

2017

Life Science Association of Manitoba

INDUSTRY PROFILE STUDY

In 2016 LSAM conducted a study of the bio sciences industry in Manitoba. We took care to measure all aspects of the industry in order to evaluate growth and contribution to the local economy.

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@LifeScienceMB

Strengthening the bio science industry
while helping to fuel, feed & heal the whole world.



LSAM

Life Science Association
of Manitoba

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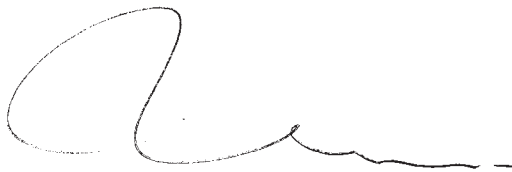
THANK YOU

We wish to thank all of the survey participants who gave their time and thoughts to this study. I hope you are able to find your own story in the pages that follow. I believe you will enjoy placing the unique industry performance here in Manitoba within a Canadian context and see that Manitoba's bio science is growing, active and planning for an extremely bright future.

This report is designed to profile Manitoba's unique bio science industry and to reveal its outstanding successes, challenges and future direction. This report has compared findings with our 2012 and 2014 studies, as well as two other national studies. The data gathered here will be used to further our understanding of the industry and leave us in eager anticipation of what is to come.

The Manitoba bio science industry continues to grow... with differing growth rates across the entire sector. With a stable level of anticipated investment, we can expect big things in the coming years.

Manitoba is well positioned to support a thriving bio science sector. We are home to experienced innovators and researchers, a strong start-up community, experienced incubators, and a commitment to success.



Tracey Maconachie
President
Life Science Association of Manitoba

Our **MISSION** is to enable commercial success for Manitoba Bio science companies by acting as a catalyst for innovation, expanding industry skills capacity, and providing a unified voice to create awareness locally and internationally.

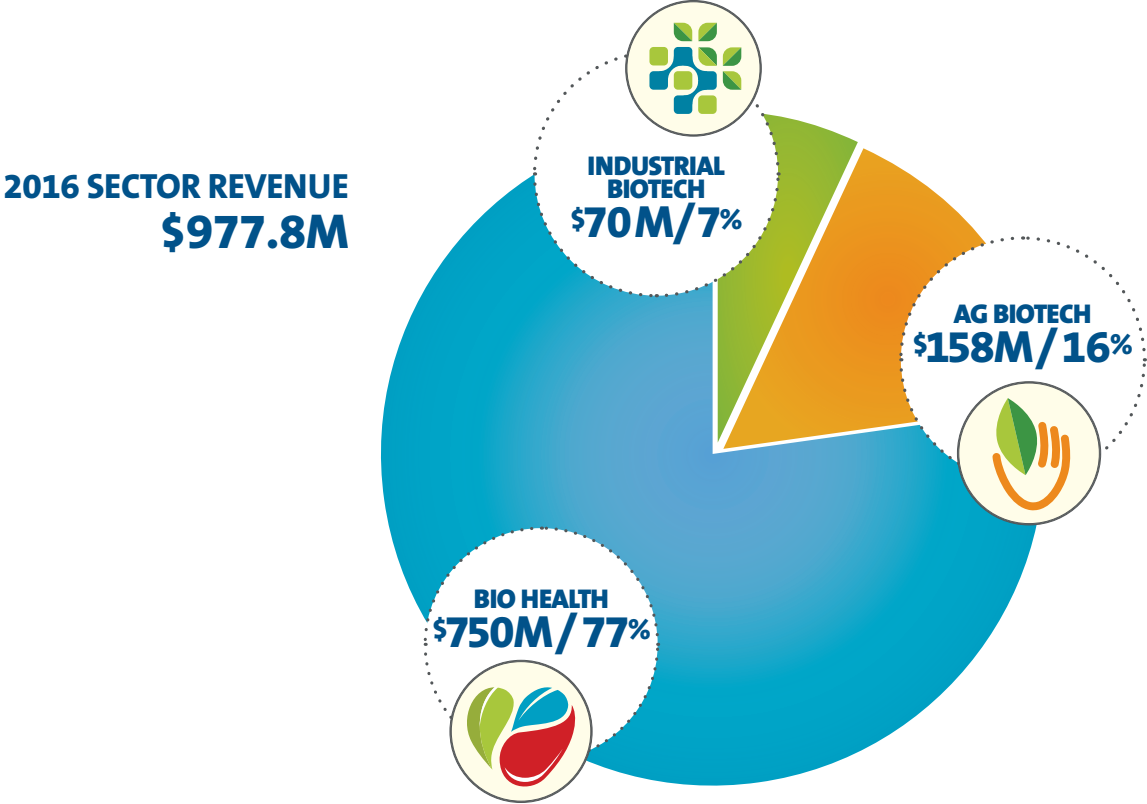
Our **VISION** is for a vibrant Manitoba bio science industry, which drives economic growth through commercialization of innovative solutions.



EXECUTIVE SUMMARY

On behalf of The Life Science Association of Manitoba (LSAM), we are pleased to present the third Manitoba Life Science Industry Profile study, a survey conducted by LSAM and independent consultants.

REVENUE

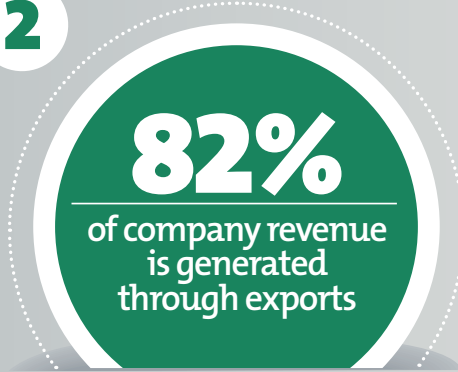


LSAM's 8

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...

...

The average bio science salary is

\$77,000

5

THERE ARE AN ESTIMATED

5,600 FTE

6

3 Key Learnings



3

Analysis suggests that **larger investments in R&D** tends to generate **increases in company revenue within a 2 year span**

4

25%
of companies which raised capital acquired capital from private investors



Almost **40%** of the workforce has a Bachelor, Master's or PhD

7

Output per worker is **\$174,389**

8



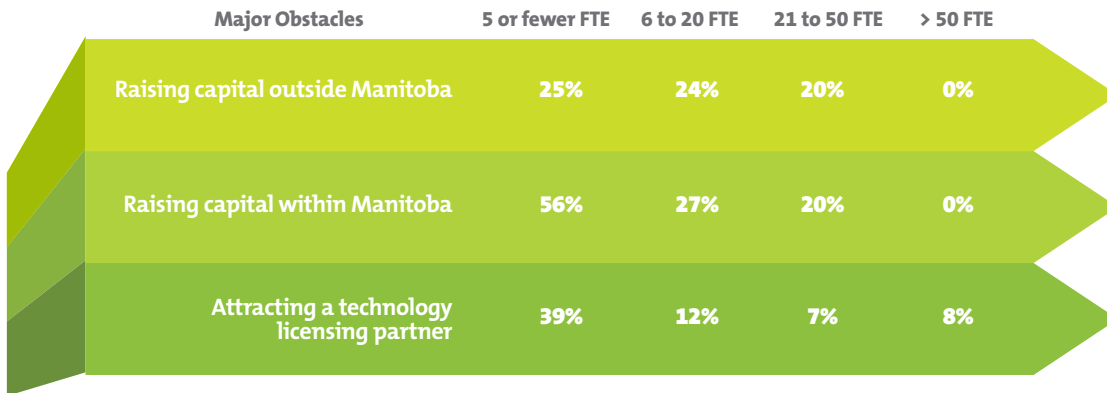
EXECUTIVE SUMMARY

The Manitoba bio science sector is a healthy, prosperous and stable part of the Manitoba economy but faces obstacles and challenges in the near future that must be analyzed and addressed. This report presents these indicators and key issues, so that LSAM can develop potential strategies moving forward.

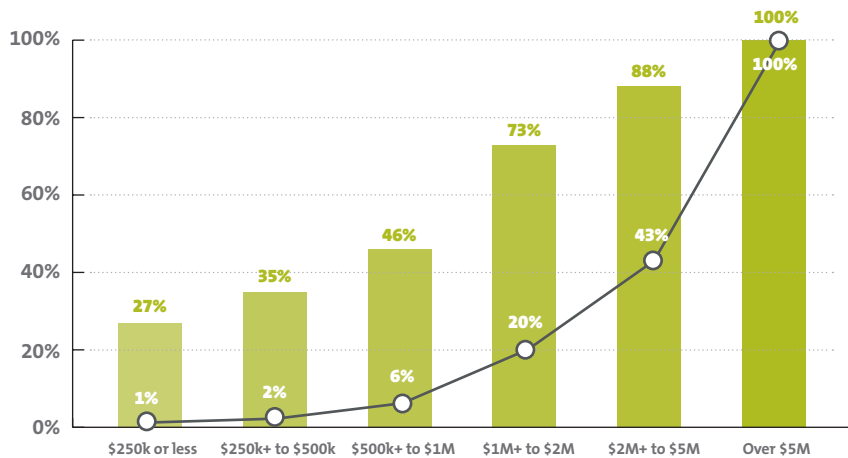
SECTOR OUTLOOK

Companies are focused on developing new products and expanding market share. On the whole, the largest challenges are: raising capital, managing the regulatory process and access Canadian markets.

The chart below outlines challenges by company size.



% COMPANIES VS % PORTION OF CAPITAL RAISED BY SECTOR



■ % Companies
—○— % Capital

This graph shows the % of companies (■) and % of capital raised (—○—) by capital range.

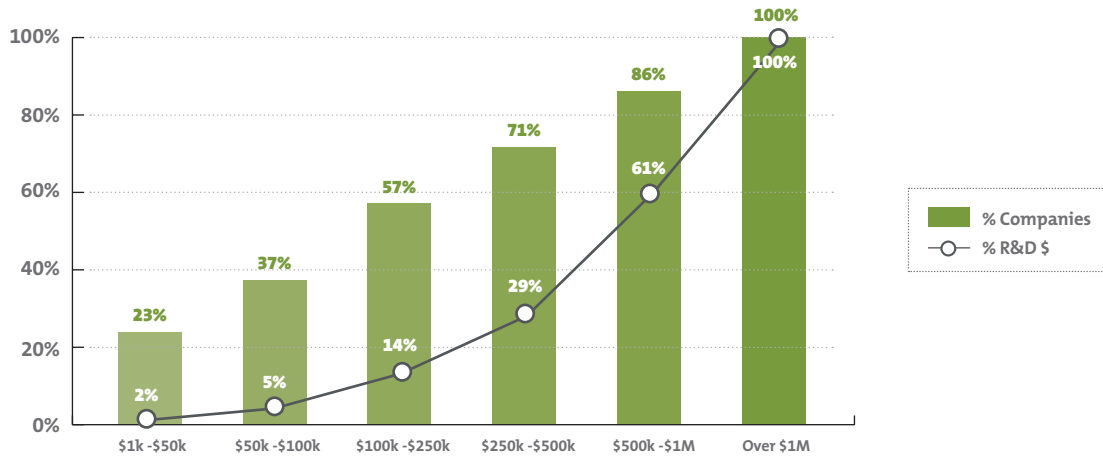
For example, 27% of companies that generate less than 250k represents less than 1% capital.

GOVERNMENT PROGRAMS

In total, there are 6 programs which are ranked by overall utilization in the previous year (2015) and indicated as follows:



% COMPANIES & % OF R&D \$ INVESTED BY R&D RANGE



METHODOLOGY

The bio science sector consists of three primary industries, namely biohealth, agricultural biotech (ag biotech) and industrial biotech¹.

A total of 162 companies were invited to participate in the 2016 survey with 97 companies providing responses - which represents a 57% response rate. Surveys were conducted via email and telephone calls.

All participant information are kept strictly confidential and data is reported in an aggregate format.

This year's study included two important features: data collected by an objective third party that allows us to guarantee anonymity and confidentiality of response; and, the development of a clear definition of industry respondents to ensure we measure what happens here in Manitoba only.

For the first time, LSAM is applying predictive analysis through the use of STATA v14.0 statistical software package. In order to successfully undertake this type of analysis, data has been arranged in panel-form. The dataset contains 381 observations, belonging to 127 unique companies (across three LSAM industry surveys), and additional research and data collection have significantly enhance the predictive capabilities of the model. Although the granular results of the model are not presented in this report, please feel free to contact Life Science of Manitoba if you would like to see the results of the longitudinal study.



Manitoba has a broad and diverse bio science sector which is comprised of businesses operating in a range of functions and capabilities. This creates opportunities and builds a strong base of highly skilled and knowledgeable workers in the province



¹ See Appendix for Industry definitions.

² See Appendix for calculation methodology

The bio science industry is defined as:

BIO HEALTH

Bio Health are companies and organizations that are developing innovations that allow for the early identification, the prevention, the treatment, and even the curing of costly and debilitating illness and disease.



AG BIOTECH

Ag Biotech companies work with a range of tools, including traditional breeding techniques, that alter living organisms, to make or modify products; improve plants or animals; or develop microorganisms for specific agricultural uses resulting in higher yields and with better nutritional profiles.



INDUSTRIAL BIOTECH

Industrial biotech companies use living cells to generate industrial products and processes. Companies working in this industry are developing new products and applications that may replace petroleum-based feedstocks and reduce the environmental impact of the manufacturing process.



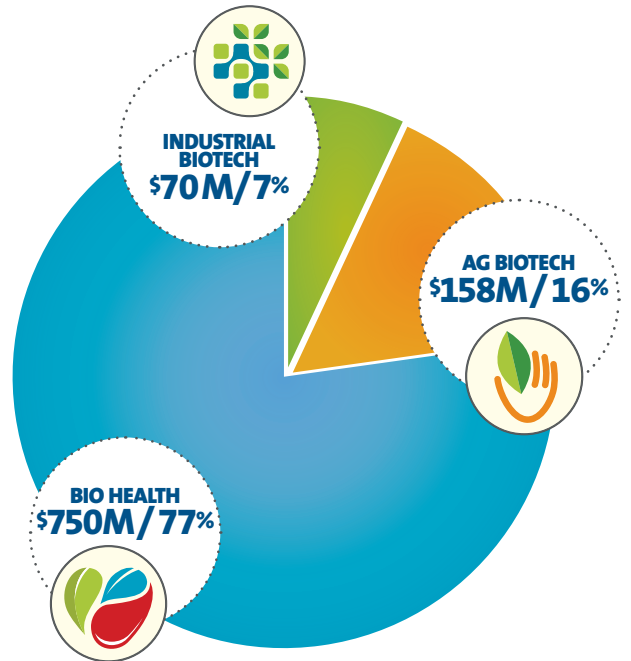
INDUSTRY PROFILE

Industry Size

Manitoba's bio science sector is a broad and diverse sector, with businesses working in the areas of bio health, ag biotech and industrial biotech.

Revenue for 2016 was estimated to be \$977,800,000 which represents 2.4% of the national bio science industry .

2016 SECTOR REVENUE
\$977.8M



MANITOBA'S BIO SCIENCE INDUSTRIES AS DISTRIBUTED BY SEGMENTS & SUBSEGMENTS

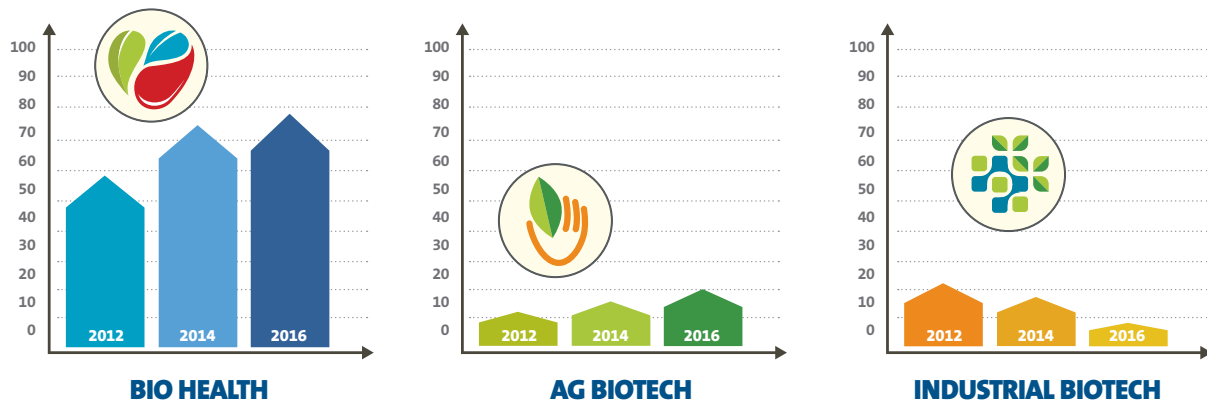
BIO HEALTH		AG BIOTECH		INDUSTRIAL BIOTECH	
Medical Technology	30%	Ag Biotech	14%	Biomaterials	5%
Medical Devices	18%	Crop Inputs	9%	Bioenergy	4%
Diagnostics	11%	Plant Genetics	4%		
Consulting	1%	Agriculture Biotechnology	1%		
Bioactives	18%	Animal Health	4%		
Functional Food & Nutraceuticals	11%	Animal Nutri Supp	3%		
Natural Compounds	4%	Veterinary Therapeutics	1%		
Consulting	2%				
Therapeutics	16%				
Biopharmaceuticals	11%				
Biologics	3%				
Consulting	2%				
Digital Health/IT	8%				
Health/IT	6%				
Digital Monitoring Devices	1%				
Consulting	1%				



INDUSTRY PROFILE

Survey results indicate an increase in number of bio health and ag biotech companies and a slight decrease in industrial biotech companies. These increases may be due to health and researchers starting businesses of their own or the change may be due to a shift towards other industries. Such as industrial biotech companies exiting the sector, this could be as a result of the significantly lower median revenues compared to the rest of the bio sciences sector (\$175,000 compared to \$750,000 in bio health and \$2,000,000 in agri-biotech). The median revenues was determined through LSAM analysis of this current data set.

COMPARISON OF % OF COMPANIES - BY INDUSTRY 2012, 2014, 2016



INDUSTRY PROFILE

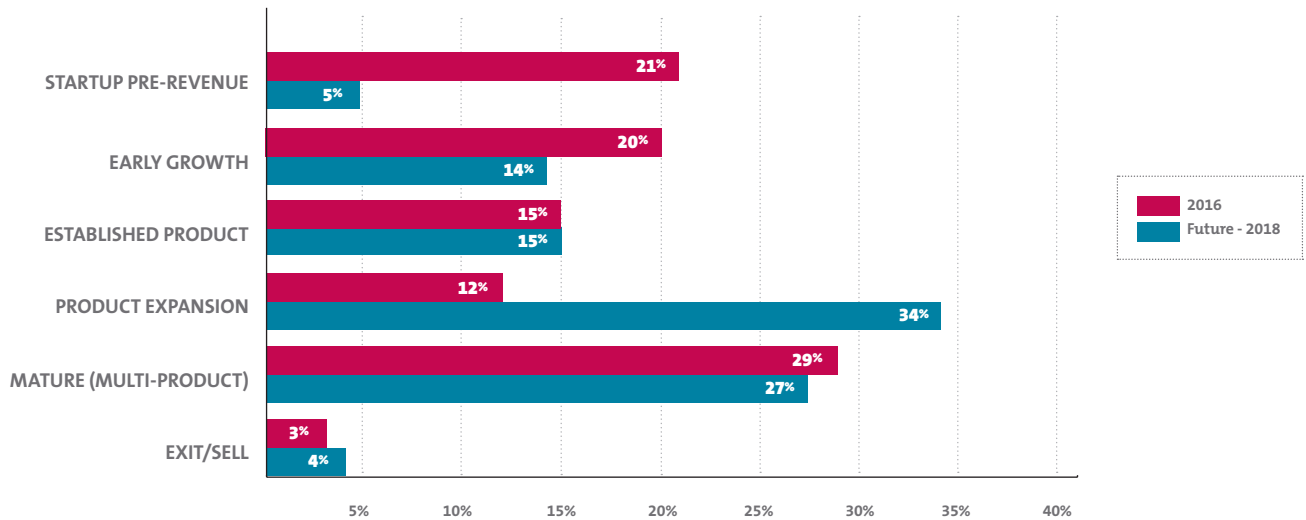
Business Life Stage

Companies surveyed were asked what stage they expected to be at in 2018 and responses indicate a general move out of start-up / pre-revenue. This indicates an optimism in terms of company growth and expansion.

Start-ups and early growth companies envision that they will move into product expansion, as demonstrated by a shift in expected business stage. Only 4% of companies foresee exiting the sector by 2018.

It is important to note that, although companies are optimistic about their shift from pre-revenue to a more mature phase, results of the predictive model suggest that it is likely to take at least five (5) years before any revenue is generated for most startups.

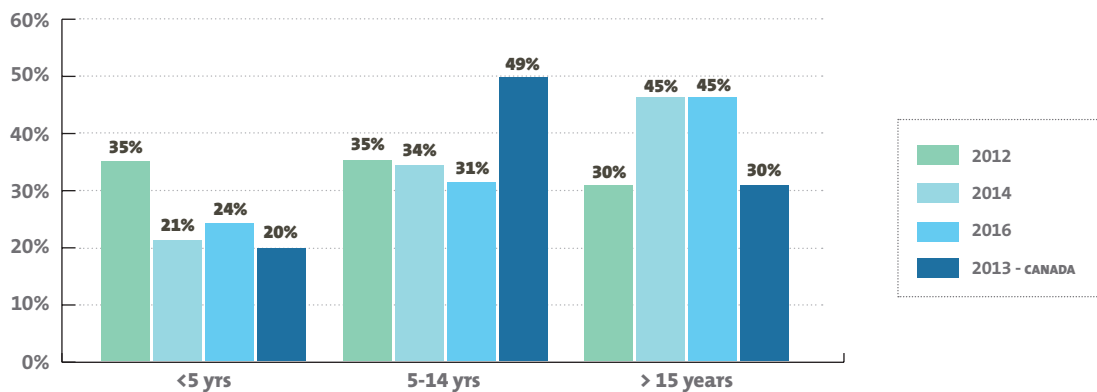
BUSINESS STAGE - 2016 VS FUTURE (2018)



Business Age

Manitoba has a higher proportion of companies that have been in business for greater than 15 years, and a slightly higher number of companies that have been in business less than 5 years, when compared to the rest of Canada. This may reflect a marginally higher start-up environment in Manitoba, balanced with several, large well established companies. Of importance is the higher proportion of stable, mature companies in Manitoba relative to the rest of Canada, indicating that Manitoba is a favourable environment for bio science business.

YEARS OF OPERATION COMPARISON - 2012 TO 2016



Revenue and Business Age

Results of the predictive model used in this report confirms that business age has a significant effect on revenue. In fact, the industry segment becomes irrelevant, which suggest that regardless of industry, staying in business longer leads to higher revenues. It is likely that this mechanism is a circular flow, ie that staying in business longer allows for companies to establish a customer base, specialized business units, best practices, and to acquire “good-will” which all directly positively affect revenue.



INDUSTRY PROFILE

Predictive analysis generated by STATA suggests that more than five (5) years is needed for bio science companies to generate revenue and that it takes most companies 10 years to exceed \$1 million in annual revenues. Additional analysis of this data set has demonstrated that significant investments in research is required to have a impact on revenue.

MOST LIKELY INCOME LEVEL FOR EACH AGE CATEGORY (\$,1M)

Sector/Age	< 5 years	5 to 9 years	10 to 14 years	15 to 24 years
Ag Biotech	Pre-Revenue*	.5 – 1m	1 – 2m	1 – 2m
Animal Health	Pre-Revenue	.1 – .25m	.5 – 1m	.5 – 1m
BioActives	Pre-Revenue	.5 – 1m	.5 – 1m	.5 – 1m
BioEnergy	Pre-Revenue	.5 – 1m	2 – 3m	2 – 3m
Digital Health	Pre-Revenue	< .1m	.5 – 1m	.5 – 1m
Therapeutics	Pre-Revenue	< .1m	.5 – 1m	2 – 3m

**this probability was very close to the probability associated with the “less than 100k” category.*
Note that for BioMaterials and Medical Technology, no forecast was available.

Company Size (Employees)

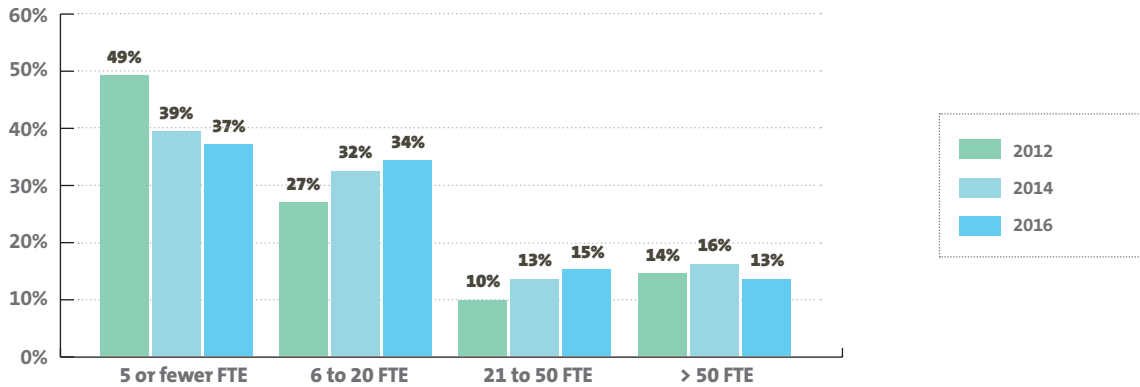
The total bio science sector is estimated to provide 5,607 full-time equivalent (FTE) jobs in Manitoba.

The bio science sector is comprised of many small (less than 20 employees) companies. However, Manitoba is also home to several large pharmaceutical manufacturers who contribute to the 13% of companies that have more than 50 employees. This hub of pharmaceutical manufacturing is due in part to the availability of skilled workers in Manitoba and Winnipeg and that we have the lowest cost index⁴ of Western Canadian cities.



⁴ KPMG Competitive Alternatives 2016 (www.competitivealternatives.com/cities/mwccw.aspx)




COMPANY SIZE (# OF EMPLOYEES)



Percentage of Employee Levels by Industry

The bio health industry has not seen a change in the number of FTE between 2014 and 2016, whereas both ag biotech and industrial biotech have increased in the same 2 year-period.

More mature ag biotech companies reported having greater than 50 FTE compared to the other industries.

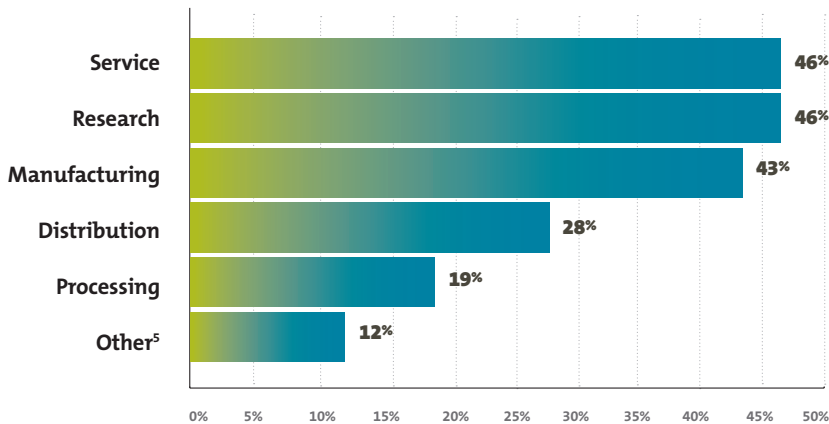
Industry	Year	< 5 FTE's	5-20 FTE's	21-50 FTE's	>50 FTE's	FTE Median
BIO HEALTH 	2016	36%	33%	19%	13%	9
	2014	39%	33%	14%	14%	9
AG BIOTECH 	2016	17%	67%	0%	17%	14
	2014	42%	37%	11%	11%	9
INDUSTRIAL BIOTECH 	2016	33%	33%	22%	11%	10
	2014	46%	27%	9%	18%	6
TOTAL BY RESPONDING COMPANIES		31	38	15	13	



INDUSTRY PROFILE




FUNCTION BY INDUSTRY (2016) - % OF COMPANIES

Percentage of Companies by Operation Function



Note Companies could select more than one.

Percentage of Operation by Segment

Industry	Research	Service	Distribution	Manufacturing	Processing
BIO HEALTH 	28%	26%	17%	22%	8%
AG BIOTECH 	18%	22%	16%	27%	18%
INDUSTRIAL BIOTECH 	33%	33%	0%	33%	0%

Research, service and manufacturing are major functions of companies in the three bio science segments.



⁵ "Other" functions included licensing and training, technology commercialization, consumer branding, product development, software development / products, consulting services, knowledge translation, pharmaceutical sales, packaging, and blending,

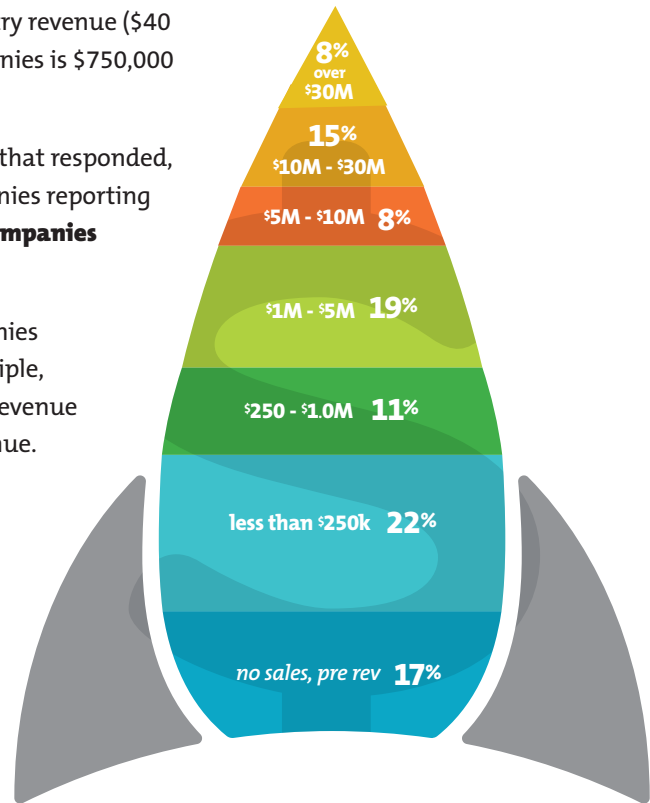
FINANCIAL PROFILE

Revenue

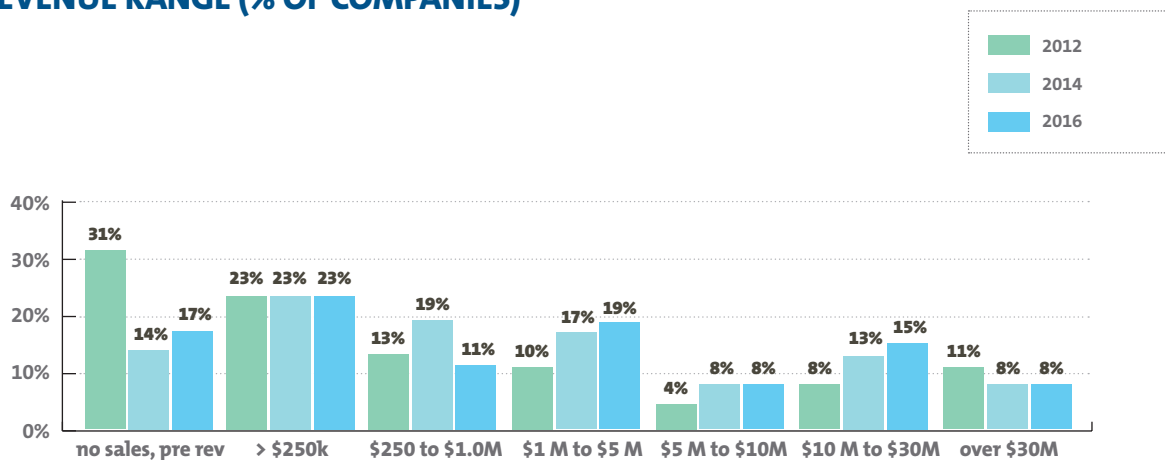
Total revenue for the bio science sector in 2016 is estimated to be \$977,800,000⁶, which represents 2.4% of the national industry revenue (\$40 billion⁷). The typical revenue of Manitoba bio science companies is \$750,000 represented by the overall sample median.

Companies were asked to report revenue. Of the companies that responded, 17% indicated that they were pre-revenue. 51% of all companies reporting revenue had less than \$1 million but more than **8% of the companies reported revenues exceeding \$30 million dollars.**

In Manitoba's bio science sector, less than 10% of the companies generated nearly 50% of the total revenues. The Pareto principle, which is the 80/20 rule, applies as 23% of companies, (with revenue exceeding \$10M) are generating more than 80% of the revenue.



REVENUE RANGE (% OF COMPANIES)



⁶ Revenue was reported in dollar ranges; hence midpoints were used in this section for the purposes of calculating actual value.

⁷BIOTECCanada report



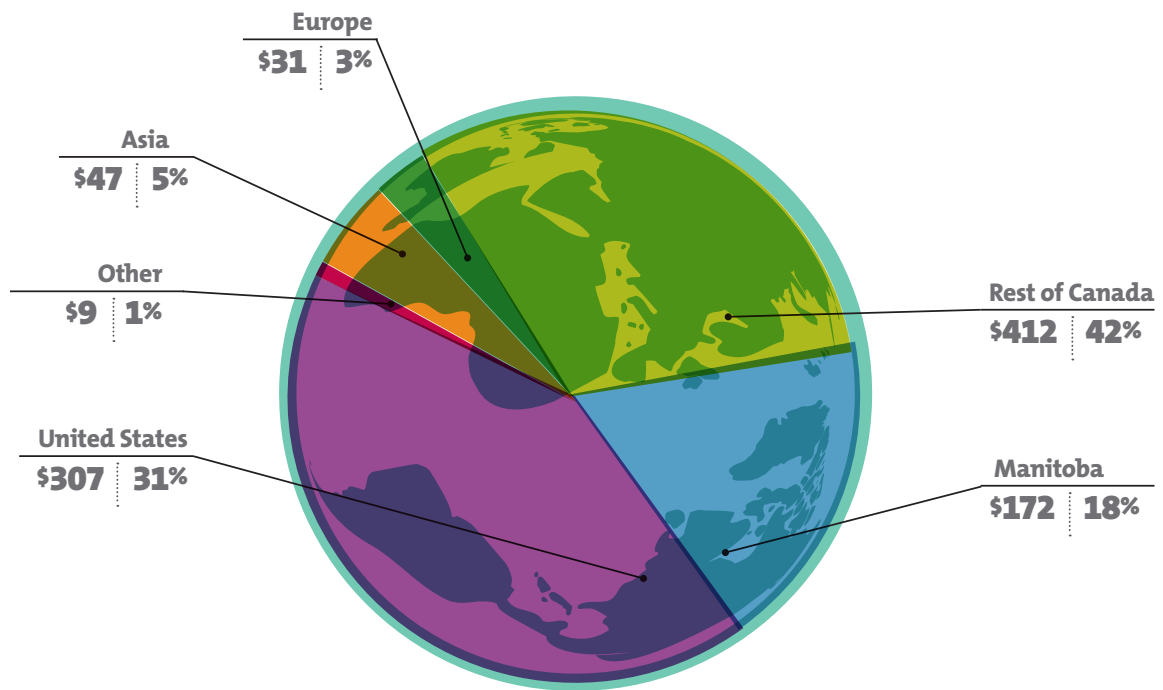
FINANCIAL PROFILE

When comparing change over time, a trend is emerging towards higher revenue for Manitoba companies. This is shown by the percentage of companies generating revenue **more than \$5 million** in 2012, 2014 and 2016 is 23%, 29%, and 31%, respectively. However, the majority of companies still generate less than \$1 million.

Excluding the companies that earned greater than \$40 million, average company revenue grew by 4.5% from 2014 to 2016. It is important to note that companies that responded to both the 2014 and 2016 survey (n = 60) grew by 24.7% over the same time-period. This is indicative of significant growth in a subset of the bio sciences population which must be examined to determine the factors that resulted in a higher than average growth rate.

Manitoba's bio science sector contributes significantly to the Manitoba economy through its high share of exports. 82% of its \$978M in annual revenues are exports, directly increasing Manitoba's GDP. This is contrary to some manufacturing industries, food for example, where a large portion of company revenues are generated by sales to other Manitoba companies (value add chain).

ANNUAL REVENUE OF THE MANITOBA BIO SCIENCE SECTOR BY REGION

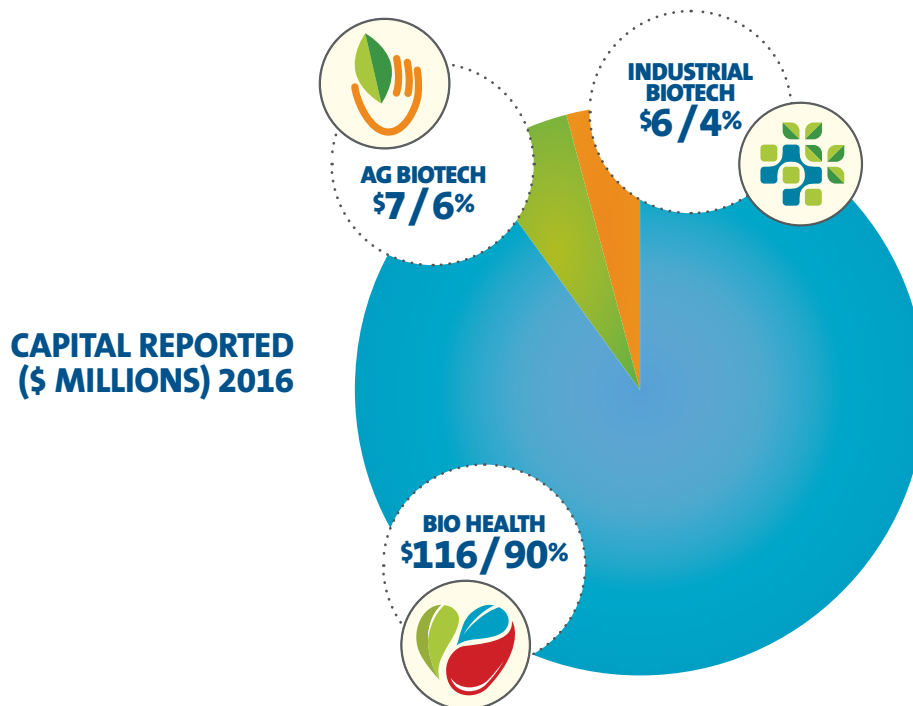


Based on the current revenue, the output per worker, defined as industry output divided by workforce size, is \$174,389 per worker in the Manitoba Bio sciences sector. Output per worker in Manitoba as a whole, defined in the same manner, is \$106,000 per worker, which is greater output of 64.5% observed in the bio science sector.



Capital Raised

Only 36% of companies attempted to raise capital, despite the fact that 58% of companies reported capital as an obstacle to growth. Of those that attempted to raise capital, 74% were successful, while 8.5% preferred not to state. This represents 26% of companies in the total industry that were able to secure capital. Total capital raised in 2016 is estimated to be \$128.4M. This is an increase of \$53M over 2014 reported figures for capital.



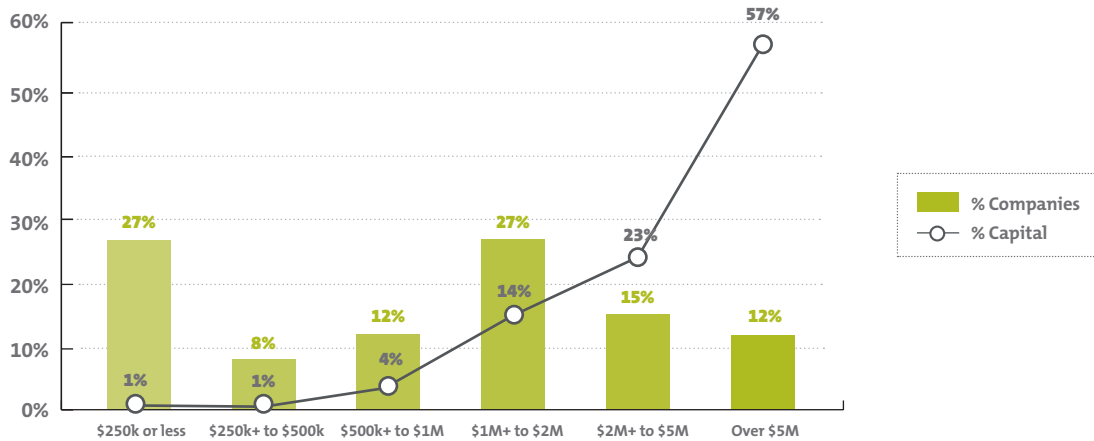
An inverse relationship exists between revenue (and company age) and capital raised. Pre-revenue businesses tend to have the greatest chance of successfully raising capital. The exception is for companies with revenue in the \$20-30 million range which tend to have a greater chance of raising capital than pre-revenue. Business age (and its positive effect on revenue) reduces the chance of raising capital with older businesses attempting to raise less and less capital which is likely due to their ability to self-fund.

- A significantly larger number of biohealth companies attempted to raise capital (75%). The bio health industry has a solid investment base through venture capital, angel investment and corporate strategics. This may be a reflection of the fact that the development costs in this industry are very high, but the income potential is great. Companies in the bio health sector demonstrated an ability to raise larger amounts of capital per company. Additionally there are more companies attempting to raise funds. Furthermore, this industry was successful in securing higher investment dollars, as demonstrated by the 13 bio health companies that raised > \$1M in investment in the previous year.
- Further to this, the small number of mature ag biotech companies (6) not seeking capital, which may be due to the fact that this industry is funding their operations through retained earnings.
- Only 3 Industrial biotech companies sought capital.



FINANCIAL PROFILE

% OF COMPANIES (BY CAPITAL RANGE) - 2016



It is of note that the average capital raised per company reported in 2012, 2014, and 2016 has been steadily increasing with values reported of: \$861,111, \$1,737,259 and \$2,957,192, respectively. 12% of companies raised over half of the capital (~\$73M) secured by the sector, with 5 bio health companies reportedly raising \$53.5M in capital. Almost half of the companies seeking capital, raised less than \$1M per company, representing 6% of the total capital raised.

Findings from 2016, show that more companies are securing larger investments than in previous years and that the number of companies securing smaller investments (< \$1M) has dropped by approximately 1/3.

% OF COMPANIES VS % OF CAPITAL DOLLARS

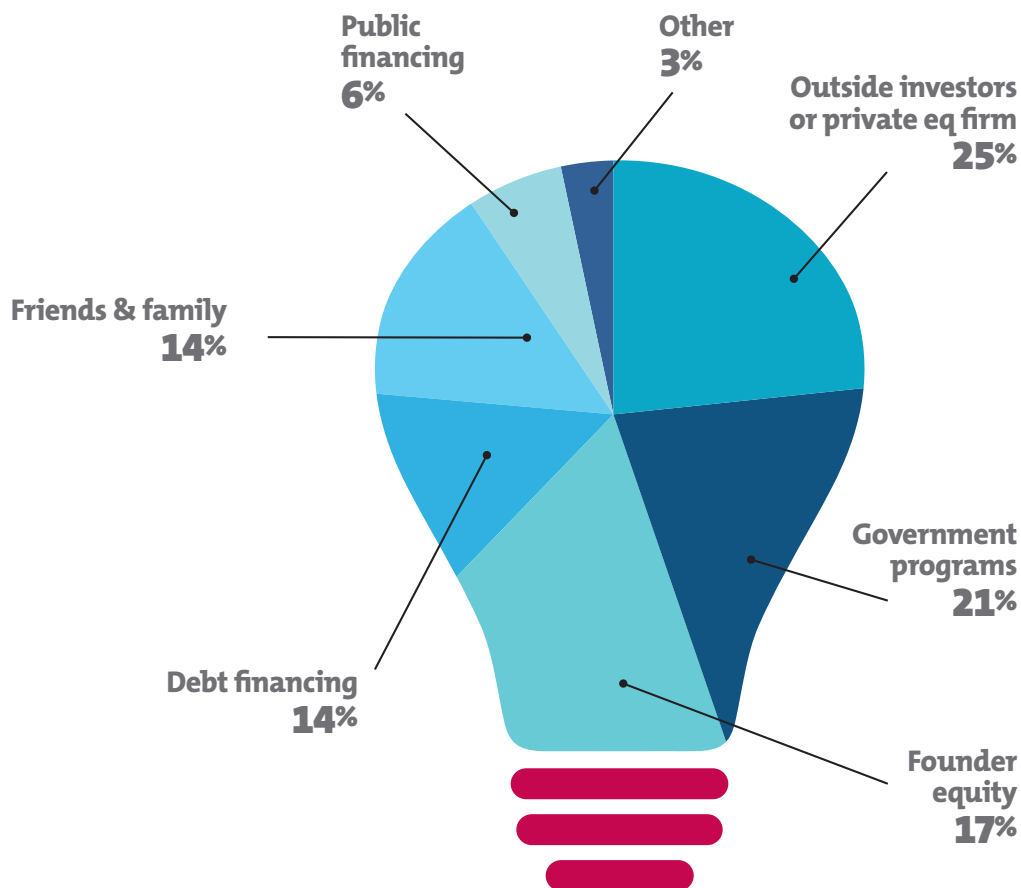
Capital Range	Measurement	2012	2014	2016	Average
> \$1.0M	% of Companies	26%	26%	54%	35%
	% of Capital	86%	87%	94%	89%
< \$1.0M	% of Companies	74%	74%	46%	65%
	% of Capital	14%	13%	6%	11%



Source of Capital

In 2016, we saw a small shift to more private equity and a move away from government investment, which should indicate a maturing⁸, more customer focused industry. This also shows a willingness by private sector to invest in bio sciences companies. However, businesses indicate that raising government capital is a significant challenge, which implies that there still exists a demand for government funding support.

Public funds through government programs make up 21% of all capital raised with the balance being a combination of various private sources of capital. Private equity is the largest source of investment at 25% of all capital raised, and these dollars are increasing. This phenomenon is seen across all innovation based industries⁹. Various factors are at play here, and may include favourable government policy that leverages private sector investment, increased reliance on outside investors/private equity and reduced reliance on government for raising capital, which is a positive indicator of a healthy, growing industry.

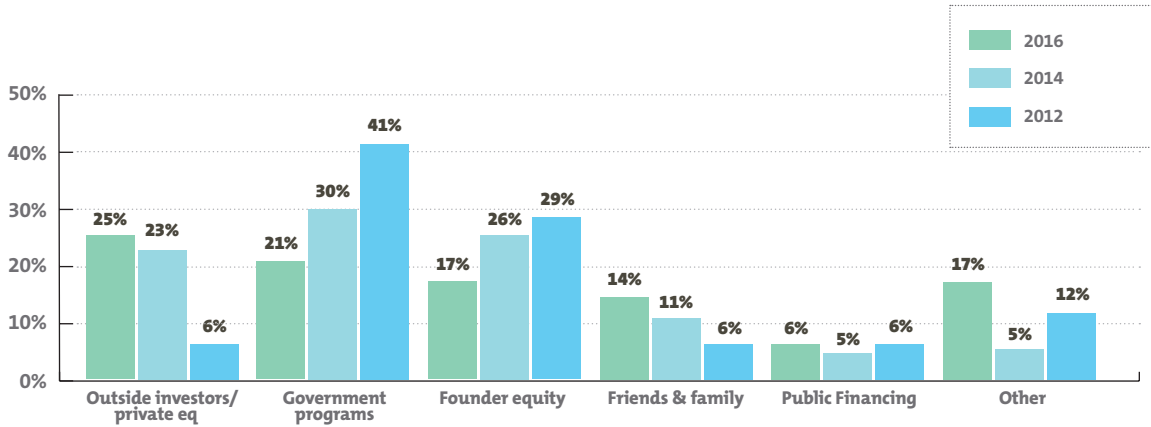


⁸ It is evident from the business age analysis that Manitoba is significantly more mature than the rest of Canada.

⁹ www.ic.gc.ca/eic/site/lsg-pdsv.nsf/eng/h_hn01776.html

FINANCIAL PROFILE

SOURCE OF CAPITAL GROWTH - 2012 TO 2016

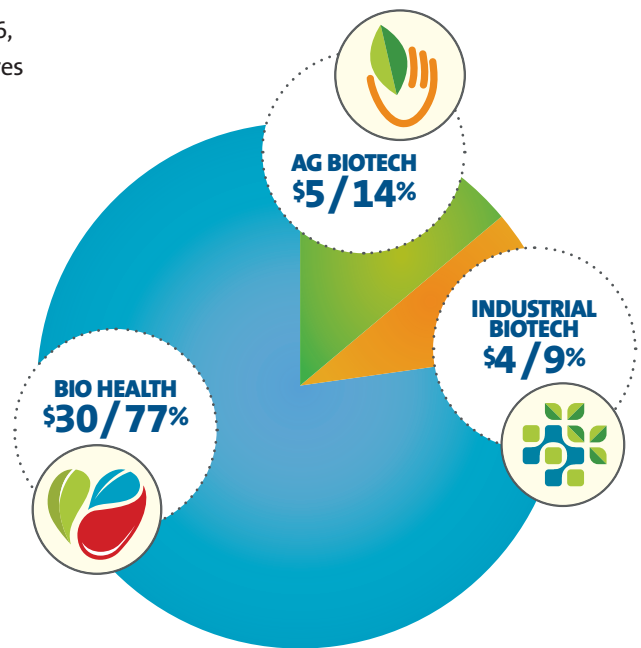


In 2016, the “Other” category increased to 17%. This is likely due to a new category called “debt financing” which was included in “other” for comparative purposes¹⁰.

R&D Investments

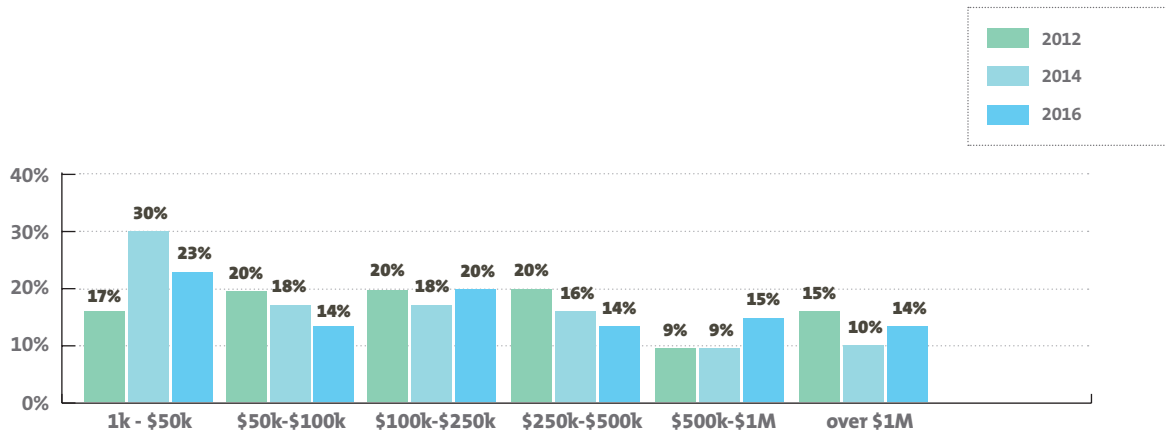
Total R&D expenditures are estimated at \$39 Million in 2016, an increase of 15% from 2014. In 2014 total R&D expenditures were \$34 Million. This data suggests that the higher levels (more than \$500k) of R&D will lead to increase revenues within 2 years.

% OF R&D (\$ MILLIONS) 2016



¹⁰ Debt Financing will become a separate category for subsequent surveys.

% OF COMPANIES VS R&D \$ - 2012 TO 2016



Results of the analysis suggests that holding all else equal, investments in R&D above \$500k leads to increases in revenue over a two-year period. With investments over \$1Million the impact on revenue is more significant. Another important result of the analysis is that holding all else equal, companies that did not invest in R&D tended to perform better than those investing less than \$500k. One possible explanation for this result is that companies in the zero R&D range do not require R&D to generate revenue, where as for companies that require R&D to grow, expenditures of less than \$500k is insufficient to increase or even maintain current revenue levels.

Although one would expect R&D expenditures to require significant time before it is translated into greater revenues, the results of the STATA model suggest **R&D expenditures greater than \$1 million dollars two years prior, have an impact on revenue.** To enhance the statistical significance if the STATA model, more observations are required.



FINANCIAL PROFILE

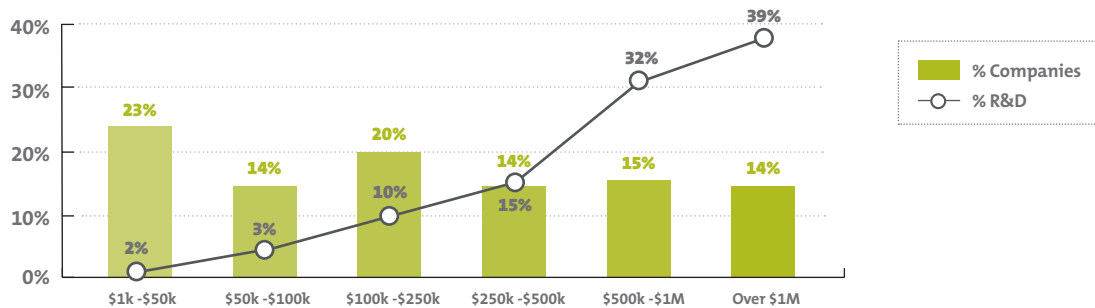
% OF COMPANIES VS % OF R&D INVESTED

(2012, 2014 2015)

R&D Range	Measurement	2012	2014	2016	Average
< \$500k	% of Companies	76%	81%	71%	76%
	% of R&D	37%	40%	29%	35%
> \$500k	% of Companies	24%	19%	29%	24%
	% of R&D	63%	60%	71%	65%

More than 70% of all R&D dollars invested was by less than 30% of the companies, when the R&D investment range is more than or equal to \$500k.

% OF COMPANIES R&D \$ VS % OF TOTAL SECTOR \$ (2016)



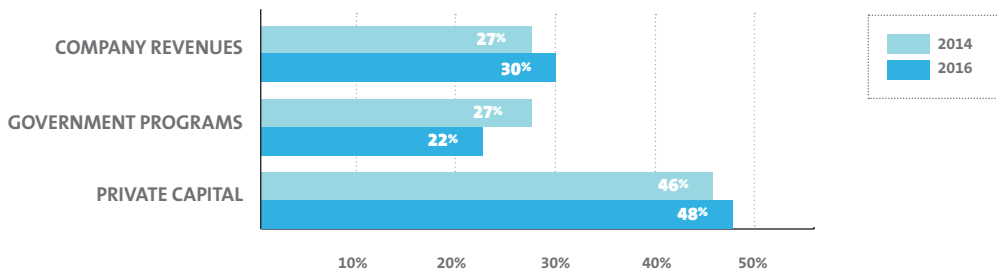
This chart demonstrates that the R&D \$ invested by the majority of companies (71%) totaled less than 30% of the actual dollars invested in R&D \$. It was also noted that the majority of companies are investing at levels that are below the threshold for impacting revenue (estimated to be \$500k).



FINANCIAL PROFILE

The figure below illustrates the relative source of R&D \$ funding in 2014 versus 2016. It demonstrates that for the most part, sources of R&D have not changed.

R&D SOURCE - 2014 VS 2016

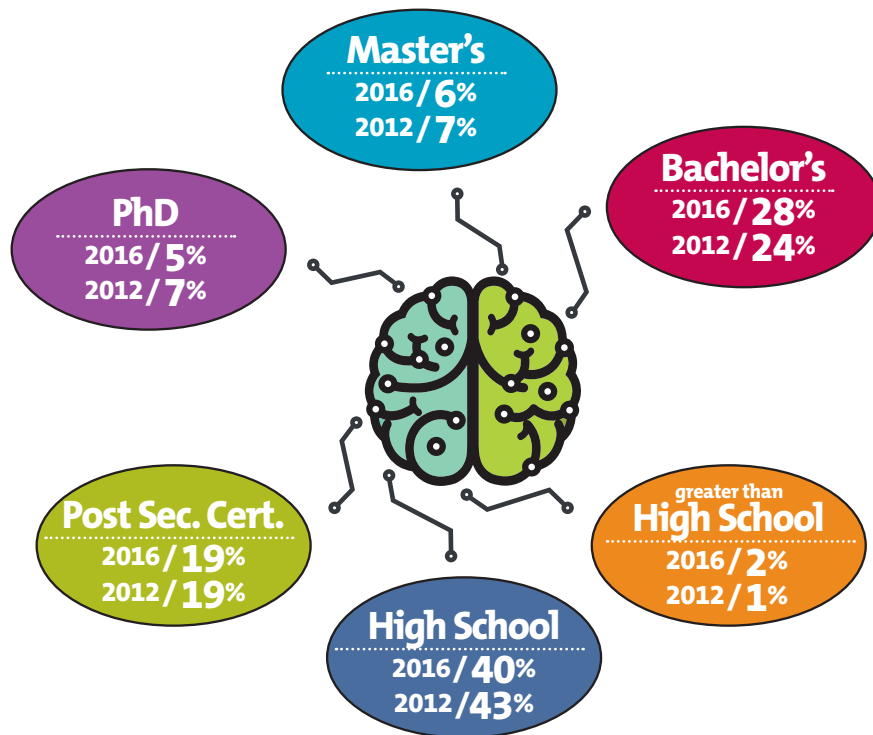


HUMAN RESOURCE PROFILE

Jobs in bio science create significant opportunities for Manitoba. Current estimates show that there are more than 5,600 full time equivalents (FTE) working in Manitoba’s bio science sector.

These jobs are typically highly skilled and pay well **compared to the average Manitoba income** (\$46,200)¹¹. The average salary is \$77,000¹² approximately **a 66% higher wage** in this sector relative to the average across all sectors. This results in a total industry **payroll of \$420,525,000 annually**.

% FULL-TIME EQUIVALENT (FTE) BY EDUCATION LEVEL - 2016



Manitoba’s bio science sector is highly educated relative to other sectors when compared to national averages (2011). Results from the 2016 survey show 58% of employees in the sector have some sort of post-secondary education – either a diploma, certificate or bachelor’s degree. The percentage of Manitoba’s bio science employees with a Bachelor’s degree, Master’s degree and PhD exceeds provincial averages (39% vs 27.4%)¹³

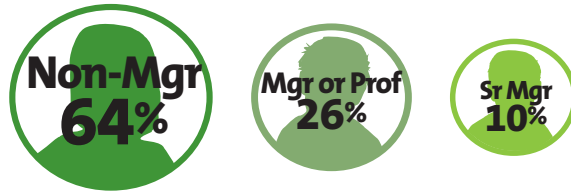
¹¹ Statistics Canada (www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/labr79-eng.htm)
¹² <http://pwp.vpl.ca/siic/industry-profiles/fastest-growing-industries-biotechnology-life-sciences/>
¹³ www.gov.mb.ca/jec/lmi/trends/index.html



HUMAN RESOURCE PROFILE

Workforce by Position Level

% EMPLOYEES - POSITION LEVEL - 2016

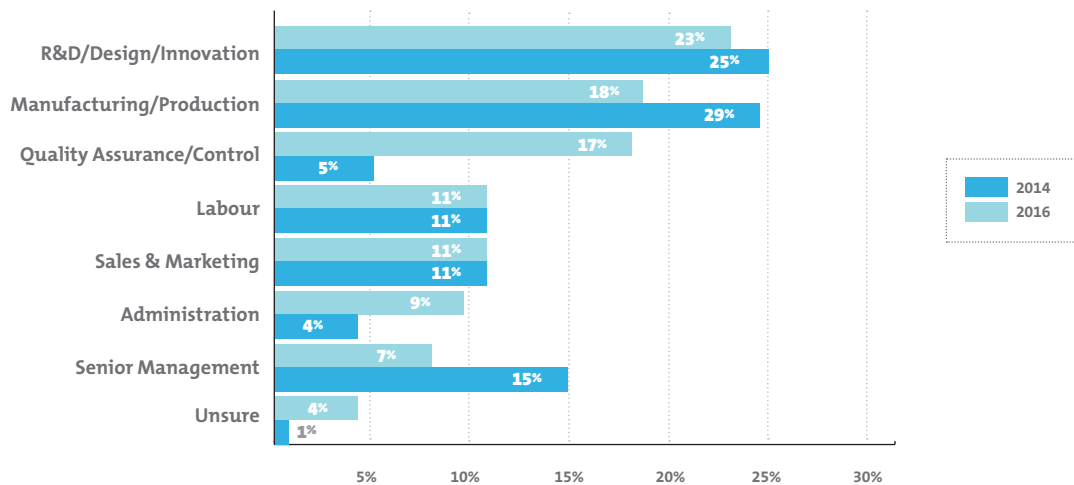


New Employees and Unfilled Positions

In total, 568 new FTE were reported in 2016. This is a 76% increase from the 321 new FTE reported in 2014. Over the last 2 years, there has been fewer manufacturing roles filled, but more quality assurance roles filled.

In 2016, there were 130 unfilled positions, a decline as compared to 181 unfilled positions reported in 2014. Of the 130 unfilled positions reported, the majority of 55% were management and 45% were non management.

NEW FTE REPORTED- 2016



HUMAN RESOURCE PROFILE

Employee Turnover

In 2016, employee turnover was consistent with 2014 ratios. The percentage of turnovers in 2016 remained the highest at non-manager levels.

SHARE OF EMPLOYEE TURNOVER BY POSITION TYPE 2016

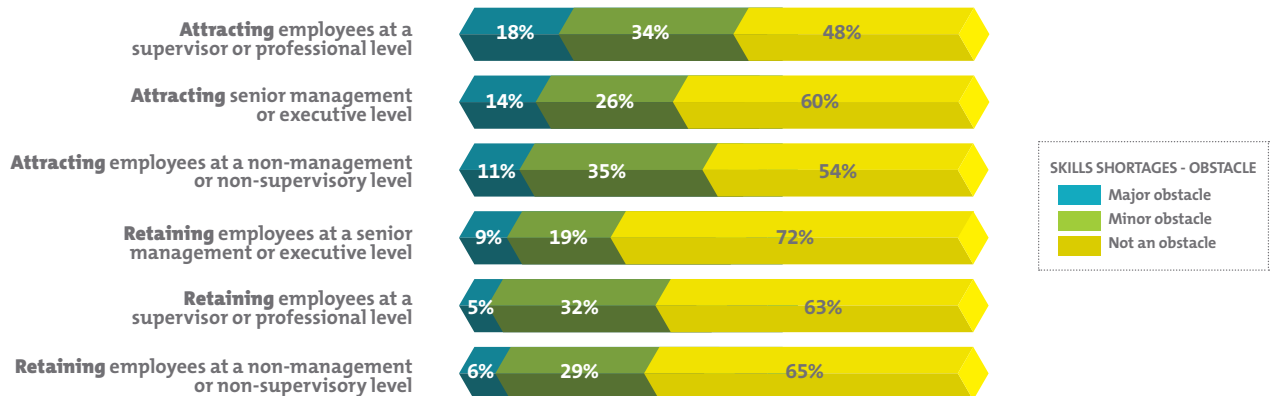
Level	2016	2014
Non Mgr	74%	73%
Mgr or Prof	16%	21%
Sr Mgr	10%	6%



Skills Shortages

Despite the greater number of skilled employees in the bio science sector relative to other sectors, attracting skilled labour for high level managerial and professional positions remains challenging. This is true despite the fact that turnover in the senior management and management is relatively low at 7% across the industry, is the lowest across all position type categories.

SKILLS SHORTAGE



This suggests that there is still an education and skills gap (leadership) in the sector which can be addressed by policy that impacts post-secondary education and skills upgrading.

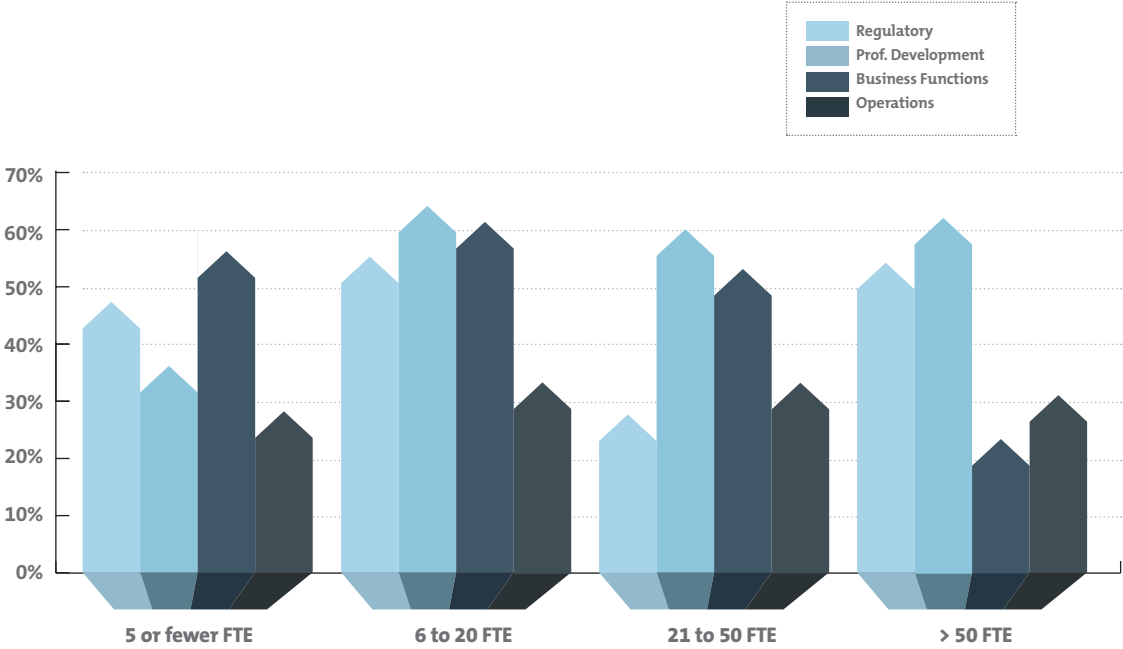
The graphic above demonstrates that difficulty in attracting employees outweighs difficulties with retention. This indicates that education, training and skills upgrading are important considerations for the economy. Bio science is a desirable sector in which to be employed and contributes to skilled and trained employees remaining in the province.

HUMAN RESOURCE PROFILE

Training Gaps

Participants were asked to indicate where they saw a role for LSAM to deliver training programs to benefit their businesses. Responses indicate that a variety of training opportunities are needed and these are training areas that LSAM already provides, indicating LSAM is currently filling a needed role.

TRAINING GAPS (BY COMPANY SIZE)



Professional development was the greatest challenge for all companies with more than 5 employees. Smaller companies are less likely to focus on leadership and other soft skills as they are striving to commercialize their products. Business functions, such as office/writing skills, is the greatest need in the smaller organizations.



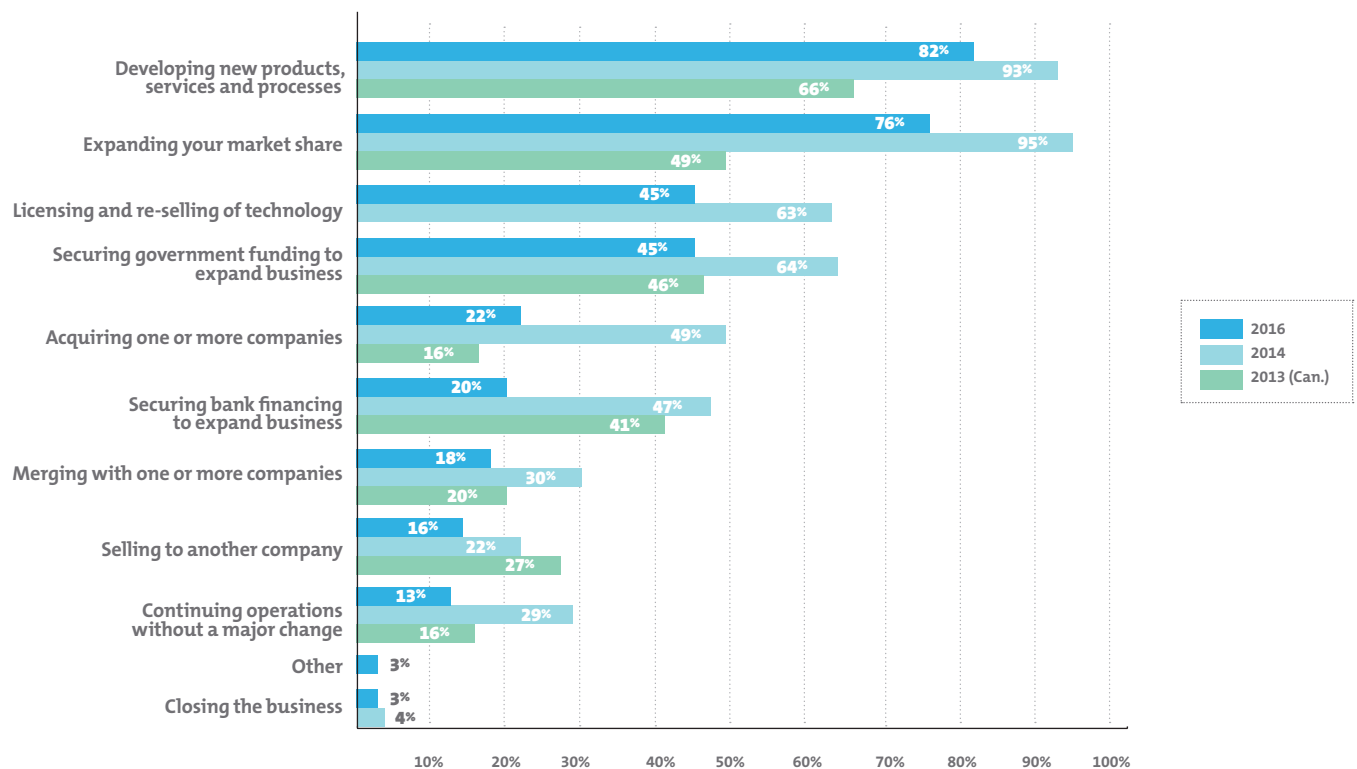
SECTOR OUTLOOK

Future Growth Strategies - Opportunities and Obstacles

The majority of companies surveyed are looking forward to expanding their market share (76%) and developing new products (82%). This optimism has continued year over year, but fewer companies appear to have the same level of expectations compared to the previous year. It is notable though that, when compared to 2014, there seems to be less companies planning a major change (13% versus 29%).

In general, the responses per strategy, were lower which may mean companies are more focused on fewer strategies versus the “shotgun mentality”.

FUTURE GROWTH STRATEGIES - 2016 COMPARISON



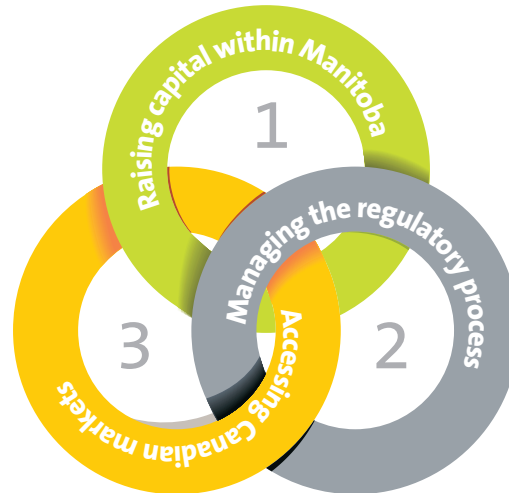
Note Companies could select more than one.



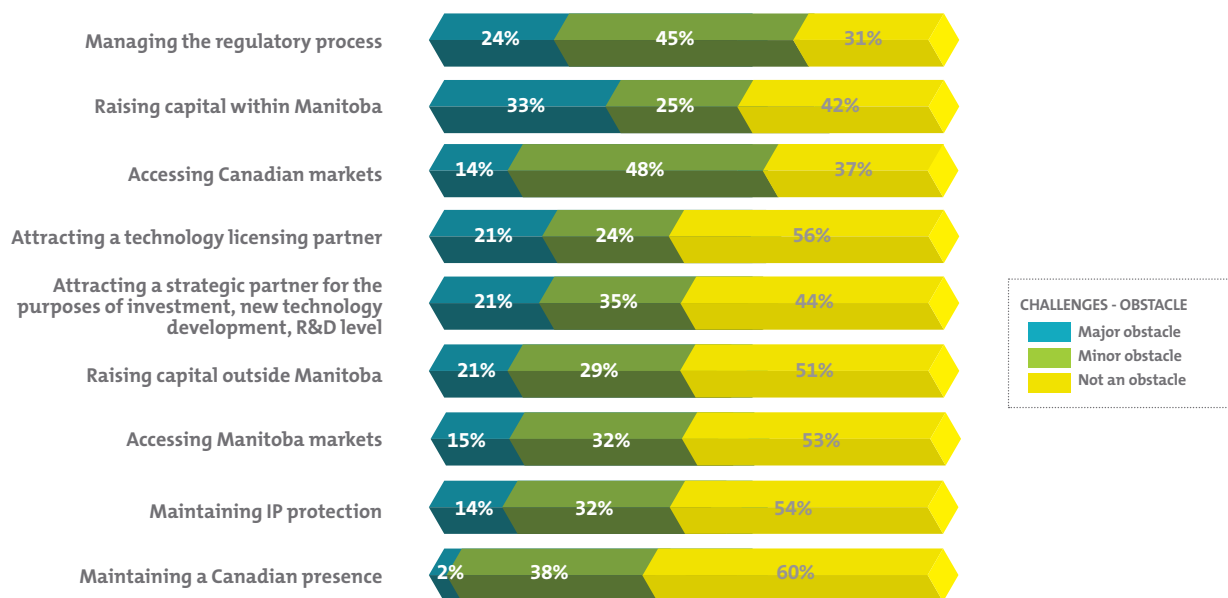
Challenges

The top 3 challenges deemed to be obstacles were:

1. Raising Capital within Manitoba
2. Managing the regulatory process
3. Accessing Canadian markets



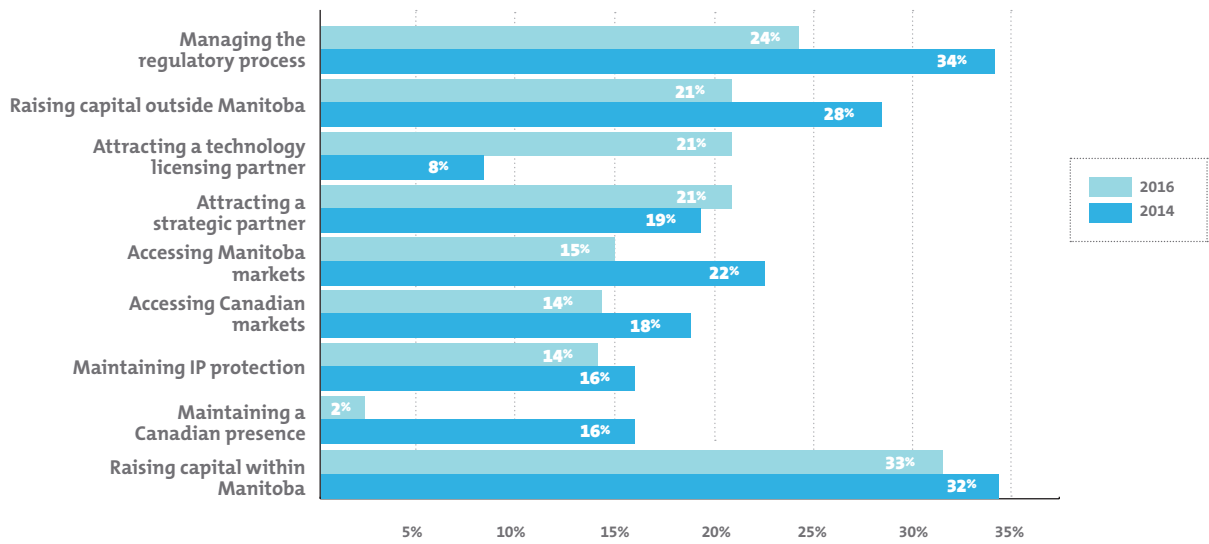
CHALLENGES – MAJOR, MINOR OR NON-OBSTACLES (2016) - % OF COMPANIES



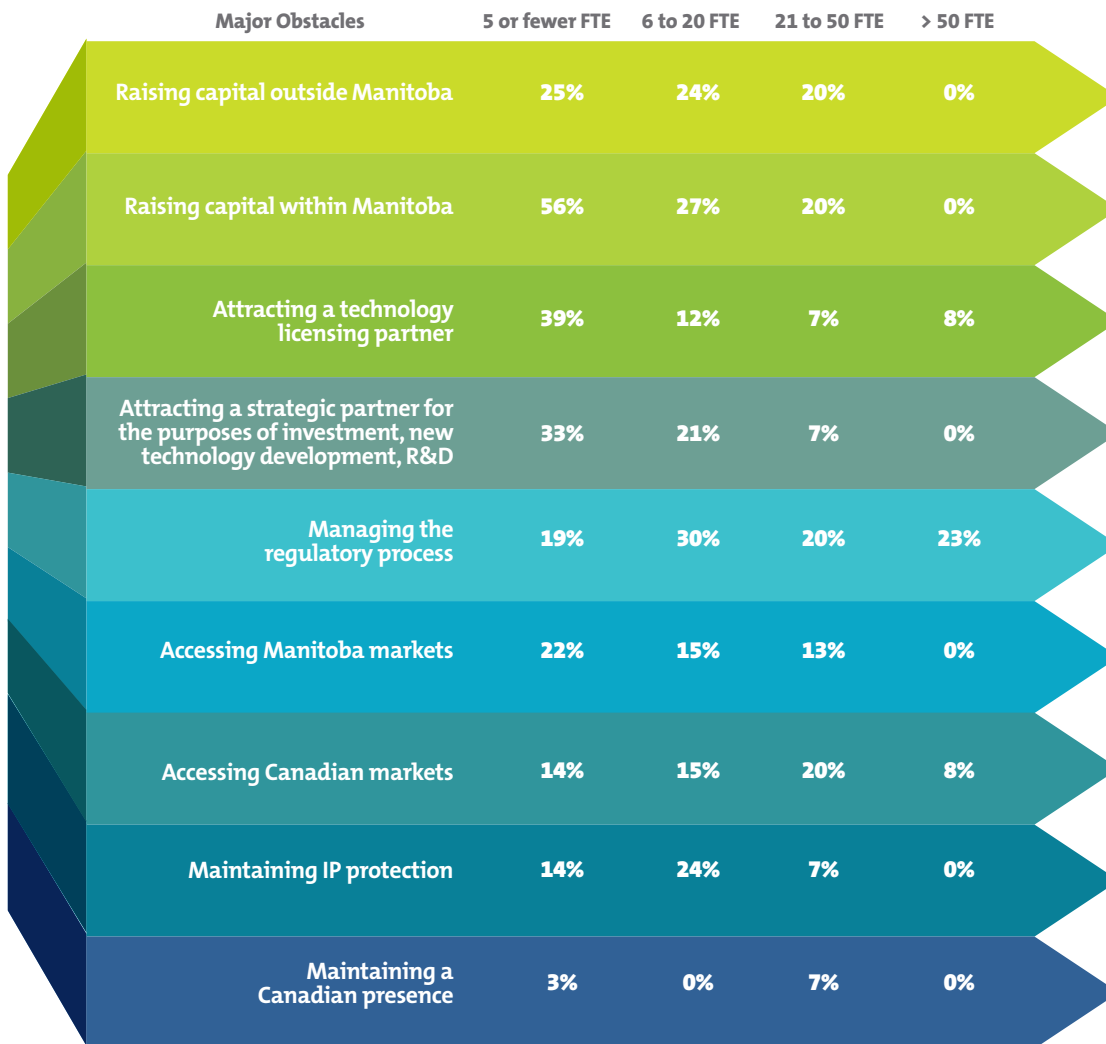
SECTOR OUTLOOK

In both 2016 and 2014, raising capital continues to be the largest obstacle. Regulatory appears to be less of an obstacle this year compared to 2014 with more companies attracting a licensing partner. This reinforces the issues regarding capital which is typically a key aspect of these partnerships.

MAJOR OBSTACLES – 2016 VS 2014 - % OF COMPANIES



MAJOR OBSTACLES BY COMPANY SIZE



Note Companies could select more than one.

The only obstacle consistent across company size is regulatory because it is a reality for all equally. However, while larger (>50 FTEs) companies primarily are focused on regulatory issues, smaller companies struggle with many other obstacles, with capital being the most significant.

Smaller companies focus on Manitoba as their primary market and this is likely as a result of the resource issues related to tackling larger foreign markets. However, accessing the Manitoba market comes with its own challenges due to policies and frameworks that create barriers for decision makers and provide no clear entry point for novel technologies.



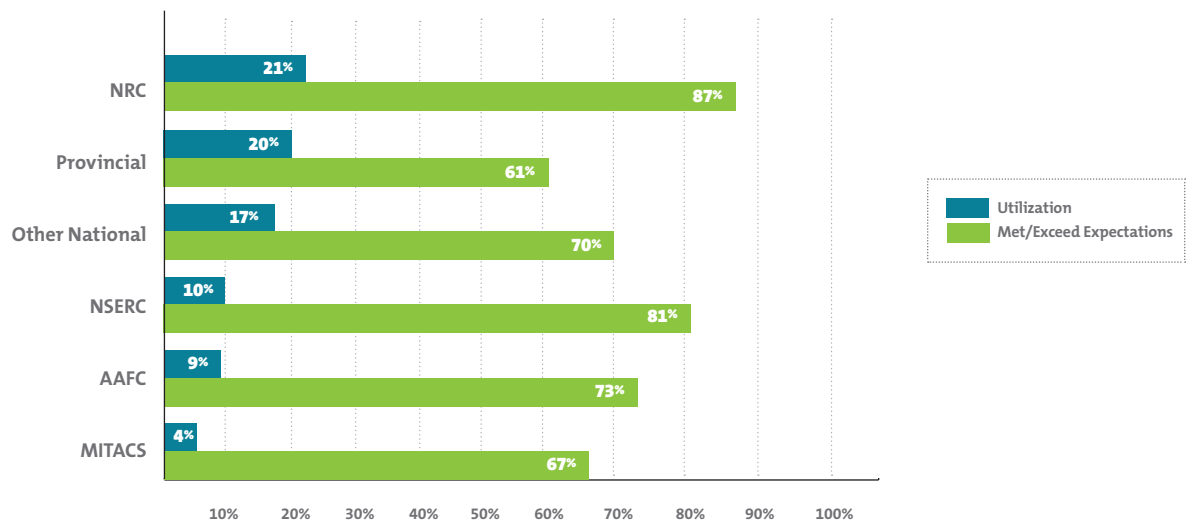
SOLUTIONS

In total, there are 6 general government program areas and 27 programs as follows:



While most programs were used by less than a quarter of the sector; the satisfaction rate of the participants was high (greater than 60%). Lack of program uptake can be due to many factors, lack of awareness, previous failure, time constraints or lack of fit for industry or company. This is an area where with the support of funders, additional evaluation could provide information to enhance programs to support bio science companies.

PROGRAM AREAS - UTILIZATION & EXPECTATIONS



GOVERNMENT PROGRAMS - UTILIZATION AND EXPECTATIONS

GOVERNMENT SUPPORTED INITIATIVES	Program Usage	Met or exceeded expectations	Did not meet expectations
National Research Council-NRC programs	21%	87%	13%
Technology Advisory Services: NRC/IRAP	32%	84%	16%
Technology Innovation Projects: NRC/IRAP	35%	85%	15%
Youth Employment Strategy Programs: NRC/IRAP	15%	93%	7%
Canadian HIV Technology Development: NRC/IRAP/CHTD	2%	100%	0%
PROVINCIAL government programs	20%	61%	39%
Commercialization Support for Business Program: Province of Manitoba	40%	59%	41%
Manitoba Side Car Fund: Province of Manitoba	4%	25%	75%
Manitoba Small Business Venture Capital Tax Credit Program: Province of Manitoba	15%	80%	20%
Canada-Manitoba Job Grant: Province of Manitoba	19%	56%	44%
NSERC programs	10%	81%	19%
Engage Grants: NSERC	23%	82%	18%
Applied Research & Development Grants: NSERC	11%	73%	27%
Experience Awards: NSERC	1%	100%	0%
Collaborative Research & Development Grants: NSERC	9%	89%	11%
Industrial Research Chairs: NSERC	4%	75%	25%
MITACS programs	4%	67%	33%
Accelerate: Mitacs	10%	80%	20%
Elevate: Mitacs	4%	75%	25%
Globalink: Mitacs	4%	50%	50%
Step: Mitacs	2%	50%	50%
Converge: Mitacs	1%	0%	100%
Agriculture and Agri-Food Canada-AAFC programs	9%	73%	27%
Growing Forward AgriInnovation: AAFC	14%	71%	29%
Growing Forward AgriCompetitiveness: AAFC	4%	75%	25%
Growing Forward AgriMarketing: AAFC	8%	75%	25%
OTHER NATIONAL programs	17%	70%	30%
Build in Canada Innovation Program (BCIP): Public Works and Government Services Canada (PWGS)	2%	0%	100%
Canadian Trade Commissioner Service: Department of Foreign Affairs Trade and Development	28%	78%	22%
Career Focus Wage Subsidy Program: BioTalent Canada	7%	86%	14%
Scientific Research and Experimental Development tax credit program (SRED): Canada Revenue Agency	51%	80%	20%
SD Tech Fund: Sustainable Development Technology Canada (STDC)	2%	0%	100%
Western Innovation Initiative (WINN): Western Economic Diversification	11%	27%	73%

This table does not have an exhaustive listing of programs. Programs listed here are primarily programs that are available to private industry.



APPENDIX

Methodology

This section presents the methodology used to analyze and interpret data obtained from the LSAM Industry Survey (2012, 2014, and 2016) and explains the process used for drawing inferences regarding the state of the LSAM Industry Sector. The analysis relies on both basic statistical procedures as well as sophisticated techniques in regression analysis. It is intended to provide readers an explanation of the methods and processes used to produce the conclusions presented in the body of this report.

DESCRIPTION OF RELATIONAL ANALYSES USING STATA 14.0

LSAM has established a dataset, comprised of data from its industry surveys, for the purpose of longitudinal causal analysis. The dataset contains information from 127 unique Manitoba bio sciences businesses which answered the LSAM Industry Survey in one or multiple years (2012, 2014, and 2016)¹⁴. This dataset has been arranged in panel form and contains the following information:

- (1) *Business Sector* – Ag, Biotechnology, Animal Health, Bio Materials, Bio Actives, Bio Energy, Digital Health, Medical Technology, and Therapeutics.
- (2) *Revenue* – Businesses revenue in a particular year defined as the interval estimate obtained through the survey.
- (3) *Age* – How long the business has been operating defined as the interval estimate obtained through the survey.
- (4) *R&D (Y/N)* – a dummy variable coded at 1 if the business expended any amount on R&D in a particular year, and 0 if the business did not.
- (5) *R&D* – the amount of R&D expended in a particular year defined as the interval estimate obtained through the survey.
- (6) *Capital Raised* – a dummy variable coded at 1 if the business raised capital in a particular year, and 0 if the business did not.
- (7) *FTE* – number of full-time equivalents working in the business in each year.

The objective of this analysis is to identify and interpret causal relationships between variables. This is accomplished through multiple regression analysis which is effective in exploring bilateral causal relationships (*ceteris paribus*). In this case, we explore three relationships:

- (1) *The effect of business sector, age, and previous year's R&D expenditure on current year's revenue.*
- (2) *The effect of business revenue, sector, and age on raising capital.*
- (3) *The effect of business revenue, sector, and age on expending on R&D*

REVENUE

To estimate revenue using the intervals reported through the survey, a mid-point of each revenue category was used. For example, businesses reporting \$100,000 to \$250,000 in revenue were assumed to have a revenue of \$175,000. The following formula for the sample mean was then utilized:

$$\mu(\text{sample}) = \frac{\sum_{i=1}^n x_i}{n} \quad (1)$$

where,

i corresponds to the *i*th observation in the sample.

n corresponds to the sample size, with *n* = 97 when including businesses that report revenues greater than \$40 million, *n* = 92 when excluding these businesses).

To obtain an appropriate measure of central tendency, using STATA 14.0, a Shapiro-Wilk test for normalcy was performed on the data. The null hypothesis, that the data follows a normal distribution was rejected. By further examining the percentage of companies at each income category, it is shown that the distribution is skewed with a higher percentage of

¹⁴ Note that for this analysis, associate businesses were excluded.



businesses earning below the “average” income. In fact the median revenue is \$750,000 and the mean is \$7.5 million (\$3.7 million when excluding the five business which account for \$330 million. The following basic inferences are immediately drawn:

(1) A “typical” Manitoba Life-Sciences business tends to earn around \$750,000 as represented by the sample median revenue value.

(2) Since at this point it is assumed to be a random sample, equation (1) is assumed to be an unbiased estimator of the population mean μ (population) and therefore it is used in the estimation of the population total as follows:

$$T=N\times\mu(\text{sample})$$

where,

T is an estimate of total industry revenues

N is the total number of businesses in the industry (=161)

Other methods of calculating the mean including logarithmic transformations, geometric, and Bayesian techniques will be investigated in the future.

It should be noted that since businesses earning over \$40 million dollars reported their actual revenues and not an interval approximation, their revenue estimates were excluded from mean and median calculations (in the estimate of population total) and added back after to ensure accuracy.

It is also important to note that a 90% confidence interval for the mean is fairly wide (\$4,270,285, \$10,781,973) for the entire sample. Throughout this report, we use 90% level of significance in our empirical testing, although 80% confidence could suffice.

EMPLOYMENT

Survey respondents were asked to report actual employees rather than an interval estimate. The mean number of employees was estimated at 34 and the median 10. Similar to revenue, there is a skewness in the distribution with 10 employees being the most appropriate measure of central tendency. Since, as in revenue, we assume that the sample mean is still the best unbiased measure of the true population mean, the sample mean is instrumented in the estimate of total industry employees. Therefore it is estimated that there are 5,607 employees working in the Manitoba bio sciences industry.

Although the granular results of the model are not presented in this report, please feel free to contact Life Science of Manitoba if you would like to see the results of the longitudinal study.

THE BIO SCIENCE INDUSTRY IS DEFINED AS:

Bio health which are companies and organizations that are developing innovations that allow for the early identification, the prevention, and even the curing of costly and debilitating illness and disease.

Ag Biotech companies work with a range of tools, including traditional breeding techniques, that alter living organisms, to make or modify products; improve plants or animals; or develop microorganisms for specific agricultural uses resulting in higher yields and with better nutritional profiles.

Industrial Biotech is a set of practices that use living cells to generate industrial products and processes. Companies working in this industry are developing new products and applications that may replace petroleum-based feedstocks and reduce the environmental impact of the manufacturing process.





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