	woman-owned	20%	69%	9%
2021	woman-owned	23%	58%	10%
2019	minority-owned	12%	75%	12%
2021	minority-owned	14%	64%	12%
2019	Indigenous-owned	7%	84%	9%
2021	Indigenous-owned	7%	73%	11%

8.0 CURRENT VS. FUTURE BUSINESS STAGE

8.1 Technology Readiness Levels (TRLs)

Technology readiness levels measure a project's stage of development using nine (9) different categories. Projects eventually led to product development, and subsequently products reaching markets.
*** TRLs are defined in the Appendix D.**

Manitoba bioscience organizations reported a wide range of projects at various TRLs. In total, 555 different projects were reported, significantly greater than in the 2020 survey (322). This is due to a large reporting of level nine (9) projects/products in development (254) as show in the graph below.

Response to Product Development

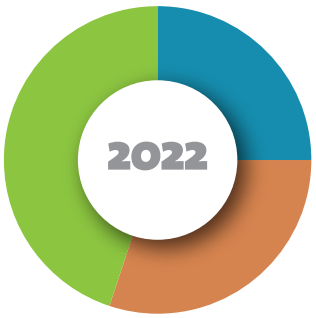
Survey Years:	2022 Survey		2020 Survey	
TRL	**Products in Development**	**Percentage of Total by Category (%)**	**Products in Development**	**Percentage of Total by Category (%)**
Level 1	45	8%	69	21%
Level 2	25	5%	55	17%
Level 3	25	5%	35	11%
Level 4	25	5%	20	6%
Level 5	32	6%	23	7%
Level 6	33	6%	25	8%
Level 7	37	7%	28	9%
Level 8	79	14%	23	7%
Level 9	254	46%	44	14%
Total	**555**		**322**	

There is a variety of project/product development taking place at all TRLs as indicated by respondents of the 2022 and 2020 surveys. **In the 2022 survey, the distribution is weighted slightly more towards the higher TRLs indicative of successful innovation, project/product development, and TRL advancement.**

TRL	% of Organizations (2022 Survey)	% of Organizations (2020 Survey)
Level 1	27%	40%
Level 2	21%	31%
Level 3	23%	40%
Level 4	27%	25%
Level 5	29%	23%
Level 6	25%	35%
Level 7	38%	37%
Level 8	27%	33%
Level 9	50%	38%

Business Age

Bioscience companies in Manitoba tend to be older and more mature than the Canadian average. In fact, over one third of the companies sampled were greater than 15 years of age. The general increase in average age is indicative of industry success, maturity, established product, and product expansion.



Less than (<) 5 years	**25%**
5 to 14 years	**30%**
Greater than (>) 15 years	**45%**

The 2022 survey resulted in responses from organizations with varying ages with 25% being less than five (5) years, 30% being five (5) to 14 years, and 45% being greater than 15 years.

COVID-19 Response

Respondents were also asked if their organization was developing projects related to the diagnosis, treatment, or management of COVID-19. The following table presents these results:

Product Development Related to the Diagnosis, Treatment, or Management of COVID-19	2022 Survey	2020 Survey
Yes	25%	33%
No	75%	67%

In 2020, there was proportionally more product development related to the diagnosis, treatment, or management of COVID-19 than in 2022.

8.2 Further Information on Sector Outlook

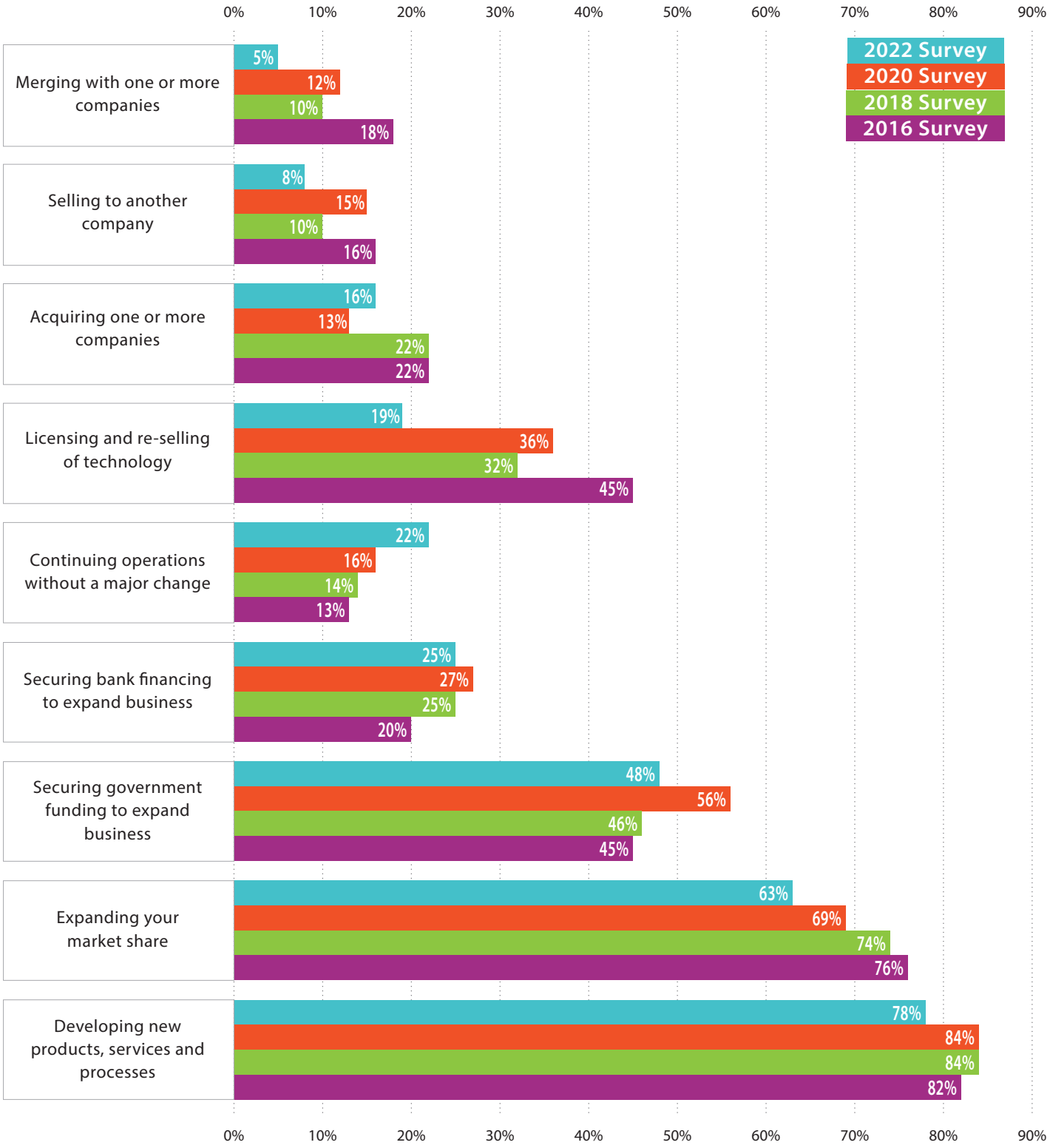
The top three Future Growth Strategies in all four study periods are:

- **Developing new products, services, and processes**
- **Expanding market share**
- **Securing government funding to expand business**

Since 2016, continuing operations without a major change has been an increasingly reported strategy, while licensing/reselling of technology, and mergers and acquisitions have been a decreasingly reported growth strategy. This suggests that organizations can grow and thrive without significant industry mergers and acquisitions.

Future Growth Strategies

Proportion of Companies

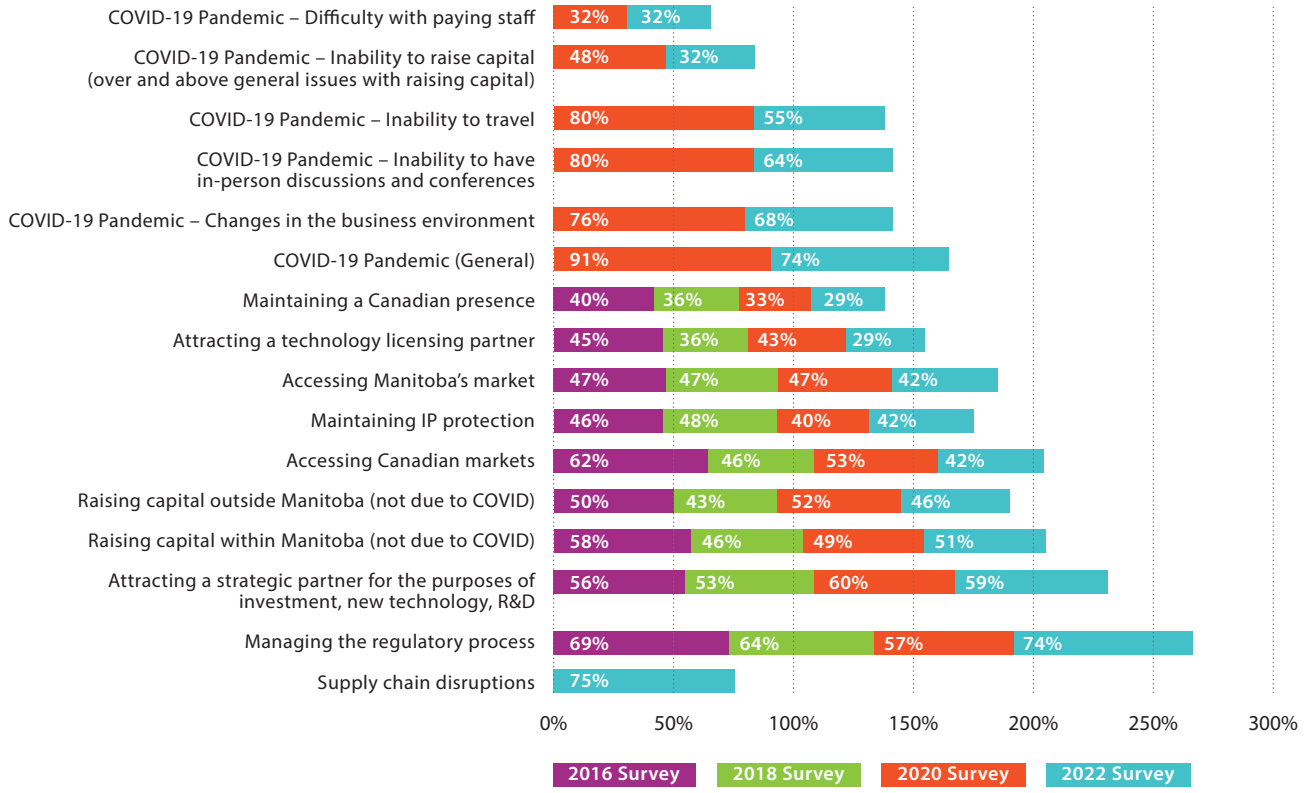


9.0 **CHALLENGES FACING** MANITOBA BIOSCIENCE COMPANIES

Manitoba Bioscience companies reported a variety of challenges/obstacles. In 2022, the biggest challenge/obstacle facing Manitoba bioscience companies is supply chain disruptions (75%), managing the regulatory process (74%), followed by changes in the business environment as a result of the COVID-19 pandemic.

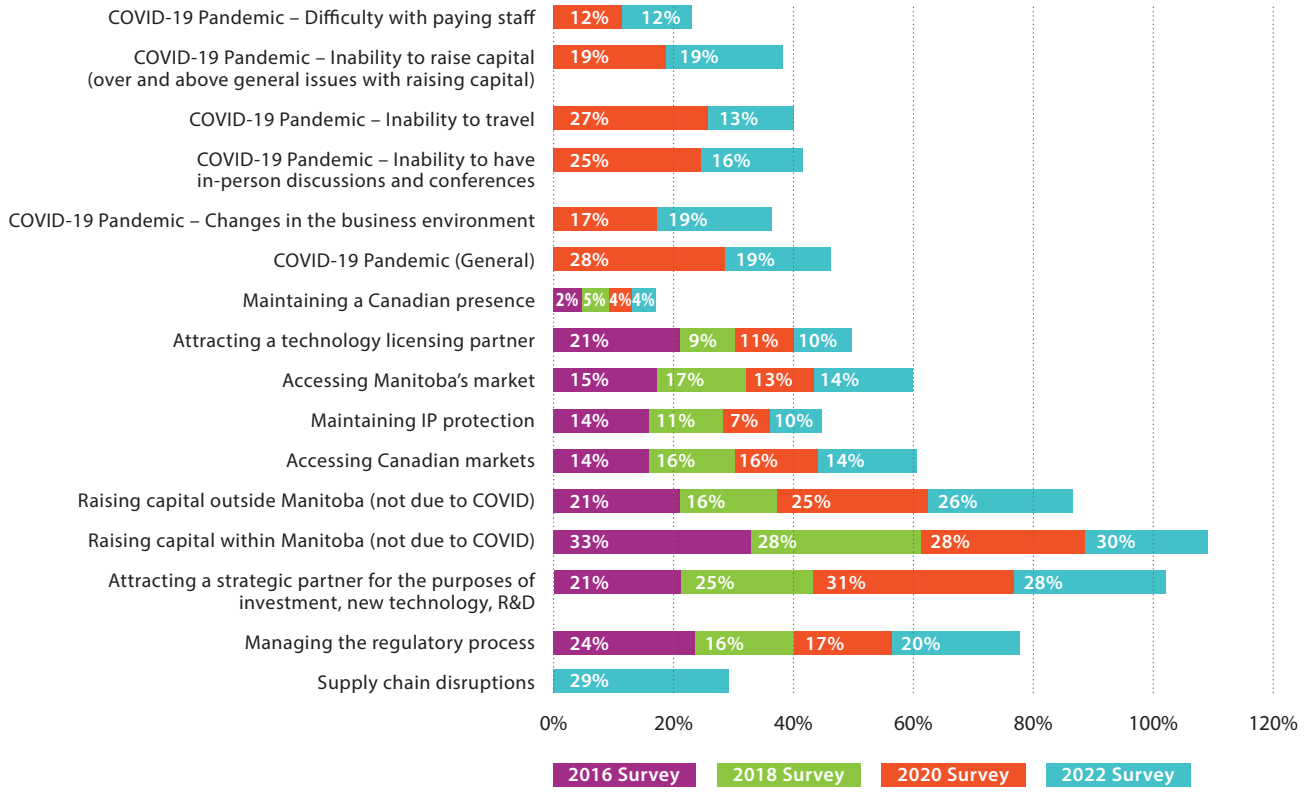
Challenges Facing Manitoba Bioscience Organizations

(Major or Minor)



Since 2016, there has been a reduction in the number of organizations reporting maintaining a Canadian presence, accessing Canadian markets, and attracting a technology licensing partner as major or minor challenges. All COVID-19 related challenges were reported as a major or minor challenge less frequently than in the previous survey (2020).

Challenges Facing Manitoba Bioscience Organizations *(Major)*



With regards to major challenges, **30% of organizations report raising capital within Manitoba as a major challenge** to the organization. Supply chain disruptions is the next most frequently reported major challenge (29%) followed by attracting a strategic partner for the purposes of investment, new technology, R&D (28%). While managing the regulatory process is the second highest reported challenge (major or minor), only 20% of organizations report it as a major challenge facing the organization.

Other than supply chain disruptions, organizations with more FTEs tend to report fewer major challenges/obstacles as shown in the table below. This is similar to previous studies.

Major Obstacles by Company Size

2020 and 2022

Major Obstacle	Year	5 or fewer FTE	6 to 20 FTE	21 to 50 FTE	> 50 FTE
Attracting a technology licensing partner	2020	18%	12%	0%	0%
	2022	15%	10%	0%	7%
Attracting a strategic partner for the purposes of investment, new technology, R&D	2020	46%	24%	13%	23%
	2022	38%	29%	17%	7%
Managing the regulatory process	2020	14%	12%	25%	31%
	2022	27%	19%	8%	14%
Accessing Canadian markets	2020	14%	28%	0%	8%
	2022	8%	24%	8%	14%
Maintaining IP protection	2020	4%	4%	13%	15%
	2022	23%	0%	8%	0%
Maintaining a Canadian presence	2020	7%	4%	0%	0%
	2022	4%	5%	8%	0%
Raising capital outside Manitoba (not due to COVID)	2020	43%	16%	13%	15%
	2022	35%	24%	25%	7%
Raising capital within Manitoba (not due to COVID)	2020	50%	20%	13%	8%
	2022	42%	19%	33%	14%
Accessing Manitoba's market	2020	21%	16%	0%	0%
	2022	12%	19%	17%	7%
Supply chain disruptions	2020	NA	NA	NA	NA
	2022	27%	19%	42%	29%
COVID-19 Pandemic – Inability to travel	2020	29%	32%	38%	8%
	2022	15%	0%	25%	14%
COVID-19 Pandemic – Inability to raise capital (over and above general issues with raising capital)	2020	27%	20%	13%	8%
	2022	23%	19%	17%	7%
COVID-19 Pandemic – Inability to have in-person discussions and conferences	2020	21%	36%	38%	8%
	2022	8%	5%	42%	21%
COVID-19 Pandemic – Difficulty with paying staff	2020	7%	24%	13%	0%
	2022	12%	10%	25%	0%
COVID-19 Pandemic – Changes in the business environment	2020	18%	24%	13%	8%
	2022	12%	14%	33%	21%
COVID-19 Pandemic (General)	2020	29%	40%	25%	8%
	2022	15%	14%	25%	21%

9.1 Are Manitoba and Canada Conducive to Growing a Bioscience Business?

Respondents were asked to assess the Manitoba and Canadian operating environment with respect to its conduciveness in growing a bioscience business.

Manitoba

Year	2022 Survey	2020 Survey
Conducive to growing a bioscience business	21%	29%
Working against the growth of bioscience businesses	21%	21%
Neutral	50%	41%
Unknown	8%	7%

Overall, between the 2020 and 2022 surveys, less responding organizations think Manitoba's operating environment is conducive to growing a bioscience business. The percentage of respondents that think Manitoba's operating environment is working against the growth of bioscience businesses is unchanged (21%), while neutral increased from 41% to 50%.

The opinion that Manitoba's operating environment is working against the growth of bioscience businesses tends to come from organizations with 6 to 20 FTEs. In 2022, similar to 2020, 38% of organizations with 6 to 20 FTEs indicate that Manitoba's operating environment is working against the growth of bioscience businesses with 33% responding neutral. Only 14% of this employment size category think that Manitoba's operating environment is conducive to growing a bioscience business.

Organizations with five (5) or fewer FTEs and 21 to 50 FTEs indicate that Manitoba's operating environment is conducive to growing a bioscience business at approximately ¼ each. In 2020, 31% of organizations with 50 or more FTEs indicated that Manitoba's operating environment was conducive to growing a bioscience business. This figure decreased to only 7% in 2022.

Canada

Year	2022 Survey	2020 Survey
Conducive to growing a bioscience business	20%	31%
Working against the growth of bioscience businesses	23%	16%
Neutral	47%	41%
Unknown	11%	11%

In Canada, there was a drastic change in opinion toward the overall operating environment. Only 20% of respondents in 2022 think that Canada's operating environment is conducive to growing a bioscience business compared to 31% in 2020. 23% of respondents in 2022 think that Canada's operating environment is working against the growth of bioscience businesses compared to 16% in 2020.

The opinion that Canada's operating environment is working against the growth of bioscience businesses tends to come from both organizations with 6 to 20 FTEs (similar to Manitoba) but also organizations with five (5) or fewer FTEs. In 2022, 24% of organizations with 6 to 20 FTEs indicate that Canada's operating environment is working against the growth of bioscience businesses. 23% of organizations with five (5) or fewer FTEs indicate the same.

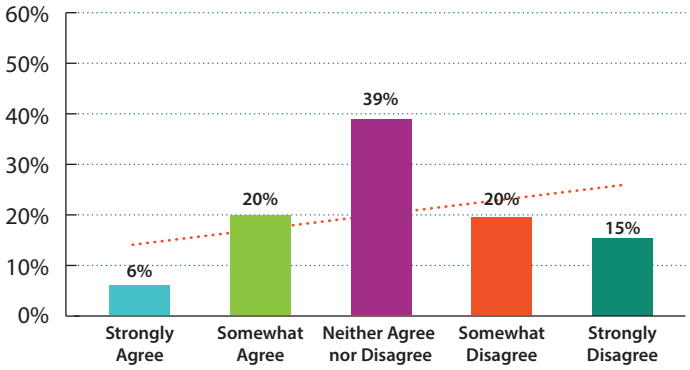
In both Manitoba and Canada, older organizations indicate conduciveness to growing a bioscience business proportionally more than younger organizations. While younger organizations indicate working against the growth of bioscience businesses proportionally more than older organizations.

Overall, neutral is the most frequently selected option with regards to Manitoba and Canada's overall operating environment.

Respondents were asked to provide insight into Manitoba's public and private sector and their respective support to the bioscience industry by agreeing or disagreeing with a series of statements.

Statement #1:

Manitoba's public sector (through programs and/or financial support) adequately supports bioscience businesses requiring assistance with the cost of operations

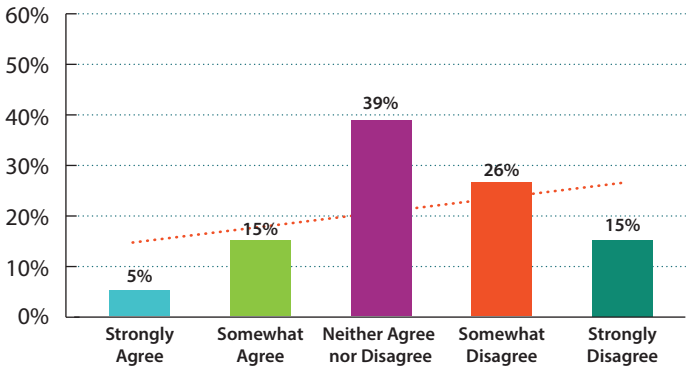


Respondents tend to disagree with the statement that Manitoba's public sector (through programs and/or financial support) adequately supports bioscience businesses requiring assistance with the cost of operations.

Although "neither agree nor disagree" is the highest response, and the "somewhat agree" and "somewhat disagree" categories are both 20%, strongly disagree is 15%, significantly greater than strongly agree (6%). It is organizations with 6 to 20 FTEs that chose "strongly disagree" at a proportionally high rate.

Statement #2:

Manitoba's public sector (through programs and/or financial support) adequately supports bioscience businesses wanting to scale-up/grow

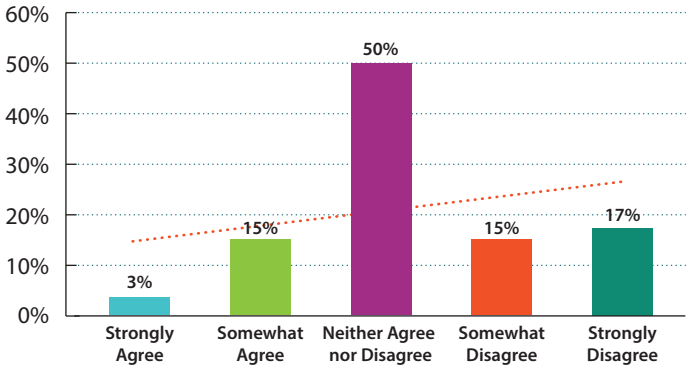


Very similar to statement #1, respondents tend to disagree with the statement that Manitoba's public sector (through programs and/or financial support) adequately supports bioscience businesses wanting to scale up/grow.

Although "neither agree nor disagree" is the highest response (and identical to statement #1), the two disagree options dominate with 41% of respondents indicating that they either "somewhat disagree" or "strongly disagree" compared to 20% in the "agree" categories. For this statement, it is organizations with five (5) or fewer FTEs and 6 to 20 FTEs that tend to "strongly disagree". The 21 to 50 FTEs and 50 or more FTEs tend to "somewhat disagree" with the statement.

Statement #3:

Manitoba's private sector institutions / organizations adequately provide financial support (either through loans or equity solutions) to bioscience businesses requiring assistance with the cost of operations

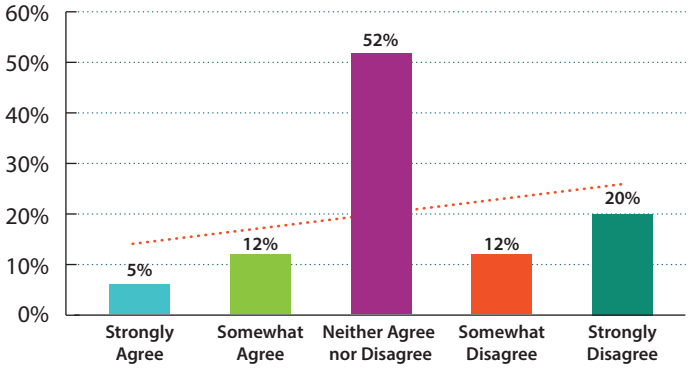


Respondents tend to disagree with the statement that Manitoba's private sector (either through loans or equity solutions) adequately supports bioscience businesses requiring assistance with the cost of operations.

Although "neither agree nor disagree" is the highest response, and the "somewhat agree" and "somewhat disagree" categories are both 15%, strongly disagree is 17%, significantly greater than strongly agree (3%). It is the organizations with 6 to 20 FTEs and 21 to 50 FTEs that chose "strongly disagree" at a proportionally high rate.

Statement #4:

Manitoba's private sector institutions/organizations adequately provide financial support (either through loans or equity solutions) to biosciences businesses wanting to scale-up/grow



Very similar to statement #3, respondents tend to disagree with the statement that Manitoba's private sector (either through loans or equity solutions) adequately supports bioscience businesses wanting to scale up/grow.

Although "neither agree nor disagree" is the highest response (52%), and the "somewhat agree" and "somewhat disagree" categories are both 12%, "strongly disagree" (20%) is significantly higher than "strongly agree" (5%). For this statement, it is organizations with five (5) or fewer FTEs, 6 to 20 FTEs, and 21 to 50 FTEs that tend to "strongly disagree". Also note that no organization with 50 or more FTEs agreed with this statement.

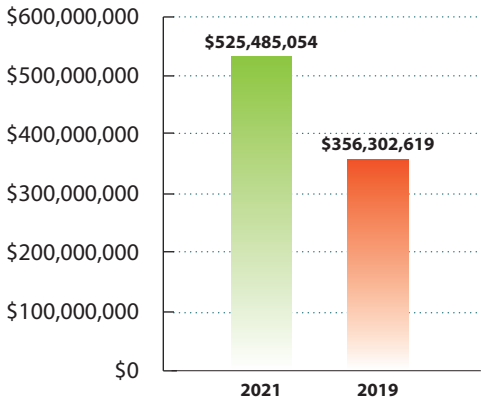
10.0 CAPITAL RAISED AND RESEARCH AND DEVELOPMENT EXPENDITURES

In 2021, the Manitoba bioscience industry raised an estimated $525,485,054 in capital.

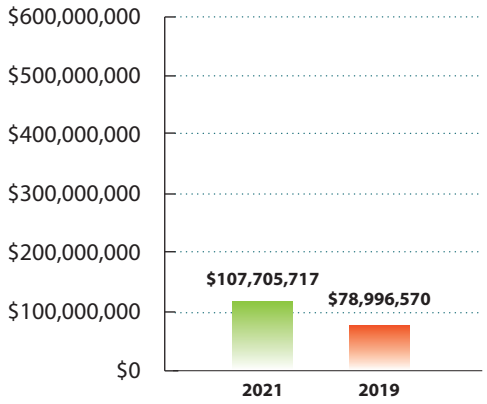
In 2021, total R&D expenditures is estimated at $107,705,717.

Both of these key performance indicators increased from 2019 where capital raised was an estimated $356,302,619 and research and development expenditures was an estimated $78,996,570.

Total Capital Raised

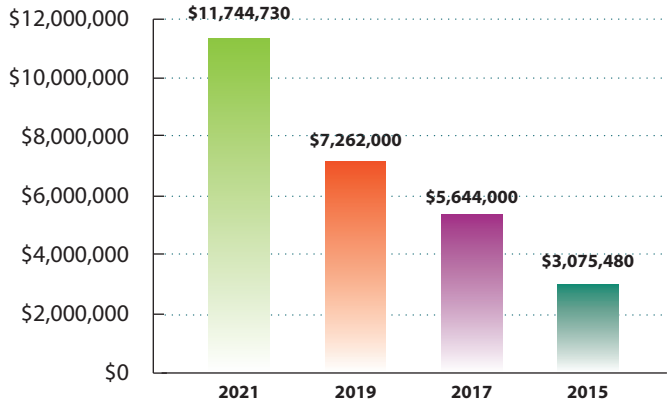


R&D Expeditures

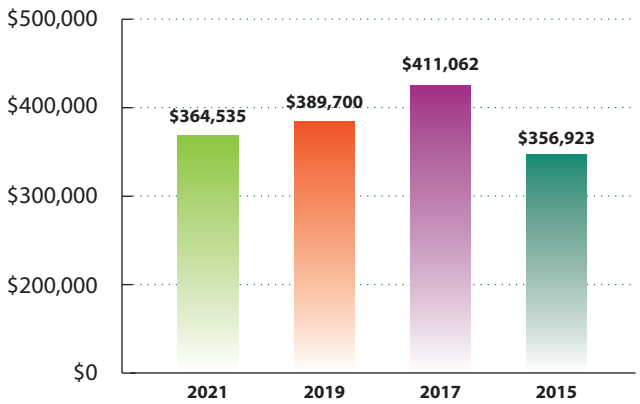


Within the sample collected from the 2016 to 2022 surveys, average capital raised per organization has increased significantly, while average research and development expenditures has increased slightly.

Average Capital Raised

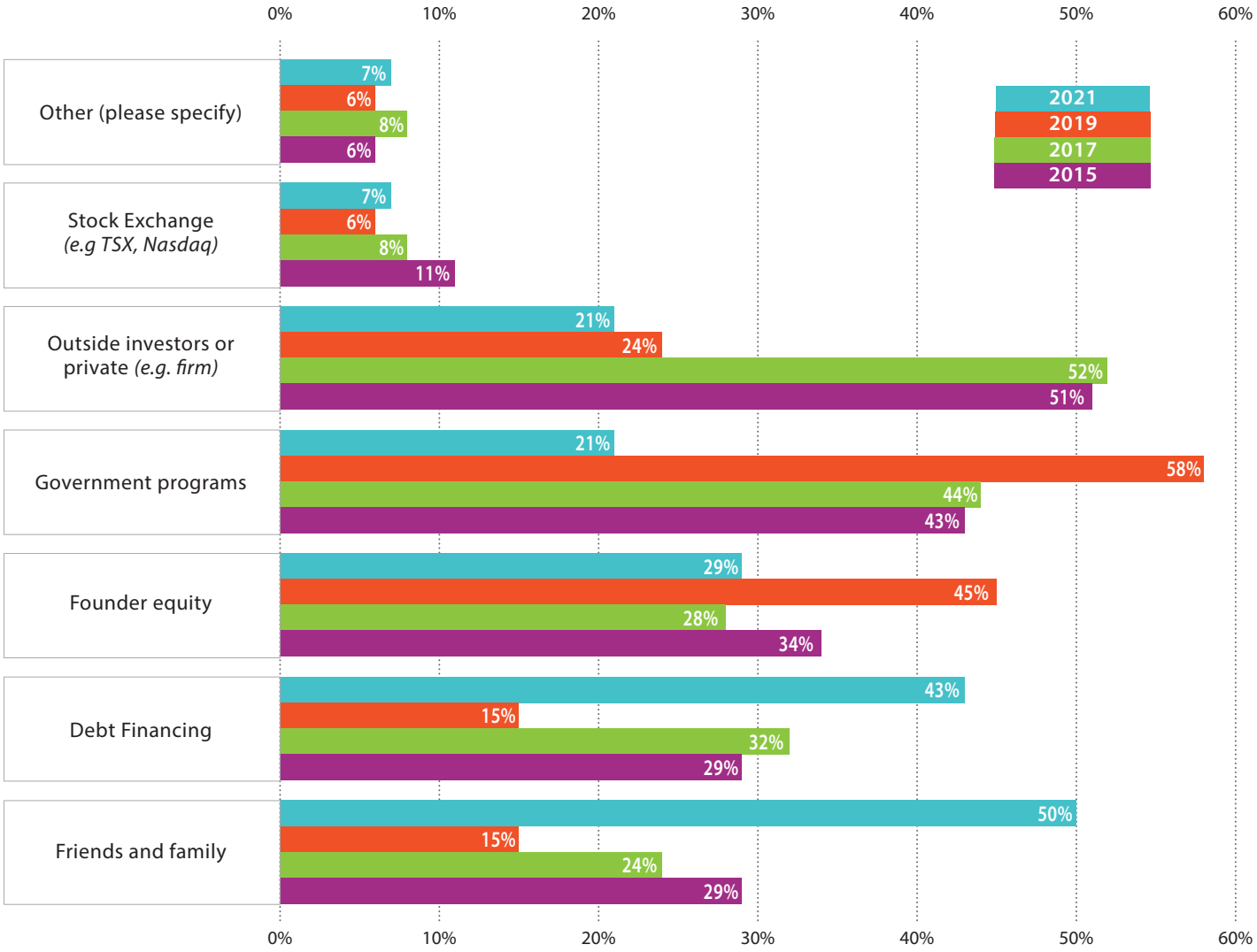


Average R&D Expenditures



Sources of Capital Raised- Comparison of Four Study Periods

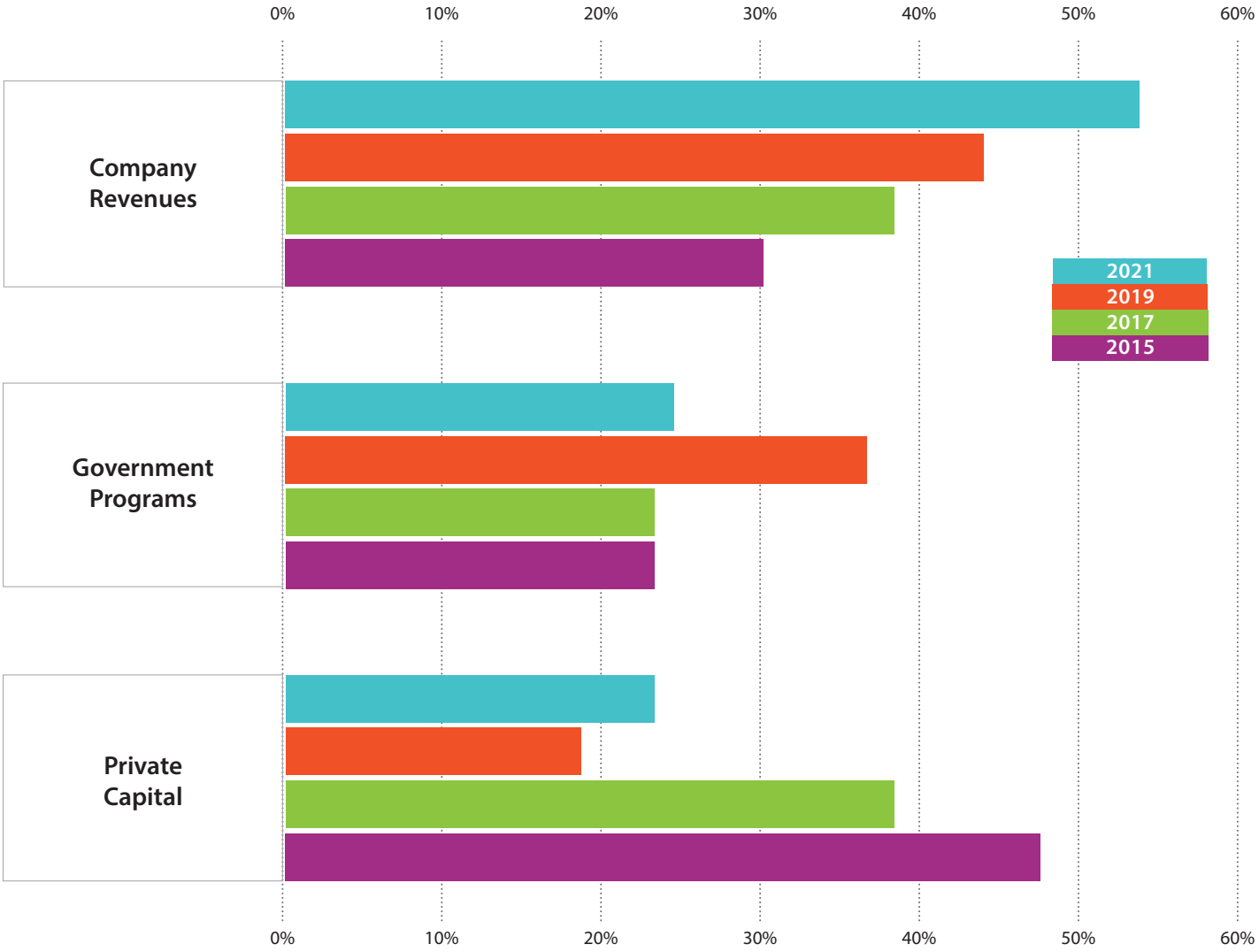
As shown below, since 2015, there has been a significant decline in outside investors or private firms as a source of capital from 51% in 2015 to 21% in 2021 and a significant increase in the use of friends and family and debt financing as a source of raising capital. In fact, 50% of respondents and 43% of respondents of the 2022 survey indicate relying on friends and family and debt financing as a source of raising capital respectively in 2021.



Sources of R&D- Comparison of Four Study Periods

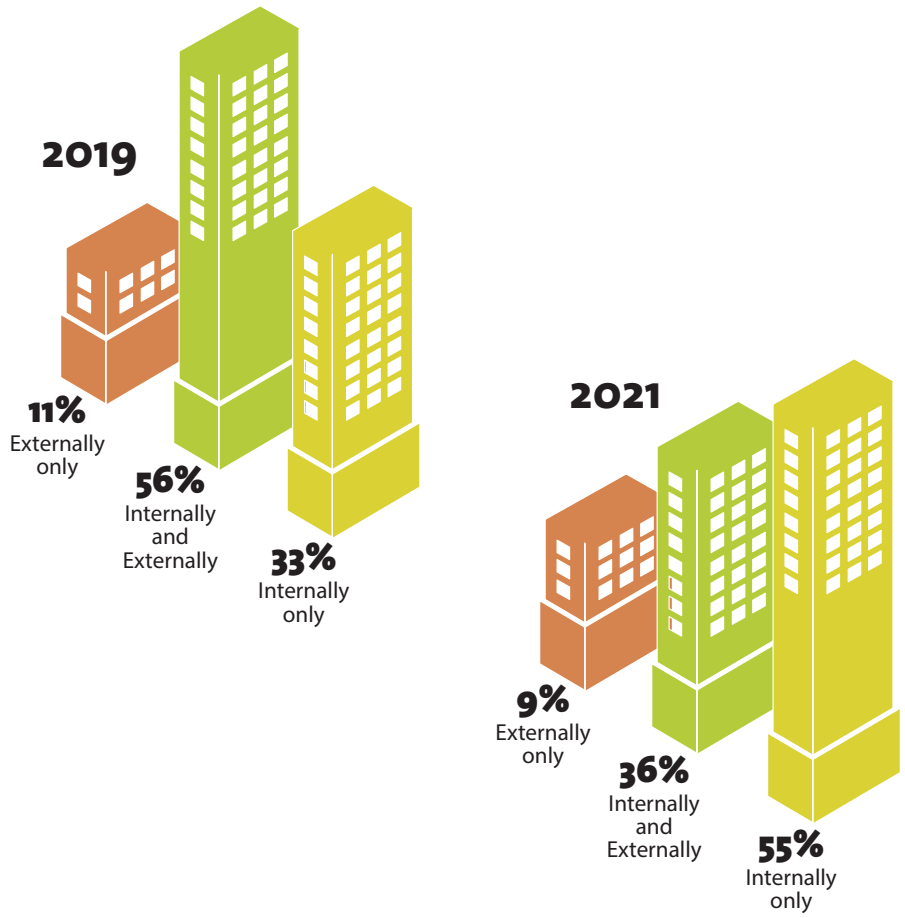
Since 2015, there has been an increase in the percentage of organizations relying on company revenues to fund research and development activities, significantly less reliance on private capital, and roughly the same use of government programs with 2019 demonstrating a large increase in the use of government programs from the typical level (this may have been due to COVID-19).

R&D Resources



How R&D is conducted within organizations

In 2021, more organizations indicate conducting research and development activities internally compared to 2019.



A significant amount of research and development activities are being conducted within Manitoba, 91% of responding organizations indicated R&D activities within the province. However, Manitoba bioscience R&D activities are also conducted elsewhere in Canada, the United States, Europe, and other locations world-wide.

Location of R&D	Number of Responding Organizations	Percentage of Responding Organizations
Within Manitoba	43	91%
Within the Rest of Canada	19	40%
Within the United States	9	19%
Within Europe	6	13%
Within The Rest of the World	2	4%

10.1 **Government Programs**

The below tables presents various government programs, their usage rate, and whether or not they met company expectations. Similar to previous years, SRED, and NRC-IRAP have the highest usage rate. Although not as frequently used, Canada-Manitoba Job Grant yields a high rating exceeding or meeting the expectations of organizations.

Provincial Programs (Manitoba)	Survey Year	Exceeded or Met expectations	Did not meet expectations	Did not use	Did not know about the initiative	Usage Rate
Scientific Research and Experimental Development tax credit program (SRED)	2020	29	2	43	1	41%
	2022	15	5	24	2	43%
Canada -Manitoba Jobs Grant	2020	20	2	48	5	29%
	2022	12	3	25	6	33%
Research Manitoba	2020	NA	NA	NA	NA	NA
	2022	9	3	30	4	26%
Innovation Growth Fund (formerly Commercialization Support for Business Program CSBP)	2020	6	2	56	11	11%
	2022	5	4	29	8	20%
Small Business Venture Capital Tax	2020	12	0	56	7	16%
	2022	5	1	32	8	13%
Workforce Development Program	2020	10	1	56	8	15%
	2022	5	1	32	8	13%
Ag Action Manitoba	2020	14	2	53	6	21%
	2022	4	1	33	8	11%
Manitoba Manufacturing Investment Tax Credit	2020	9	0	58	8	12%
	2022	1	2	37	6	7%
Industry Expansion Training Program	2020	6	1	59	9	9%
	2022	2	1	36	7	7%
Manitoba Works Capital Incentive Tax Credit	2020	6	1	59	9	9%
	2022	0	1	37	8	2%

Federal Programs	Survey Year	Exceeded or Met expectations	Did not meet expectations	Did not use	Did not know about the initiative	Usage Rate
National Research Council - Industrial Research Assistance Program (NRC - IRAP)	2020	31	7	35	1	51%
	2022	21	5	18	2	57%
Scientific Research and Experimental Development tax credit program (SRED)	2020	28	4	41	1	43%
	2022	18	5	23	0	50%
Canadian Trade Commissioner Service/CanExport	2020	21	4	42	7	34%
	2022	17	2	24	3	41%
Natural Science and Engineering Research Council (NSERC)	2020	14	3	56	1	23%
	2022	9	3	32	2	26%
MITACS	2020	15	4	50	3	26%
	2022	9	3	31	3	26%
PrairiesCan previously Western Economic Diversification (WD)	2020	17	5	47	5	30%
	2022	6	5	31	4	24%
Canadian Agricultural Partnership Program	2020	15	5	48	6	27%
	2022	5	3	31	7	17%
BioTalent	2020	11	2	55	5	18%
	2022	5	3	33	5	17%
Strategic Innovation Fund (SIF)	2020	6	6	52	10	16%
	2022	2	4	34	6	13%
Protein Industries Canada (PIC)	2020	12	3	54	5	20%
	2022	4	2	36	4	13%
Employment and Social Development Canada (ESDC)	2020	NA	NA	NA	NA	NA
	2022	3	2	32	9	11%
Prairie Biosciences Canada (PBC)	2020	9	0	56	9	12%
	2022	2	1	39	4	7%

COVID-19 Support Programs

The COVID-19 programs often had a usage rate above 30% and were all highly rated in terms of exceeding or meeting organization expectations.

COVID-19 Support Programs	Survey Year	Exceeded or Met expectations	Did not meet expectations	Did not use	Did not know about the initiative	Usage Rate
Canada Emergency Wage Subsidy (CEWS)	2020	21	3	48	1	33%
	2022	20	3	42	1	35%
$40,000 Interest free loan program	2020	22	1	48	1	32%
	2022	20	2	41	3	33%
NRC-IRAP (IAP) Innovation Assistance Program	2020	17	1	51	4	25%
	2022	15	3	41	7	27%
Temporary Wage Subsidy for Employers (10%)	2020	22	1	49	1	32%
	2022	12	6	45	3	27%
Provincial Summer Student Recovery Program	2020	12	1	56	4	18%
	2022	5	2	52	7	11%
Canada Emergency Commercial Rent Assistance Program	2020	3	2	64	4	7%
	2022	2	2	59	3	6%
Covid 19 Farm and Food Processors Support	2020	1	0	66	6	1%
	2022	0	3	53	10	5%
Regional Relief and Recovery Fund (RRRF)	2020	4	0	65	4	5%
	2022	0	3	53	10	5%
Work Sharing Program (WS)	2020	1	0	66	6	1%
	2022	0	2	55	9	3%
MB GAP Protection Plan	2020	5	1	62	5	8%
	2022	1	1	56	8	3%
Temporary Foreign Workers Permit Process	2020	2	1	63	7	4%
	2022	0	2	58	6	3%

11.0 **LABOUR MARKET** INFORMATION

THE MANITOBA BIOSCIENCE INDUSTRY EMPLOYS

14,330 individuals.

IT IS A HIGH VALUE-ADDED INDUSTRY WITH

direct GDP per worker of $366,048.

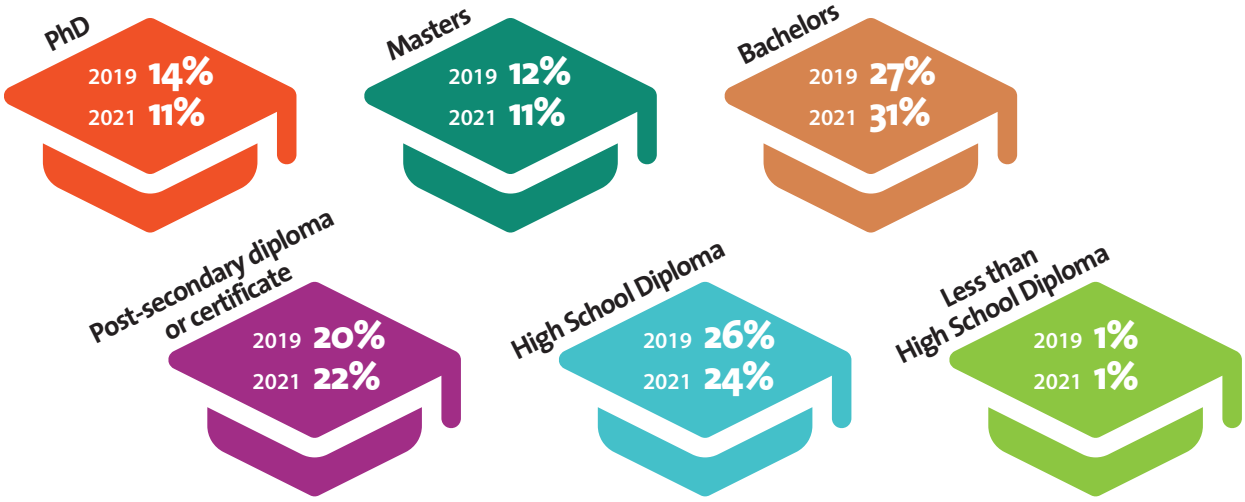
The following table provides a list of the top 13 occupations employed by the Manitoba bioscience industry in terms of industry concentration:

Title	Total Job Openings in Manitoba Bioscience Industry 2022 to 2026	Total Employment in Manitoba Bioscience Industry 2021	Average Annual Salary 2022
Medical laboratory technicians and pathologists' assistants	59	482	$59,944
Medical laboratory technologists	55	405	$84,509
Technical sales specialists - wholesale trade	39	317	$81,615
Retail and wholesale trade managers	55	277	$80,838
Manufacturing managers	32	308	$111,256
Chemical plant machine operators	0	302	$61,840
Sales and account representatives - wholesale trade (non-technical)	18	201	$80,158
Material handlers	24	192	$50,256
Chemical technologists and technicians	18	179	$61,236
Medical radiation technologists	29	185	$84,185
Chemists	16	159	$85,605
Shippers and receivers	19	146	$46,373
Biologists and related scientists	31	129	$93,683

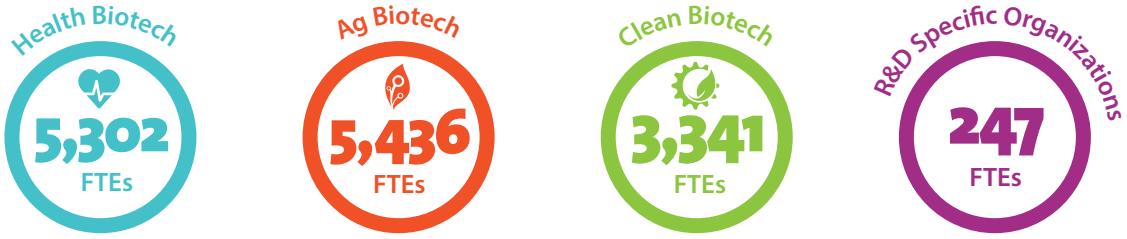
Manitoba Bioscience Full Time Equivalent (FTE) by Education Level

Degree/Education Qualifications

The Manitoba bioscience industry is highly educated with 53% of the workforce possessing a bachelor's degree or above[6].



Total Bioscience industry employment by sector (2021)



[6] *This is known as highly qualified professionals (HQP)*

Proportions of Full-Time Equivalent (FTE) Employees in Manitoba's Bioscience Industry

By subsector and highest education level

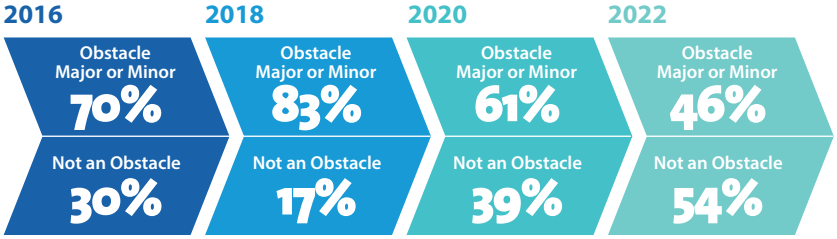
Just under half of the Health Biotech workforce is considered Highly Qualified Professionals (HQP), consistent since 2017. There has been a significant increase in the percentage of the Ag Biotech workforce that is HQP since 2017, from 34% to 68% in 2021. Clean Biotech is seeing an increase in the high school workforce from 62% in 2017 to 71% in 2021.

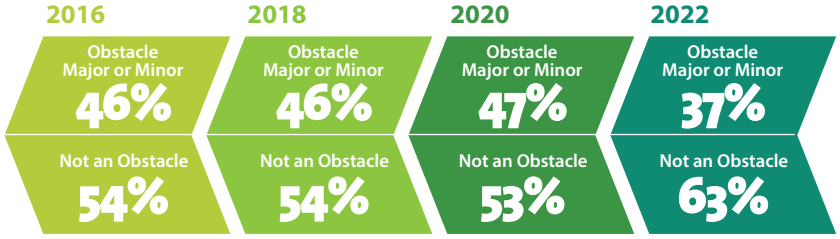
Sector	Year	HQP (%)	High School	Other
Clean Biotech	2017	22%	62%	16%
	2019	16%	74%	11%
	2021	13%	71%	15%
Health Biotech	2017	49%	29%	22%
	2019	41%	36%	23%
	2021	44%	30%	26%
Ag Biotech	2017	44%	26%	41%
	2019	56%	26%	18%
	2021	68%	10%	22%
Support Organization/Others	2017	63%	23%	14%
	2019	70%	10%	20%
	2021	70%	11%	19%

11.1 Recruitment and Retention

In the 2022 survey, both recruitment and retention were stated to be less of a challenge than in previous years.

RECRUITMENT
Overall difficulty in attracting in all positions





RETENTION
Overall difficulty in retaining in all positions

In the 2016 survey, 30% of organizations reported recruitment as not being an obstacle. This figure fell in the 2018 survey, and since has increased to 54% in the 2022 survey. This indicates that organizations are having less issues hiring candidates to fill vacant job positions. Retention has always been less of a challenge than recruitment overall with 54% reporting retention as not an obstacle in 2016, and 63% in the 2022 survey.

Educational institutions from which employees are currently being hired

University of Manitoba is the most frequently reported institution that organizations recruit from, followed by RRC Polytech and University of Winnipeg.

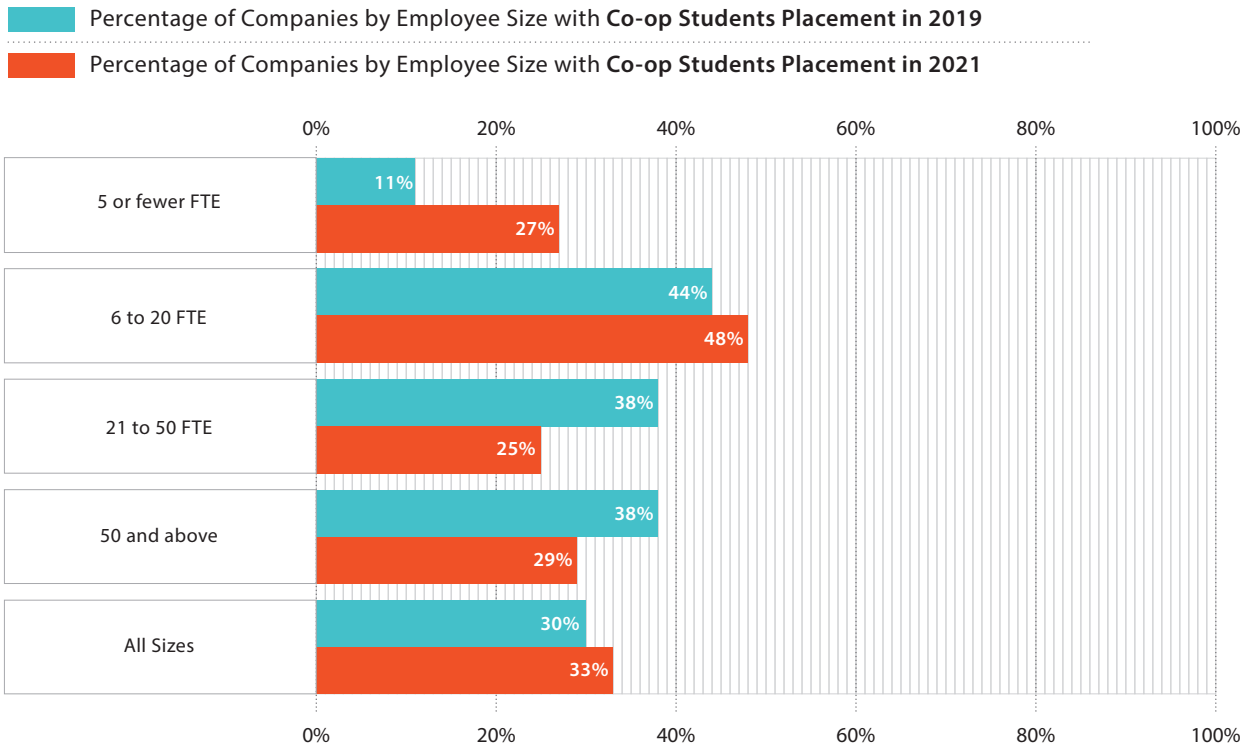
Institutions	% of Organizations Recruiting 2020 Survey	% of Organizations Recruiting 2022 Survey
High School	8%	14%
University of Manitoba	55%	47%
University of Winnipeg	20%	16%
RRC Polytech	31%	34%
Assiniboine Community College	11%	4%
Brandon University	8%	4%
Other Universities or Colleges in Manitoba	7%	10%
Universities or Colleges in Alberta	9%	4%
Universities or Colleges in Saskatchewan	9%	5%
Universities or Colleges in British Columbia	1%	7%
Universities or Colleges in Ontario	8%	12%
Universities of Colleges in Quebec	4%	5%
Universities or Colleges in the Maritimes	1%	3%
Universities or Colleges in the Territories or Nunavut	0%	1%
Universities or Colleges in the United States	4%	8%
Universities or Colleges outside of Canada or the USA	5%	8%
Other (don't specify)	3%	8%
None - Not currently hiring/recruiting	36%	27%

Co-op Student Placement

The Manitoba bioscience industry employs co-op students. In 2021, **91 co-op students** were placed within organizations responding to the survey, an average of 1.25 students per organization. This is an **increase** from 1.11 average co-op students placed in the previous study.

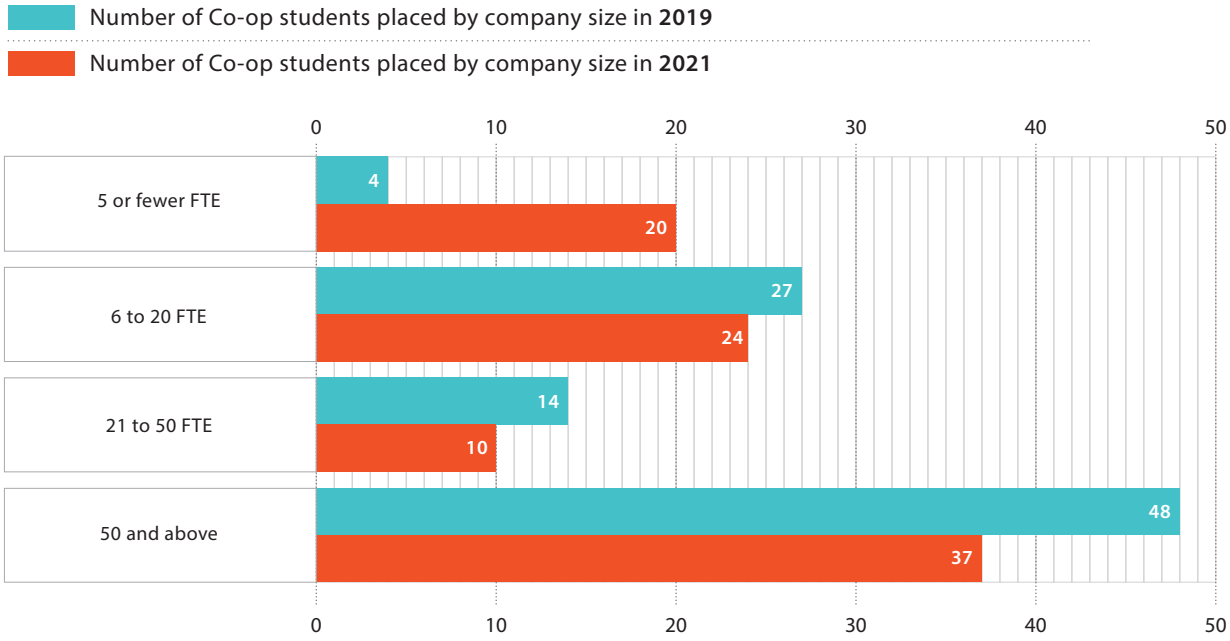
In 2021, there was an increase in the number of organizations with five (5) or fewer FTEs that recruit co-op students (27% from 11%). Overall, the percentage of organizations that recruit co-op students increased by 3%, from 30% in 2019 to 33% in 2021.

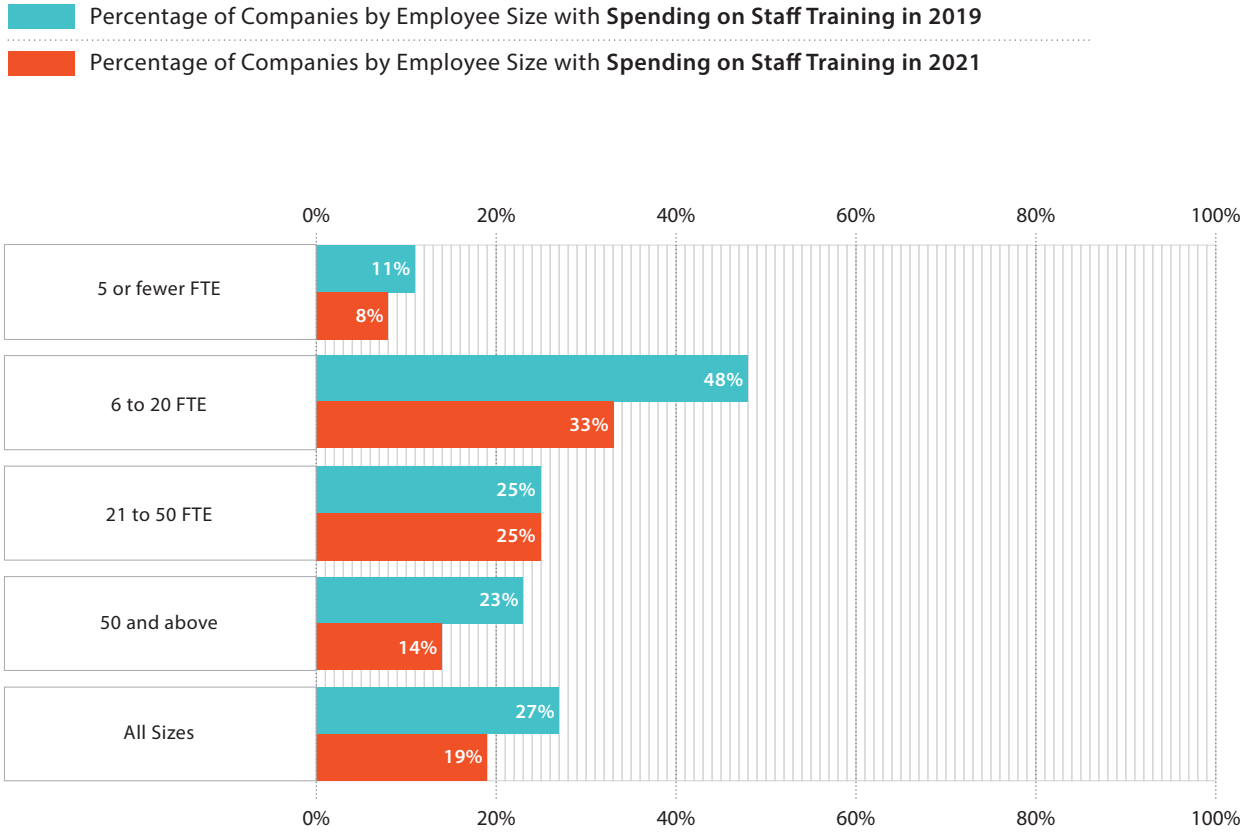
The following chart presents co-op student placement by organization size:



Although there is significant co-op placement within all organization sizes, most of the co-op students are placed within organizations with 50 or more employees. However, this percentage has decreased since 2019 from 52% to 41%.

In 2021 and 2019 a total of 91 and 93 co-op students were placed as follows:



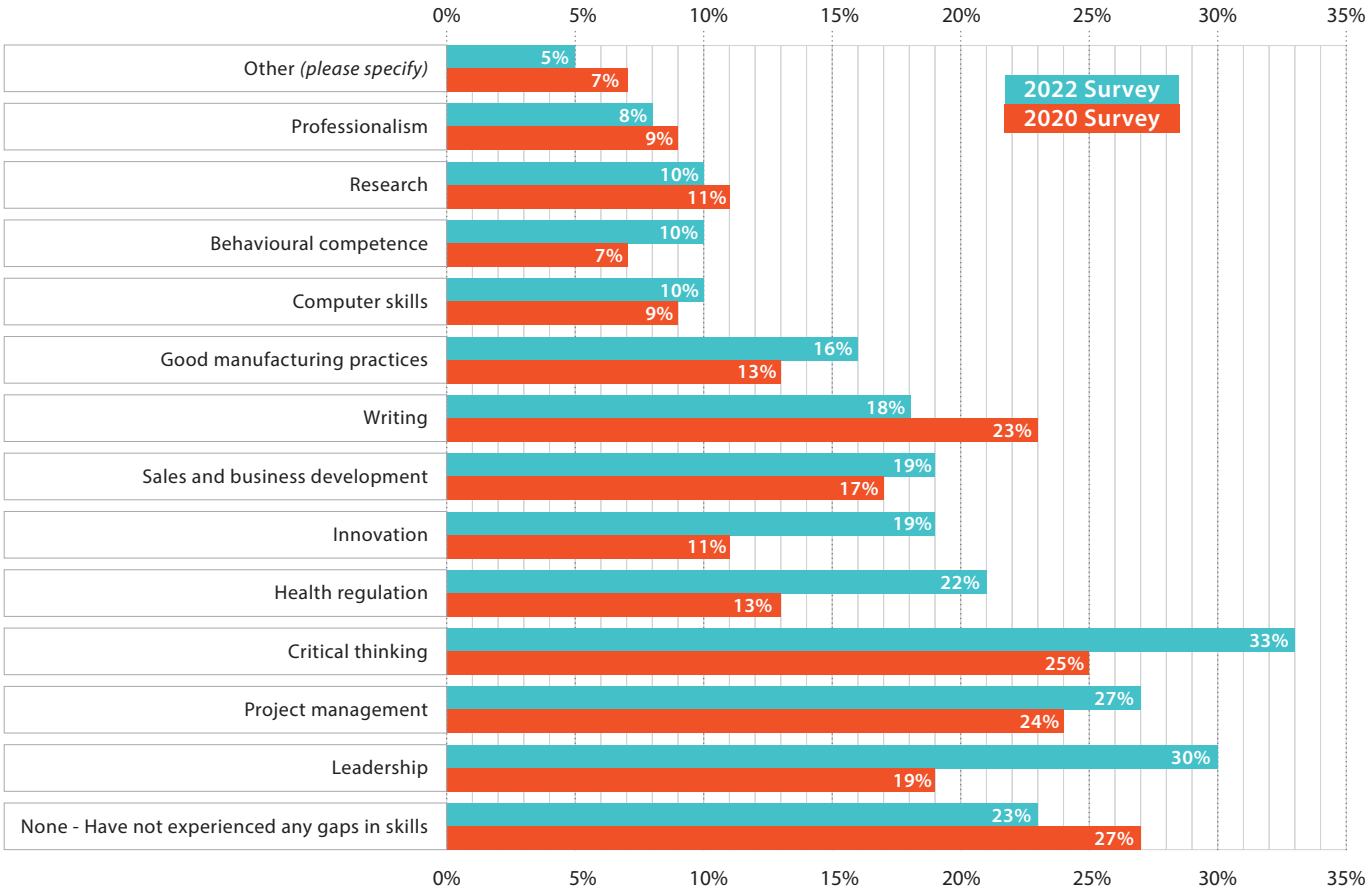


In 2021, there were less organizations proportionally that reported spending on staff training (19%), a decrease from 27% in 2019. In 2021, a large percentage of the value of training expenditures was from the 21 to 50 FTE category accounting for 69% of industry training expenditures. In 2019, the 6 to 20 FTE and 50 or more FTE category accounted for 78% of the value of industry training expenditures.

Skills Gap

Similar to previous survey's, **the largest skills gap is critical thinking (33%), an increase from 25% in the 2020 survey.** Leadership is second (30%) with an increase from 19% in 2020. Of the 14 skills listed, nine (9) skills exhibited an increase from the 2020 survey indicative of increasing skills gaps within the newly recruited workforce.

% of Organizations Reporting Skills Gaps from Workforce Hired from Educational Institutions



Top 5 Skills Gap

Critical Thinking

Leadership

Project Management

Health Regulation

Innovation

Training Needs

Respondents were asked to identify where BAM could fill training needs that exist within the organization. Respondents indicate that "Professional development: leadership, management, communication, human resource" is a training need with 40% reporting. However, this percentage has decreased from the 2018 and 2020 survey. "Regulatory" ranks the lowest at 26%. Since 2018, the percentage of organizations indicating that BAM could fill training needs has decreased for all categories. **This is indicative of the positive training provided by BAM since 23% of organizations indicate that they "do not have training gaps".**

Training Gaps	Comparison Years	% Reporting
Regulatory	2020 Survey	36%
	2022 Survey	26%
Professional development: leadership, management, communication, human resource	2020 Survey	53%
	2022 Survey	40%
Management Business functions: sales, marketing, production, product/service development,	2020 Survey	47%
	2022 Survey	32%
Business development Operations: GMP, lean	2020 Survey	35%
	2022 Survey	36%
Other (please specify)	2020 Survey	8%
	2022 Survey	1%

12.0 THE GREEN INDUSTRY

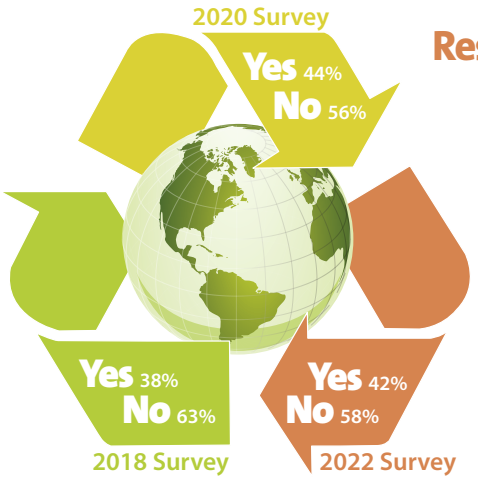
Definition of Green- make less harmful or more sensitive to the environment

Bioscience companies are largely "green" by the nature of the goods and services provided, the products and processes created and developed, and the workforce they employ (green occupations). The percentage of organizations reporting "green" product development component grew from 38% to 44% between 2017 and 2019, with Ag Biotech organizations specifically increasing their "green" activities. Although, between 2019 and 2021, Ag Biotech and Health Biotech organizations continued to increase their greenness, the proportion for the entire sector fell slightly to 42% due to a decrease in Clean Biotech "green" activities.

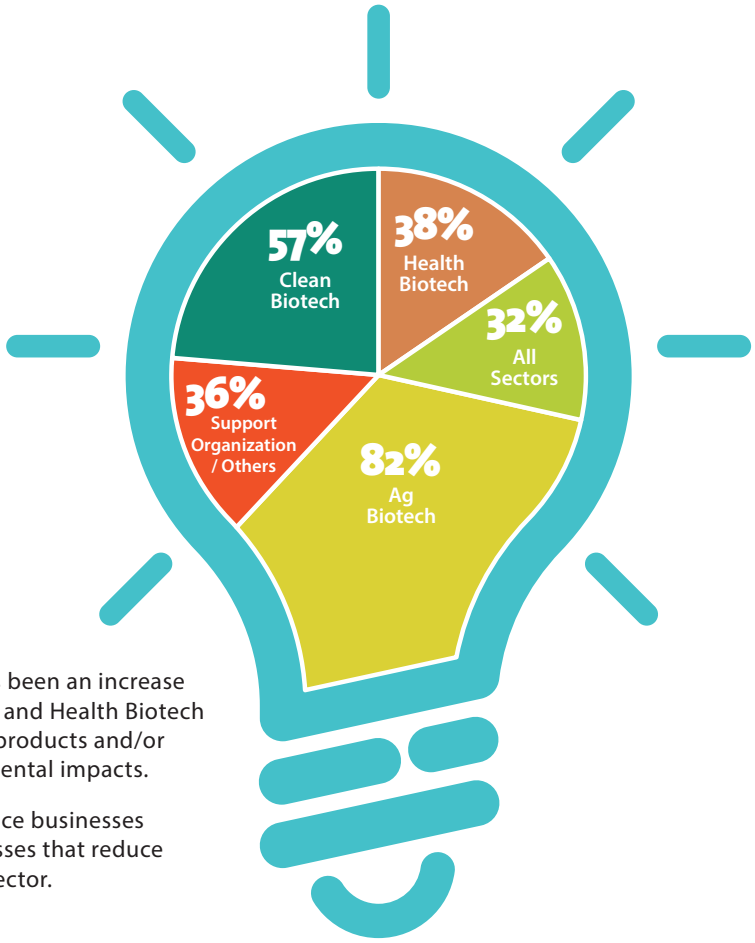
In 2022, 42% of survey respondents indicate that they are producing products and/or processes which reduce environmental impacts beyond those produced by the common technology currently used. This is slightly less than in 2020 (44%) but greater than 2018 (38%).

Environmental Impact Reduction - 2022

Proportion of bioscience business creating products and/or processes that reduce environmental impact.



Response to Product and/or Processes Reducing Environmental Impact



Since the 2018 survey, there has been an increase in the percentage of Ag Biotech and Health Biotech organizations that are creating products and/or processes that reduce environmental impacts.

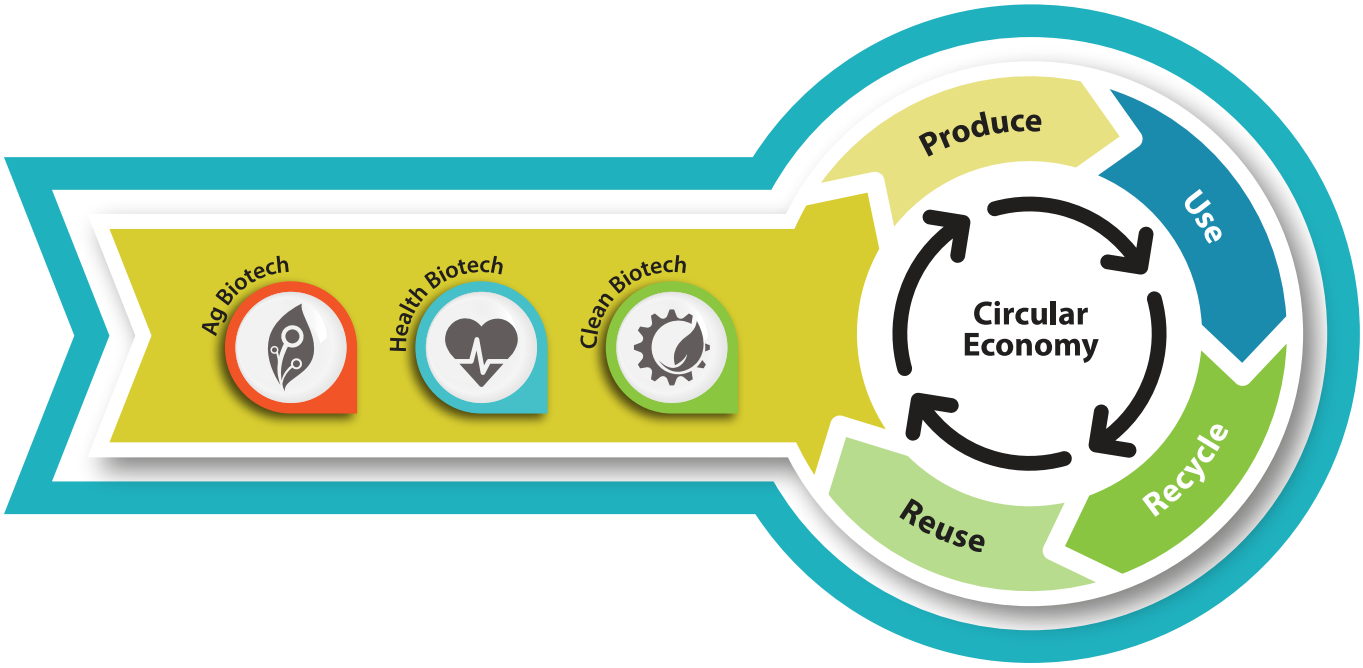
Proportion of surveyed bioscience businesses creating products and/or processes that reduce environmental impacts by subsector.

12.1 **Circular Economy**

Circular economy is a model of production and consumption, which involves sharing, leasing, reusing, repairing, refurbishing, and recycling existing materials and products as long as possible resulting in the extension of product life cycle.

Respondents were asked to rate their involvement in the circular economy from "not active at all", to "very active". Approximately the same percentage of Biotech organizations are very active in the circular economy with support organization/other reporting the highest at 29%. Clean Biotech organizations are proportionally the least active in the circular economy with one third (33%) reporting "not active at all". Aside from support organization/other, **Health Biotech and Ag Biotech organizations are the most active with 78% and 72% reporting being "moderately active" or higher.**

Circular Economy	Clean Biotech	Health Biotech	Ag Biotech	Support Organization / Other
5 – very active	17%	15%	18%	29%
4	17%	22%	27%	36%
3 – moderately active	33%	41%	27%	29%
2	0%	20%	9%	0%
1 – not active at all	33%	2%	18%	7%



13.0 **REQUIRED** GOVERNMENT INTERVENTION

Steps for Government to assist Manitoba's bioscience industry- in competing globally

Required Government Intervention	Years	All Sizes
Provide research grants	2018 Survey	58%
	2020 Survey	61%
	2022 Survey	66%
Improve the speed of the regulatory process	2018 Survey	53%
	2020 Survey	51%
	2022 Survey	64%
Create more favourable tax incentives	2018 Survey	53%
	2020 Survey	56%
	2022 Survey	60%
Create incentives for risk capital	2018 Survey	52%
	2020 Survey	60%
	2022 Survey	59%

The above results from 2022 suggest that survey respondents want the government involved with the industry in the form of research grants, and improving the speed of the regulatory process.

Since 2018, all categories increased except the "none of the above" and "other" categories. Contrary to previous years, the five (5) or fewer FTE reporting organizations tend to require government intervention in all the categories.

Other mentioned areas perceived to be appropriate for government intervention include:

(1)	Remove red tape, particularly concerning healthcare research.
(2)	Public entities (Shared Health, Province of MB, etc.) need to invest in home-grown technologies from the outset and implement specific "local-sourcing" policies which favour purchasing products/services.

14.0 REGULATORY BODIES

The bioscience industry is a very highly regulated sector, stakeholders identified bottlenecks that affect innovation and economic growth as a result of the duration of time it takes to receive regulatory approval from conception to commercialization.

Health Canada, US Food and Drug Administration, and the Canadian Food Inspection Agency are the major regulators of the bioscience industry as reported by the survey respondents.

External regulators like US Food and Drug Administration, and The CE Mark may regulate the products of Manitoba bioscience businesses as they are responsible for standards in the United States and Europe.

The highest reported regulatory body by survey respondents is Health Canada at 56% in 2022 followed by US Food and Drug Administration (37%) and the Canadian Food Inspection Agency (33%).

Regulatory Body Issuing Clearance/Approval for New Products	Comparison Years	% Reporting
Health Canada	2018 Survey	59%
	2020 Survey	60%
	2022 Survey	56%
US Food and Drug Administration	2018 Survey	36%
	2020 Survey	41%
	2022 Survey	37%
Canadian Food Inspection Agency	2018 Survey	28%
	2020 Survey	36%
	2022 Survey	33%
The CE Mark	2018 Survey	22%
	2020 Survey	11%
	2022 Survey	19%
Canadian Standards Association (CSA)	2018 Survey	NA
	2020 Survey	NA
	2022 Survey	18%
International Organization for Standardization (ISO)	2018 Survey	NA
	2020 Survey	NA
	2022 Survey	16%
Provincial Environmental statutes (The Environment Act)	2018 Survey	16%
	2020 Survey	16%
	2022 Survey	14%

continued

Regulatory Body Issuing Clearance/Approval for New Products	Comparison Years	% Reporting
None of the above	2018 Survey	21%
	2020 Survey	19%
	2022 Survey	12%
Municipal governments	2018 Survey	14%
	2020 Survey	19%
	2022 Survey	10%
Other	2018 Survey	4%
	2020 Survey	9%
	2022 Survey	8%
Environmental Social and Corporate Governance (ESG)	2018 Survey	NA
	2020 Survey	NA
	2022 Survey	5%
Canadian Agency for Drugs and Technology in Health (CADTH)	2018 Survey	NA
	2020 Survey	NA
	2022 Survey	5%
Federal environmental statues (CEPA)	2018 Survey	11%
	2020 Survey	7%
	2022 Survey	4%

APPENDIX A: METHODOLOGY

This year's Industry Profile Study relies on data obtained from various sources and a comprehensive methodology to provide a robust, accurate presentation of the industry, its composition, and various challenges facing companies. This year and in 2020 and 2018, to compute population totals, the Statistics Canada Business Register Data was used along with the results of the survey. To fill gaps in data, specifically when the survey sample was too small to estimate various categories, Statistics Canada GDP, wholesale, and manufacturing data was instrumented. The 2020 and 2018 industry profile studies both follow approaches and industry definitions consistent with other bioscience studies including Battelle, Life Sciences Ontario (LSO), and Life Sciences BC (LSBC). Since Life Sciences BC excludes Ag Biotech, the 2022 BAM Industry Profile Study follows the methodologies and definitions primarily adopted by Battelle and LSO, with even further focus on LSO which both include Ag Biotech.

Questions contained in this year's BAM Industry Survey were similar to questions asked in previous surveys and therefore comparisons are made with results from previous studies and with results from LSO and LSBC studies. Other questions were also asked of respondents including topics such as COVID-19. Statistics Canada datasets (see Appendix B: Data Sources) were used to enhance the accuracy of results and reduce reliance on sample data. Since this study uses detailed data obtained from the Business Register including business counts by detailed subsector NAICS, Manitoba bioscience industry population statistics are inferred from the sample as well as secondary data. This differs from studies conducted in previous years, prior to 2018, which relied primarily on sample statistics thereby underestimating the size of the Manitoba Bioscience Industry. This study herein is able to make direct comparisons between population statistics (e.g., revenue, employment, capital, R&D) between 2017 and 2019 study periods.

The following table provides a breakdown of the survey sample by sector and subsector:

Industry Sub-Segment	2018 Survey		2020 Survey		2022 Survey	
	Manitoba Responses	% of Total	Manitoba Responses	% of Total	Manitoba Responses	% of Total
Biochemicals	**3**	**4%**	**2**	**2%**	**0**	**0%**
Bioenergy	**3**	**4%**	**1**	**1%**	**2**	**3%**
Biomass Fuels	**1**	**1%**	**2**	**2%**	**2**	**3%**
Biomaterials	**3**	**4%**	**4**	**5%**	**3**	**4%**
Digital Health	**9**	**11%**	**4**	**5%**	**5**	**7%**
Consulting	3	4%	0	0%	2	3%
Digital Monitoring Devices	1	1%	2	2%	1	1%
Health/IT	5	6%	2	2%	2	3%
Medical Technology	**18**	**22%**	**17**	**20%**	**15**	**21%**
Consulting	**3**	**4%**	**4**	**5%**	**3**	**4%**
Diagnostics	**6**	**7%**	**3**	**4%**	**2**	**3%**
Medical Devices	**9**	**11%**	**10**	**12%**	**10**	**14%**
Medicaments	**9**	**11%**	**11**	**13%**	**10**	**14%**
Consulting	**3**	**4%**	**4**	**5%**	**4**	**5%**
Biologics	**1**	**1%**	**1**	**1%**	**1**	**1%**
Biopharmaceuticals	**5**	**6%**	**6**	**7%**	**5**	**7%**
Health Food and Ingredients	**8**	**10%**	**21**	**25%**	**11**	**15%**
Consulting	**3**	**4%**	**7**	**8%**	**4**	**5%**
Functional Foods	**2**	**2%**	**7**	**8%**	**5**	**7%**
Nutraceuticals	**3**	**4%**	**7**	**8%**	**2**	**3%**
Natural Compounds	**0**	**0%**	**0**	**0%**	**0**	**0%**
Animal Health	**2**	**2%**	**3**	**4%**	**4**	**5%**
Animal Nutrition Supplements	**1**	**1%**	**2**	**2%**	**3**	**4%**
Veterinary Consulting Services	**1**	**1%**	**1**	**1%**	**1**	**1%**
Soil Health	**5**	**6%**	**4**	**5%**	**3**	**4%**
Digital Agriculture	**5**	**6%**	**6**	**7%**	**3**	**4%**
Plant Science	**3**	**4%**	**2**	**2%**	**1**	**1%**
Support Organization/ Other	**12**	**15%**	**7**	**8%**	**14**	**19%**
Total	**81**	**100%**	**84**	**100%**	**73**	**100%**

A total of 73 responses were recorded. To calculate estimates of totals for the entire industry consisting of 720 companies, Business Register data was used to determine business count totals by each NAICS. Business Register data also provides details as to company size (employees). Once the total number of companies by each NAICS was compiled, averages obtained from the sample for revenue, employees, R&D, and capital were computed and applied to the population totals for each NAICS. In the event only a subset of the six-digit NAICS category was considered biosciences, the size of the bioscience workforce contained within the NAICS was used to estimate employment and business totals.

For example, NAICS 5417 Research and development services was evaluated as follows:

Manitoba - NAICS 5417 - Scientific research and development services	
All occupations	970
031 Managers in health care	0
082 Managers in ag…	10
2112 Chemists	40
212 Life sciences professionals	145
2211 Chemical technologists...	30
222 Technical occupations in Life	20
311 Physicians, dentists…	0
313 Pharmacists, dieticians…	0
321 Medical technologists	25
Biosciences/Life Sciences Sub-Total	270
weighting factor	0.278

Source: Statistics Canada - Customized Dataset from 2016 Census

The workforce concentration indicates that 27.8% of NAICS 5417 is bioscience related and therefore, business count data was adjusted such that 27.8% of the business counts for NAICS 5417 were counted as bioscience. This method is identical to the method used by LSO 2015. Since this report uses Census 2016 data compared to LSO 2015 which uses National Household Survey (NHS) data, this report herein is likely to be more accurate.

Classification Definitions	Inclusions
"Industry"	The total of Health Biotech, Ag Biotech and Clean Biotech organizations in Manitoba
"Sectors"	Health Biotech | Ag Biotech | Clean Biotech
"Subsectors"	Each of the elements on the BAM Industry Wheel (four categories for each of the three major sectors as well as support organizations)
"Segments"	The NAICS codes comprising the bioscience industry

With respect to key performance indicators such as revenue and employees, if the survey sample was too small to compute estimates for the population, the manufacturers and wholesalers revenue database was obtained and weighted by employee counts for each 6-digit NAICS. If this data was unavailable, GDP estimates were converted to revenue/sales using the Statistics Canada supply and use tables and subsequently weighted by employee counts (business register). With respect to capital and R&D, using the sample, capital and R&D per worker was estimated and then applied to the employment population totals to compute total industry capital and R&D. Direct, indirect, and induced GDP were calculated using the market prices multipliers contained in the Statistics Canada supply and use tables (SUTs).

For a full detailed discussion of the methods and data used in this study, please contact BAM.

APPENDIX B: DATA SOURCES

2022 Bioscience Association Manitoba Industry Survey

2020 Bioscience Association Manitoba Industry Survey

2018 Bioscience Association Manitoba Industry Survey

Statistics Canada. Table 16-10-0117-01 Principal statistics for manufacturing industries, by North American Industry Classification System (NAICS) (x 1,000)

Statistics Canada. Table 14-10-0201-01 Employment by industry, monthly, unadjusted for seasonality

Statistics Canada. Table 33-10-0214-01 - Canadian business counts, location counts with employees, by employment size and North American Industry Classification System (NAICS), Canada and provinces, June 2019, semi-annual (number)

Statistics Canada. Table 552-0006 - Canadian business counts, location counts with employees, by employment size and North American Industry Classification System (NAICS), Canada and provinces, June 2017, semi-annual (number)

Statistics Canada. CRO0165342_DM.2: Sex (3), Age (5), Industry - North American Industry Classification System (NAICS) 2012 (426), and Occupation - National Occupational Classification (NOC) 2016 (692) for the Employed Labour Force Aged 15 Years and Over, in Private Households of Manitoba, 2016 Census - 25% Sample Data

Statistics Canada. Table 36-10-0402-01 Gross domestic product (GDP) at basic prices, by industry, provinces and territories (x 1,000,000)

Statistics Canada. 2016 Census

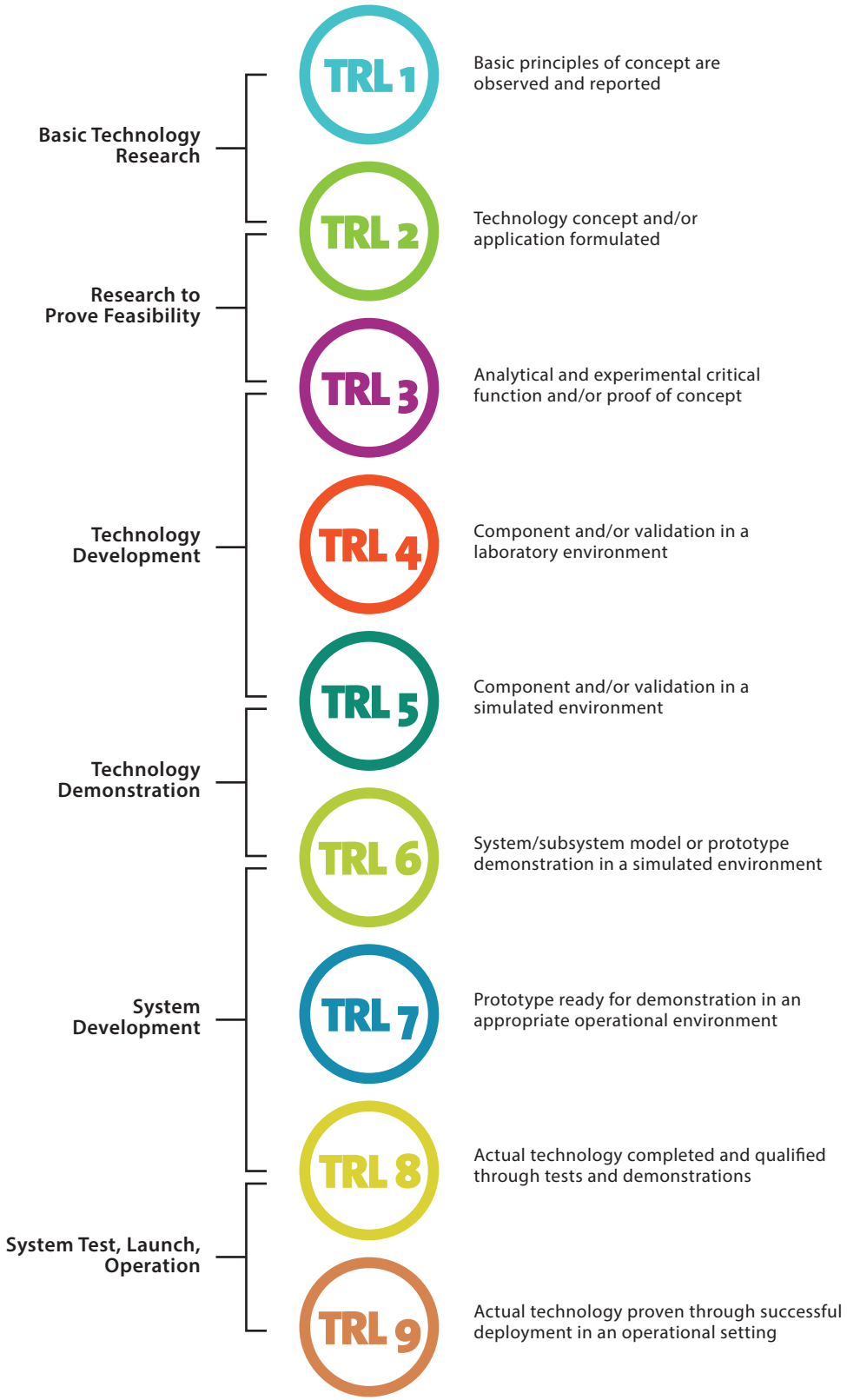
APPENDIX C: INDUSTRY AND SECTOR DEFINITIONS

Based on a full-review of NAICS codes and studies previously conducted by LSO and Life Sciences BC, the following NAICS definitions were used in this report, to quantify the Manitoba Bioscience Industry:

	NAICS	
Agricultural Feedstock and Chemicals (Ag Biotech)	311111	Dog and cat food manufacturing [311111]
	311119	Other animal food manufacturing [311119]
	311221	Wet corn milling [311221]
	311224	Oilseed processing [311224]
	325190	Other basic organic chemical manufacturing [325190]
	325313	Chemical fertilizer (except potash) manufacturing [325313]
	325314	Mixed fertilizer manufacturing [325314]
	325320	Pesticide and other agricultural chemical manufacturing [325320]
	418310	Agricultural feed merchant wholesalers [418310]
	418320	Seed merchant wholesalers [418320]
	418390	Agricultural chemical and other farm supplies merchant wholesalers [418390]
Drugs and Pharmaceuticals (Health Biotech)	325410	Pharmaceutical and medicine manufacturing [325410]
	414510	Pharmaceuticals and pharmacy supplies merchant wholesalers [414510]
Medical Devices and Equipment (Health Biotech)	334512	Measuring, medical and controlling devices manufacturing [334512]
	339110	Medical equipment and supplies manufacturing [339110]
	417930*	Professional machinery, equipment and supplies merchant wholesalers [417930]
Research, Testing, and Medical Laboratories	541380*	Testing laboratories [541380]
	541710*	Research and development in the physical, engineering and life sciences [541710]
	621510	Medical and diagnostic laboratories [621510]
Additional industries included in the expanded definition	311211	Flour milling [311211]
	311420	Fruit and vegetable canning, pickling and drying [311420]
	413190	Other specialty-line food merchant wholesalers
	446191	Food (health) supplement stores [446191]
	541514	Computer system design and related services (except video game design and development) [541514]
	541690	Other scientific and technical consulting services [541690]
	541940	Veterinary services [541940]
Renewable Energy (Clean Biotech)	221119	Other electric power generation [221119]
	321111	Sawmills (except shingle and shake mills)
	221122	Electric power distribution [221122]
Bio – Industrial (Clean Biotech)	313110	Fiber, yarn and thread mills - manufacturing [313110]
	314990	All other textile product mills [314990]
	322110	Pulp mills [322110]
	322121	Paper, except newsprint, mills [322121]
	322122	Newsprint mills [322122]
	322130	Paperboard mills [322130]
	325610	Soap and cleaning compound manufacturing [325610]
	325991	Custom compounding of purchased resins [325991]
	325999	Other miscellaneous chemical product mfg. [325999]
	326290	All other rubber product manufacturing [326290]
	333416	Heating equipment and commercial refrigeration equipment manufacturing [333416]
Environmental Safety/Energy Conservation Services (Clean Biotech)	541620	Environmental consulting services [541620]
	562210	Waste treatment and disposal [562210]
	562910	Remediation services [562910]

The NAICS review conducted in preparation for this study examined a variety of factors including the nature of the goods and services provided by each subsector, the labour force concentration (proportion of the NAICS consisting of life science related occupations), and the nature of businesses actually contained in each NAICS (obtained from external sources).

APPENDIX D: TECHNOLOGY READINESS LEVELS



In 2022, BAM conducted a study of the bioscience industry in Manitoba. We took care to measure all aspects of the industry to evaluate the growth and contribution to the local economy. Data collected will pertain to 2021 unless otherwise stated in Appendix A, Methodology.

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