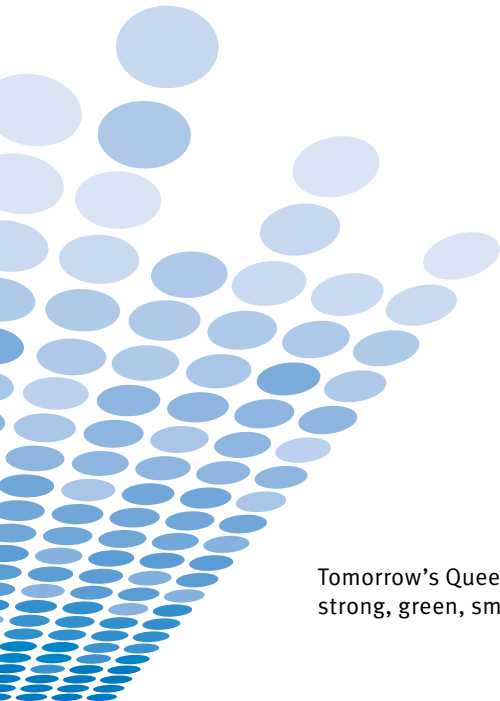


Queensland Life Science Industry Report 2010

Final report – 26 May 2010

Prepared by Dr Patrick Silvey and Dr Lavinia Proctor





VenturePro

Taking Research to Market



Important Notice:

This report was prepared by VenturePro Pty. Ltd. ('VenturePro') on behalf of the Queensland Department of Employment, Economic Development and Innovation (DEEDI). The information, statements, examples, statistics and opinions (defined as "Information" in this document) contained in this report have been prepared by VenturePro from material provided by, and discussions with, third parties, including the Queensland Government.

Reference is made to original sources of Information where appropriate. However, no verification of the Information has been carried out by VenturePro or any of its respective agents, directors, officers or employees. VenturePro has based its report on the Information received or obtained, on the basis that such Information is accurate. The Information in this report is provided in good faith and without prejudice.

The DEEDI and VenturePro and its respective agents, directors, officers or employees make no express or implied representation or warranty as to the accuracy, reliability or completeness of the Information. No party should rely on any material contained in this document as a statement or representation of fact. Each party should satisfy itself as to the accuracy of the material by such independent review, investigation or analysis as it or its advisers may think fit.

To the maximum extent permitted by law, VenturePro and DEEDI expressly disclaim any and all liability for representations or warranties, express or implied, contained in, or for omissions from, this document or any other written or oral communication transmitted or made available pursuant to this document.

Authorship and acknowledgements

The Queensland Life Science Report 2010 was prepared by VenturePro. The primary authors were Dr Patrick Silvey and Dr. Lavinia Proctor. Other contributors to the project included Ms Lisa Devereaux, Mr Lahn Straney and Dr. Kymberley Vickery. The assistance of Dr Debra Venables and Ms Sarah Bloxsom in the Office of Biotechnology and Therapeutic Medicines and Devices, DEEDI in completing this study is gratefully acknowledged. The principal contact at VenturePro is Patrick Silvey –patrick.silvey@venturepro.com.au; Ph: +61 (7) 3899 5223; +61 (0) 402 308 922.

DEEDI and VenturePro are grateful to the 134 organisations that invested their time and effort to complete the survey. Without this commitment from members of the Queensland Life Sciences industry this important analysis would not be possible.

Survey Data and Secondary Sources

The information presented was collected from a primary survey of the Queensland Life Sciences industry undertaken in December 2009 and January 2010 and various secondary data sources as referenced. The survey was conducted using an online survey platform (see Appendices).

For the purpose of this survey, it was assumed that the entire Queensland Life Sciences Industry comprised 295 organisations in 2009 as listed in the database held by the Queensland Office of Biotechnology and Therapeutic Medicines and Devices. This database includes 235 companies and 60 research organisations. About half of the database (146) comprised 'biotechnology' organisations with the remainder (149) being classified as 'therapeutic medicines and devices' (TMD) organisations.

The survey was completed by 134 organisations (45%) within the DEEDI database of 295 organisations. Survey participants included 104 public and private companies (referred to as 'companies') and 30 university institutes, departments, research centres or independent research organisations with a life science focus (referred to as 'research organisations'). Of the 134 respondents to the survey, 58 (43%) were TMD organisations and 76 (57%) were biotechnology organisations.

All financial figures in this report are presented in Australian Dollars (\$AU). For some of the measures, figures presented for Queensland were compared to those from other countries. Where figures derived from secondary data were converted to Australian dollars from another currency, the conversion rates presented in the Appendices were applied.

Statistical Limitations

This survey presents data from a 'sample population' of the Queensland Life Sciences industry. The industry includes a range of organisations: from major research institutions to smaller publicly-funded research units, and publicly-listed companies to start-up companies. Given this, as well as the limitations in the sample size (representing 45% of the organisations assumed to comprise the industry), the data gathered from this population can be highly variable. The distribution of values within the dataset did not, in many cases, represent a normal distribution. This is particularly true for measures including total income, total expenditure and total employment, where reported figures ranged from hundreds of employees and tens of millions of dollars in income/expenditure for large research institutions, down to a single employee and zero income for a start-up company. In cases such as these, the median was deemed to be more representative of the sample population than the average.

Total population estimates were derived using multiple imputation methods. A complete list of Life Sciences companies was compiled through consultation with the DEEDI Office of Biotechnology and Therapeutic Medicines and Devices. The organisation's classification (company/research organisation) and estimated organisation size (classified as small, medium or large) were used in a regression equation to estimate missing data points.

Given the non-parametric distribution of the data, the total population estimates and confidence intervals were estimated using bootstrap methods. The organisation classification and size served as strata for the re-sampling. The confidence intervals presented are 95% bias corrected and accelerated to account for the typical right skew of count—particularly in financial data. These methods are superior to mean imputation methods, in that known information can be used to inform the missing value. It was believed, therefore, that these methods were likely to provide a more accurate representation of the industry.

Since estimates of population totals are likely to be speculative in nature, these should be taken only as a guide to the growth of the industry, relative to the reported figures from comparable surveys undertaken in 2007. In the 2007 Queensland Biotechnology Industry and Queensland Therapeutic Medicines and Devices Industry surveys, a similar mean imputation estimation methodology was employed. Where possible the methodologies used to calculate population totals are consistent with those used in previous surveys. In some cases, 2007 survey results were reanalysed using the methodology applied to the 2009 survey results. There will be variations between the 2007 and 2009 surveys in terms of the specific organisations that responded to the survey in each year. Thus the sample population is different. In addition, income data for the TMD analysis in 2007 was collected in a different format (i.e. as an income range) from the current survey where an actual figure was required from respondents. As such, where direct comparisons between 2007 and 2009 figures are presented, the difference between them is indicative of change but it should not be taken as a definitive indicator of change.

Glossary of Abbreviations

ABS	Australian Bureau of Statistics
ARC	Australian Research Council
ASX	Australian Stock Exchange
BERD	Business Expenditure on Research and Development
Biotech	Biotechnology
CAGR	Compound Annual Growth Rate
CAPEX	Capital Expenditure
cGMP	Current Good Manufacturing Practice
CMO	Contract Manufacturing Organisation
CRO	Contract Research Organisation
DEEDI	Queensland Department of Employment, Economic Development and Innovation
EMDG	Export Market Development Grant
FTE	Full Time Equivalent
FY	Financial Year
GDP	Gross Domestic Product
GOVERD	Government Expenditure on Research and Development
GSP	Gross State Product
IPO	Initial Public Offering
NHMRC	National Health and Medical Research Council
OECD	Organisation for Economic Co-operation and Development
R&D	Research and Development
RO	Research Organisation
TMD	Therapeutic Medicines and Devices

Table of Contents

1.0 EXECUTIVE SUMMARY	5
2.0 KEY FINDINGS	8
3.0 INTRODUCTION	13
4.0 PROFILE OF SURVEY RESPONDENTS	15
5.0 INDUSTRY PROFILE	20
6.0 EMPLOYMENT	29
7.0 ECONOMIC PERFORMANCE	39
8.0 COMMERCIAL PERFORMANCE	53
9.0 EXPORTS AND INTERNATIONAL COLLABORATIONS	67
10.0 EDUCATION AND SKILLING	73
11.0 INDUSTRY PERSPECTIVES	76
12.0 SUMMARY OF KEY STATISTICS	80
13.0 APPENDICES	83



1.0 Executive Summary

The Queensland Life Science Industry Report 2010 presents a profile of the size and performance of the Life Sciences industry in Queensland in the 2009 financial year. A survey of Life Sciences industry members was conducted in late 2009, with 45% of the 295 organisations deemed to be in the industry responding to a detailed questionnaire. Data collected from the 134 respondents was used to derive estimates of key industry measures for the industry, as at June 2009. This is the first time that the various sectors have been combined and reported on as a single Life Sciences industry. Analysis and reporting for the industry in previous years, most recently in 2007, was undertaken separately for the sectors of 'Biotechnology' and 'Therapeutic Medicine and Devices' (TMD).

The Queensland Life Sciences industry is central to the Queensland Government's focus on innovation and the creation of a strong and diverse economy. The Life Sciences have the potential to grow Queensland's economy by creating new industries in biodiscovery and bioproducts, in addition to increasing the productivity and competitiveness of Queensland's traditional industries.

The Queensland Government commissioned the report, and previous studies on the state of the Life Sciences sectors, to inform policy and program development and aid in benchmarking the State's industry against the national industry and selected overseas markets. The report also allows the government and industry to assess progress against the industry's growth projections set out in the *Queensland Biotechnology Strategic Plan 2005-2015: Biotechnology—Setting New Horizons*. For the purpose of this analysis, the Life Sciences industry is defined as biotechnology and its sub-sectors (including industrial, environmental, agricultural, food and medical biotechnology), pharmaceuticals, complementary medicines, functional foods, and medical devices and equipment.

Key Findings

The report describes a sector reporting growth in key parameters of employment and income and positive sentiment for the future. The estimates presented in this report, when compared to relevant data from previous industry surveys in 2007, point to a significant increase in income and employment for the Life Sciences industry as a whole over the last 2 years.

Income and Employment Growth. The industry employed an estimated 19,730 people – 27% higher than estimates derived in combined 2007 surveys for 'Biotechnology' and 'TMD (15,569). The industry had an estimated combined income of \$4.94 billion – 58% higher than estimates derived in the combined 2007 surveys (\$3.13 billion). Most of this difference in income was attributed to the Biotechnology sector (\$2.19 billion in 2009 compared to \$896 million in 2007; 144% higher) rather than the TMD sector which was 23% higher at \$2.76 billion, up from 2.23 billion in 2007.

Changes in the Biotechnology Sector. Comparison with the 2007 Biotechnology sector estimates suggest significant increases in income for that sector over the past 2 years. However wages and salary expenditure, R&D expenditure and capital expenditure were all estimated to be lower for biotechnology in 2009.

Changes in the TMD Sector. Estimates for the TMD sector suggest growth across income, employment and wage and salary expenditure over the past 2 years. However, capital expenditure estimates were also significantly lower for this sector in 2009 compared to 2007.

Industry Maturity. In the current survey, for organisations developing therapeutic goods, 34% had lead products at market. For those with non-therapeutic goods, 42% of respondents had their lead product at market. In the 2007 Biotechnology survey only 13% had therapeutic products at market and only 20% had non-therapeutic products at market. More companies with lead products at market should translate into higher revenues for the sector overall.

Industry Sentiment and Forecasts. Business sentiment within the industry was strong, with 71% of respondents expecting their income to increase over the coming year and 88% expecting income to increase over the next three years. Approximately 58% and 40% of respondents expected capital and R&D expenditure respectively, to remain the same or decrease over the coming year. Almost two thirds (60%) forecast increased R&D expenditure over the next 3 years.

Progress Against Biotechnology Sector Projections. In relation to the biotechnology component of the sector, the *Queensland Biotechnology Strategic Plan 2005-2015* outlined industry projections for Queensland biotechnology companies to generate revenues of \$4 billion and employ 16,000 people by 2025 (see Table below). A breakdown of the data from the current survey yielded estimates that private biotechnology firms within Queensland employed 3,760 full-time equivalent staff and generated an aggregate income of \$1.09 billion in 2009. Although only indicative, since they are imputed estimates, these figures suggest that industry growth projections on jobs and revenue are tracking well against projections. It was not possible to measure market capitalisation for the sector in the current study since reliable data is only readily available for publicly listed firms.

Industry's growth projections for Queensland's biotechnology industry 2025			
Economic Projections	2010	2015	2025
Create Jobs	3,500	7,500	16,000
Generate Revenue	\$0.6 billion	\$1.5 billion	\$4 billion
Market Capitalisation	\$3 billion	\$7.5 billion	\$20 billion

What does it mean for Queensland?

Significant increases in income and employment in particular might seem counter to the increasingly poor economic climate at the time. However, a number of elements of the survey results, as well as secondary indicators of economic growth and business and industry sentiment at the time (in Australia and overseas), support the likelihood of growth in the Queensland Life Sciences sector.

Commentary and statistics in other publications point to growth in Life Sciences sectors during the period, but caution about the future. Of particular note, the Beyond Borders: global biotechnology report 2010 from Ernst & Young reported that 2009 was the first year that companies in the industry's established biotechnology centres of the US, Europe, Canada and Australia had an aggregate net profit. The improvement in the US was said to be driven by a dramatic increase in net profit due largely to the adoption of new cost-cutting and efficiency measures. This occurred in an environment where access to capital for many companies remained scarce. The report found that two-thirds of US biotechnology firms and nearly as many European firms reduced spending on research and these trends are mirrored in estimates derived for the Queensland Biotechnology industry in 2009.

Lower investment in capital expenditure will have assisted the industry in maintaining stability during the negative economic environment. Increasing 'maturity' in the sector (with more companies having products in the market) may have also assisted in facilitating growth in income and employment.

Despite positive business sentiment and indicators of growth within the broader Queensland Life Sciences industry between 2007 and 2009, the risks and barriers identified by survey respondents indicate that there are significant challenges facing the Queensland Life Sciences industry. Expectations of lower R&D expenditure and lower capital expenditure in the coming 12 months suggest a level of caution for the short term. Respondents indicated, by a substantial margin, that the major risk to their businesses and the major barrier to revenue growth was access to sufficient capital for growth or market entry. Similar sentiments were revealed in Life Sciences industry surveys conducted recently in New Zealand and Canada.

In recognition of the need for capital to support the industry, both the Federal Government and the Queensland Government have recently announced strategies to increase venture capital (VC) funding to the sector. The Queensland Government announced in May 2010 that it will invest \$25 million in a venture capital fund with global biopharmaceutical leader Eli Lilly and Company, and other strategic US partners. The Australian Government has partnered with the private sector to support the venture capital sector through the Innovation Investment Fund (IIF) and the Pre-Seed Fund (PSF).

Despite an uncertain economic climate the current survey suggests that the Life Sciences industry in Queensland remained buoyant, likely aided by prudent management and a greater number of companies having products in the market and generating revenue. Whilst sentiment for the short term (to 12 months) appears to be one of caution, there is a much stronger positive outlook over a three year timeframe.



2.0 Key Findings

Summary of Key Findings

The key findings arising from the Queensland Life Science Survey are presented below. The figures presented in the tables below are estimates for the entire Queensland sector. These estimates were statistically derived from the data provided by 134 industry members out of an estimated total of 295 organisations across the state.

Life Sciences Sector			
	Estimates for 2007 Survey	Estimates for 2009 Survey	Difference
Income (\$M) (incl. revenue & grants)			
All respondents	\$3,130	\$4,943	58%
Companies	N/A	\$3,844	
Research Organisations	N/A	\$1,099	
Employment (full-time equivalents)			
All respondents	15,569	19,731	27%
Companies	N/A	13,442	
Research Organisations	N/A	6,289	
Wage & Salary Expenditure (\$M)	\$789	\$1,078	37%
R&D Expenditure (\$M)	N/A	\$803	N/A
Capital Expenditure (\$M)	\$704	\$253	-64%

** Combined estimates from previous Biotechnology and Therapeutic Medicines and Devices Surveys FY2007*

Biotechnology Sector			
	Estimates for 2007 Survey	Estimates for 2009 Survey	Difference
Income (\$M) (incl. revenue & grants)			
All respondents	\$896	\$2,185	144%
Companies	\$395	\$1,093	177%
Research Organisations	\$501	\$1,092	118%
Employment (full-time equivalents)			
All respondents	7,630	9,929	30%
Companies	1,840	3,760	104%
Research Organisations	5,790	6,169	7%
Wage & Salary Expenditure (\$M)	\$502	\$387	-23%
R&D Expenditure (\$M)	\$641	\$550	-14%
Capital Expenditure (\$M)	\$469	\$173	-63%

Therapeutic Medicines and Devices Sector			
	Estimates for 2007 Survey	Estimates for 2009 Survey	Difference
Income (\$M) (incl. revenue & grants)			
All respondents	\$2,234	\$2,758	23%
Companies	ND	\$2,750	
Research Organisations	ND	\$7	
Employment (full-time equivalents)			
All respondents	7,939	9,802	23%
Companies	ND	9,682	
Research Organisations	ND	120	
Wage & Salary Expenditure (\$M)	\$287	\$691	141%
R&D Expenditure (\$M)	ND	\$253	N/A
Capital Expenditure (\$M)	\$235	\$80	-66%

ND – not determined

Note: The statistical approach adopted to generate state-wide estimates is based on total population averages and mean imputation. Where possible, the Queensland-wide estimates generated through the Queensland Life Science Industry Report 2010 are compared to figures from two separate studies in 2007 – the Queensland Biotechnology Industry Survey and the Queensland Therapeutic Medicines and Devices Industry (TMD) Survey. Estimates of population totals are speculative in nature, and should therefore be taken as a guide as to the growth of the industry and not as absolute definitive measures. The methodologies used to calculate population totals in previous reports are consistent with the current report. However, as the methodology may vary slightly, direct comparisons between figures presented should not be taken as a definitive indicator of change.

Key measures of commercial performance for survey respondents are tabulated below alongside the same measures as assessed in the Queensland Biotechnology Survey 2007.

Commercialisation Performance of Survey Respondents			
Measure	Previous Reports (FY2007)		Current Report (FY2009)
	Biotech	TMD	
Australian Patents Granted	50	ND	143
Out-License Agreements	20	ND	39
In-License Agreements	35	ND	49
Utilisation of Contract Manufacturing Organisations	23%	ND	33%
Utilisation of Contract Research Organisations	23%	ND	29%

Industry Structure

- **Respondent Profile:** Of the 134 respondents to the survey, 76.1% were public or private companies and 22.4% were research organisations. The remaining two respondents (1.5%) fell into the 'Other' category – a sole trader and an Incorporated Association. With regard to private companies, 53 (51%) had been established since 2000, with 23 (22%) being formed within the last 5 years. Seventeen (17%) company respondents were spin-outs from a Queensland university or research institution.
- **Life Science Sub-Sectors:** The 'Human Health' sub-sector was the largest component of the Queensland Life Sciences industry in 2009 with 55% of those surveyed falling into that sub-sector. Service providers made up 19%; Biotechnology, 13%; Animal Health, 5%; and 'Other', 8%.
- **ASX-Listed Life Science Companies:** As at 30th June 2009, 8.3% of ASX-listed Life Sciences companies were registered in Queensland (10 companies) and their average market capitalisation

was \$26.6 million. The total market capitalisation for all ASX-listed Australian Life Sciences firms (120) at the 30th of June 2009 was \$31.0 billion (or \$4.5 billion excluding CSL Ltd, Cochlear Ltd. and Resmed Ltd; 117 companies – average \$38.5 million).

- **Business sentiment:** Sentiment in the industry was positive with 61 (71%) respondents expecting income to increase over the coming year and 75 (88%) respondents expecting income to increase over the next three years. While 26 respondents (42%) expected an increase in capital expenditure (capex) over the next 12 months, the majority (50%) expected capex to remain the same and 8% expected capex to decrease.

Stage of Development

- **Stage of Company/Organisation Development:** The majority of respondents developing therapeutic goods reported that they were either at an advanced stage of development (38% at registration/market), or at a very early stage (38% at discovery/preclinical stage). For those focused non-therapeutic goods, 47% had not yet reached product trials, 17% were at trial/testing stage, and 36% were at the commercialisation/ market stage.
- **Outsourcing:** Thirty of 91 respondents (33%) reported that they had engaged a Contract Manufacturing Organisation (CMO) in FY2009. Direct expenditure was reported by 23 organisations who engaged CMOs across eight countries, collectively spending \$15.0 million (average spend of \$789,658; median spend \$500,000). CMOs engaged by Queensland respondents were largely located in Australia (46%) and the USA (20%). A total of ten countries were named as providers of CMO services (CMO engagement in two of the named countries involved in-kind, but not cash expenditure on services).

Twenty-six respondents out of 89 (29%) reported that they had engaged a Contract Research Organisation (CRO) in FY2009. Twenty-two of those reported direct expenditure in engaging CROs across five countries, collectively spending \$14.5 million (average spend of \$657,599; median spend \$245,268). Most of the CROs engaged by Queensland companies were located in Australia (64%), USA (17%) and Canada (7%). A total of seven countries were named as providers of CRO services (CRO engagement in two of the named countries involved in-kind, but not cash, expenditure on services).

Employment and Wages

- Survey respondents employed a total of 6,673 Full Time Equivalent (FTE) persons with the number of reported FTEs ranging from nil in some start-up companies to several hundred in research organisations. The Human Health sector was the largest employer with 4,039 FTEs reported.
- It was estimated that Queensland-wide, the Life Sciences sector employed 19,731 people, with 13,442 (68%) of those employed by private industry. Each organisation in the DEEDI database was classified as being either a biotechnology or a TMD organisation. Based on this classification it was estimated that 9,802 FTEs were employed in the TMD sector and 9,929 FTE's were employed in the biotechnology sector.
- An estimated 6,314 FTEs (32%) Queensland-wide were employed as R&D professionals or other technical and R&D support staff.
- Queensland-wide employment estimates increased by 27% from figures determined in the 2007 surveys. Alongside a 58% increase in the income estimate, this lends weight to conclusions in 2007 that, in general, productivity in the sector may be increasing as it matures.
- It was estimated that \$1,078 million was expended on salaries by the Queensland industry in FY2009 including \$149 million by research organisations and \$929 million by companies.
- The average salary of employees among the respondents to the survey was estimated at \$77,732 compared to an ABS estimated average across all industries in Australia of \$62,431 and Queensland \$61,464.¹

¹ Australian Bureau of Statistics, August 2009; seasonally adjusted; ordinary time.

Income

- **Income:** The estimated total income across the entire Queensland Life Sciences industry was \$4.94 billion in FY2009. This is 58% higher than the \$3.13 billion estimate in 2007 (combined total from the Queensland Biotechnology Industry and Therapeutic Medicines and Devices Industry Surveys).
- Surveyed organisations generated a total of 78% of their total income from the sale of goods and services in FY2009. Income to companies across the entire Queensland industry from the sale of goods and services was estimated to be \$3.25 billion. For research organisations this figure was estimated to be \$0.75 billion.
- **International Business Deals:** For the 31 respondents that reported revenue from international business deals, an average of 23% of their total income was generated from these deals, with the USA being the most common target market for existing and future business. Twenty-two companies reported income from international business deals totalling \$13.2 million. Nine research organisations reported income from international business deals totalling \$3.0 million.
- **Grant Income:** Survey respondents reported a total of \$158 million in grant income in FY2009 – research organisations reported \$131 million (83% by value) and companies reported \$27 million (17% by value). The total grant income estimated to have been received by the entire Queensland Life Sciences industry in FY2009 was \$508 million.

Respondents to the 2009 Queensland Life Science Industry Survey were awarded \$75.3 million in grant funding during FY2009, with \$66.7 million of this funding being actually received in 2009.

- **NHMRC Grant Funding:** The value of NHMRC grants awarded to Queensland researchers was \$102.5 million in 2009, compared to \$60 million in 2006. Queensland's share of the total national NHMRC grant funding was 13.3% in 2006 and 14.5% in 2009. Queensland's share of the national ARC grants by value was 15.1% in 2005 and 21.9% in 2008.

Debt and Equity Finance

Twenty-four respondents reported a total of \$85.6 million in financing in FY2009, including \$42.8 million in venture capital funding, \$27.5 million in debt finance, \$2.4 million in angel funding and \$12.9 million from other sources, including equity investment from existing shareholders and bank interest.

ABS data indicates that the total value of investments by Australian Venture Capital firms in Queensland organisations was \$1,059 million (13.6% of the national total) in FY2009, compared to \$939 million (13.5%) in FY2007.

R&D and Capital Expenditure

- **R&D Expenditure:** R&D expenditure across the entire Queensland Life Sciences industry in FY2009 was estimated to have been \$803 million, with \$417 million (52%) arising from research organisations and \$386 million (48%) from companies.
- **Capital Expenditure:** Companies accounted for 72% of all capital expenditure reported by respondents for FY2009. Capital expenditure across the entire industry in Queensland in FY2009 was estimated to have been \$253 million.

Patents and Licensing

- **Patents:** A total of 143 complete patent applications were filed by, or granted to, surveyed organisations in FY2009 – 24 (17%) were granted to research organisations and 119 (83%) to companies. According to the US Patent and Trademark Office, 1,292 US utility patents were granted to Australian inventors in 2008.
- **License Agreements:** Eleven Queensland Life Sciences organisations reported 39 out-license agreements, while nine organisations reported 49 in-license agreements in FY2009.



3.0 Introduction

The Queensland Life Science Industry Report 2010

3.1 Queensland Life Science Industry Analysis

This report, commissioned by the Queensland Department of Employment, Economic Development and Innovation (DEEDI), presents a profile of the Life Sciences industry in Queensland in 2009. The report provides an update to the previous Queensland Biotechnology Industry Report (FY2007) and Queensland Therapeutic Medicines and Devices Industry Report (FY2007).

The nature, size and performance of the Queensland Life Sciences industry in 2009 were assessed in this project. The resultant industry profile was compared to those from previous analyses of the Therapeutic Medicines and Devices and Biotechnology industries, determined separately in 2007. The analysis will be used to inform State Government policy and program development, and aid in benchmarking Queensland's industry against the national industry as well as key overseas markets.

3.2 Queensland Life Science Industry Survey

The basis for the Queensland Life Science Industry Report 2010 is a combination of (a) the results of a voluntary survey conducted by VenturePro Pty Ltd in December 2009/January 2010, and (b) publicly available secondary data. The Queensland Life Science Industry Survey was sent to 308 Life Sciences companies and research institutions across Queensland. Of this number, 13 organisations were subsequently removed from the database for this study, as they were no longer operating, or were deemed not to sit within the Life Sciences sector. The appendices to this report contain a summary of key statistics and a description of the methodology applied.

For the purpose of the survey, a Life Sciences entity was defined as any company, university group or research institution undertaking life science-related activities encompassed by the categories described below. These broad categories were adapted from the AusBiotech definition of biotechnology, in combination with typical Pharmaceutical industry definitions (*See the appendices for further detail of activities included in each category*).

To enable comparisons with previous surveys, the categories listed below were also grouped into two major industry divisions: Biotechnology (companies with core biotechnology activities in agriculture and food biotechnology, environmental biotechnology, industrial biotechnology, bioinformatics and medical biotechnology) and Therapeutic Medicines and Devices (TMD: pharmaceuticals or drug discovery, medical devices, complementary medicines/functional foods and animal health).

Industry Sectors

Human Health – Pharmaceuticals or Drug Discovery

Human Health – Complementary Medicines

Human Health – Functional Foods/Beverages

Human Health – Medical Devices

Animal Health

Agriculture and Food Biotechnology

Environmental Biotechnology

Industrial Biotechnology

Bioinformatics

Industry Service Provider

Aggregated survey results collected from Queensland companies and research organisations are presented in the context of key economic, commercialisation, research and development (R&D) and education measures. These parameters are used to determine the progress of the Queensland industry over the past two years.



4.0 Profile of Survey Respondents

SNAPSHOT

- *The survey was undertaken by 134 organisations out of 295 Life Sciences organisations identified (45.3%).*
- *57% of survey respondents were 'Biotechnology' organisations, while the remaining 43% were 'Therapeutic Medicines and Devices' organisations.*
- *Over half of survey respondents operated primarily in the 'Human Health' sectors of Pharmaceutical, Medical Devices and Complementary Medicine/Functional Foods*
- *51% of respondent companies were established within the last 10 years, and 22% within the last 5 years.*

Respondent Profile

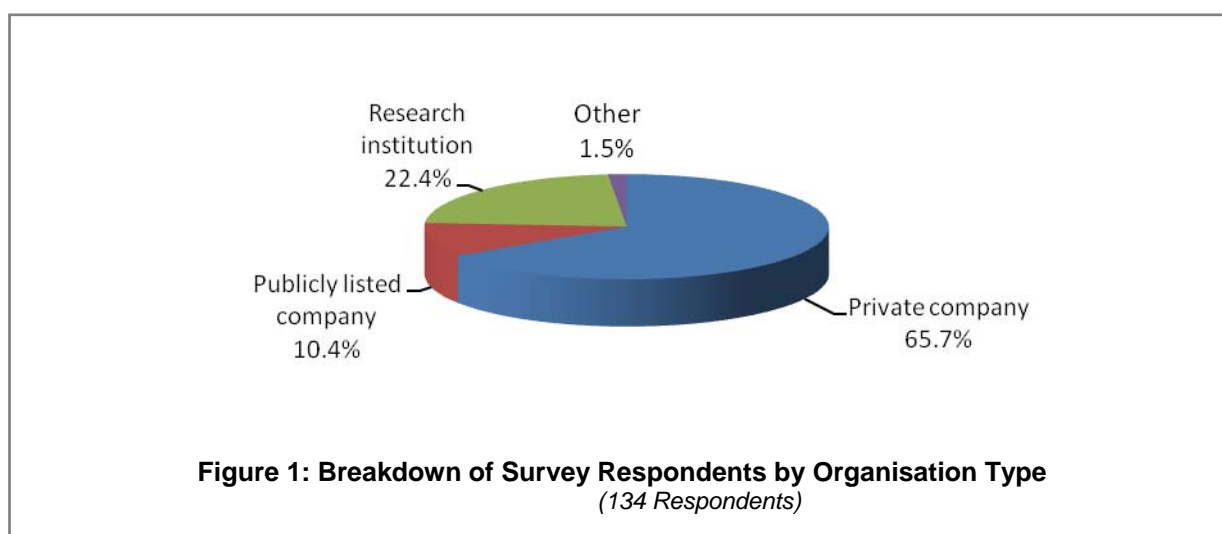
The profile of respondents to the 2009 Queensland Life Science Industry Survey is described below. The overall survey response rate was 45%. Survey respondents were distributed across the Biotechnology (57%) and Therapeutic Medicines and Devices (TMD) (43%) sectors of the Life Science industry. Respondents were categorised as either private (78%) or public sector (22%) organisations, and at the next level down they were defined by their size (small, medium or large) according to the number of employees. The overall profile of the respondent population was believed to be broadly representative of the entire sector in Queensland and this provides a measure of confidence in the statistical calculations undertaken to generate Queensland wide estimates for many of the measures examined in the survey.

4.1 Classification of Respondent Queensland Life Science Organisations

The survey was undertaken by 134 organisations out of 295 Life Sciences organisations identified (45.3%).

The participants included 104 public and private companies (referred to as 'companies') and 30 university research centres or independent research organisations with a life science focus (referred to as 'research organisations').

Of 134 survey respondents, 10.4% identified themselves as publicly listed companies, 22.4% as a university or research institution and 65.7% as a private company. 1.5% fell into an 'Other' category including a sole trader and an incorporated association (Figure 1).



4.2 Respondent Life Science Organisations by Industry Division

The Queensland Life Sciences industry is estimated to comprise 295 organisations operating in two major industry divisions, Biotechnology (146 organisations) and Therapeutic Medicines and Devices (TMD; 149 organisations). These divisions do not operate in isolation and, in some cases, organisations may operate across both industry divisions.

A breakdown of the survey respondents by industry division indicates that 57% of survey respondents were 'Biotechnology' organisations, while the remaining 43% were 'Therapeutic Medicines and Devices' organisations.

Both industry divisions were well represented in the 2009 Queensland Life Science Industry Survey. 52% of the organisations operating in the 'Biotechnology' sector responded to the survey as did 39% of the organisations operating in the 'Therapeutic Medicines and Devices' sector (Table 1).

	Companies	Research Organisations	TOTAL
Biotech	47 responded of 90 (52%)	29 responded of 56 (52%)	76 responded of 146 (52%)
TMD	57 responded of 148 (39%)	1 responded of 1 (100%)	58 responded of 149 (39%)
TOTAL	104 responded of 235 (35%)	30 responded of 60 (50%)	134 responded of 295 (45%)

4.3 Respondent Life Science Organisations by Industry Division and Organisation Size

The profile of responding organisations was further defined by estimated organisation size. This parameter was defined on the basis of the number of employees resident within each organisation i.e. small 0-25; medium 26-100; and large greater than 100 full-time equivalent employees.

A breakdown of survey respondents by industry division (i.e. Biotechnology or TMD) and organisation size is shown in Table 2.

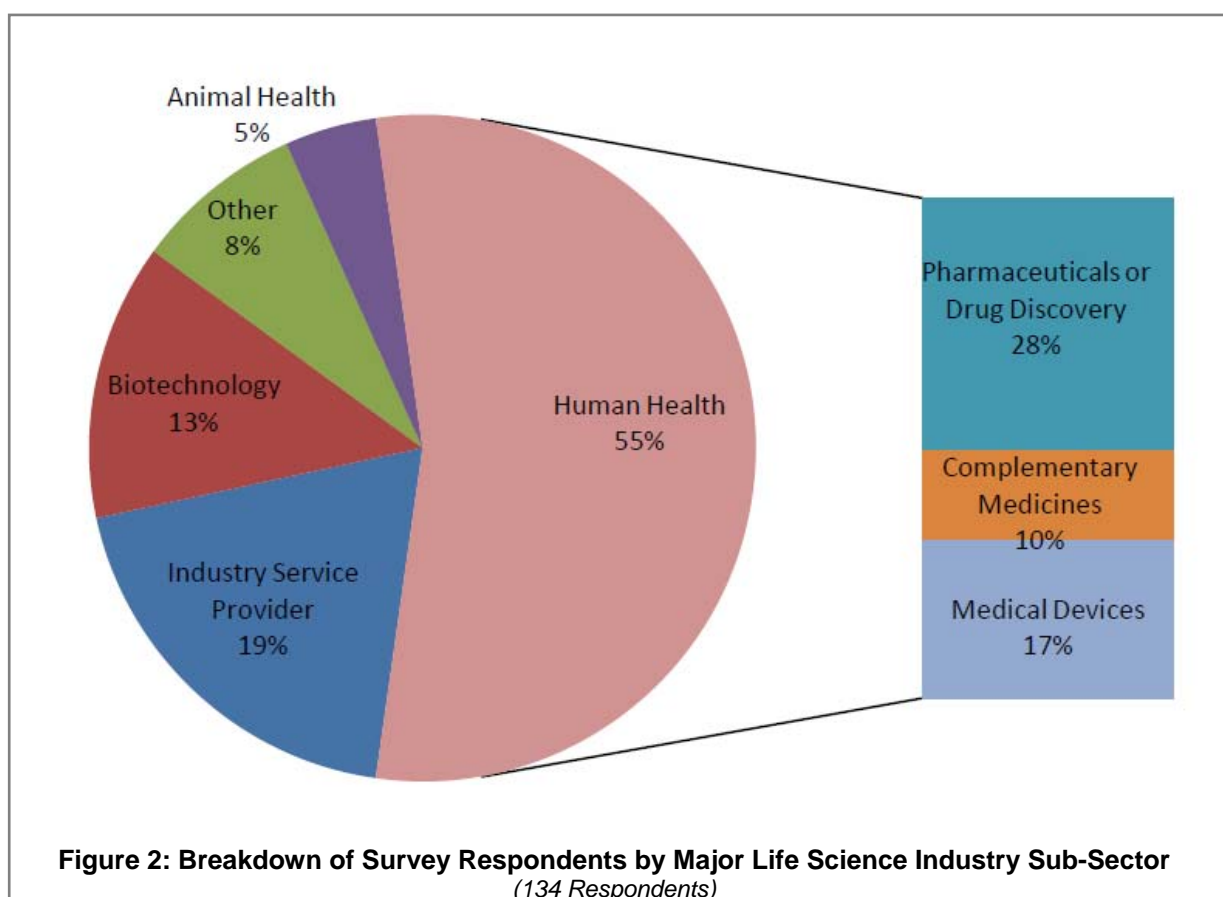
	Small	Medium	Large	TOTAL
Biotech				
Companies	39	5	3	47
Research Organisation	9	8	12	29
TMD				
Companies	41	11	5	57
Research Organisation	0	0	1	1
TOTAL	89	24	21	134

4.4 Profile of Respondent Companies

The Queensland Life Sciences industry operates across six (6) major industry sub-sectors - Pharmaceutical or Drug Discovery, Complementary Medicine/Functional Foods, Medical Devices, Animal Health, Biotechnology² and Industry Service Providers.

Although organisations may operate across more than one sub-sector, when companies were assigned to just one main industry sub-sector based on their core activities, over half (55%) of survey respondents operated primarily in the 'Human Health' sectors of Pharmaceutical, Medical Devices and Complementary Medicine/Functional Foods. 19% were Industry Service Providers and 13% were Biotechnology organisations. Only 5% were involved primarily in Animal Health and the remaining 8% were placed in an 'Other' category (Figure 2).

²Refers to organisations undertaking core activities in agriculture and food, environmental, industrial and medical biotechnology.



Fifty-three companies (51% of all companies surveyed) reported that they had commenced operations since 2000. Thirty-one (30%) companies were formed between 1990 and 1999, fourteen (13%) between 1980 and 1989, four (4%) between 1970 and 1979 and two companies were formed pre-1970 (Table 3).

Year of Inception		Number of Companies	% of Companies	
Pre-1970		2	2%	
1970-1979		4	4%	
1980-1989		14	13%	
1990-1999	1990-1994	10	10%	30%
	1995-1999	21	20%	
2000-2009	2000-2004	30	29%	51%
	2005-2009	23	22%	

4.5 Statistical Limitations

Estimates of population totals are likely to be speculative in nature; these should be taken only as a guide to the growth of the industry, relative to the reported figures from comparable surveys undertaken in 2007.

The imputation methodology utilised for the 2009 Queensland Life Science Industry Survey employed more information to generate the predictions than used to produce estimates from the 2007 Queensland Biotechnology Industry and Queensland Therapeutic Medicines and Devices Industry

Surveys. For the Queensland-wide estimates reported in the 2010 Queensland Life Science Industry Report, results were regressed on several factors i.e. the organisation classification, industry division and an estimation of the organisation size. This approach allows an assessment of the relationships between the factors and the variable of interest (e.g. employment, income, expenditure) and permits the generation of estimates that control for non-responding organisations using a multivariate prediction equation. However, as with all imputation methods there is an underlying assumption that missing values from organisations that did not respond were not materially different from those that reported to the survey (i.e. the sample was representative of the population).

In the 2007 Queensland Biotechnology Industry and Queensland Therapeutic Medicines and Devices Industry Surveys, although a similar mean imputation estimation methodology was employed, results were regressed on only one factor. Regardless of the analysis methodology employed, there will be inevitable variations between the 2007 and 2009 surveys in terms of the specific organisations that responded to the survey in each year. Thus the sample population is different. In addition, income data for the TMD analysis in 2007 was collected in a different format (i.e. as an income range) than in the current survey where an actual figure was required from respondents.

As such, where direct comparisons between 2007 and 2009 figures are presented, any variation between them is indicative of change but the actual difference should not be taken as definitive.



5.0 Industry Profile

- *The Human Health sub-sector is the largest component of both the Queensland and Australian Life Sciences industries.*
- *8.3% of Australian listed Life Sciences companies were registered in Queensland (at 30 June 2009) and their average market capitalisation was \$26.6 million.*
- *The majority of respondents developing therapeutic goods reported that they were either at an advanced stage of development (38% at registration/market), or at a very early stage (38% at discovery/preclinical stage).*

Industry Profile

5.1 Comparing the Queensland and Australian Life Science Industry

The sub-sector breakdown of the Australian and Queensland Life Science sectors is shown below. The Queensland data arises directly from the current survey. The figures provided for the Australian Life Sciences industry were extracted from IBISWorld Industry Reports. Although some broad conclusions can be drawn from this data, IBISWorld and AusBiotech do not have their industry sub-sector classifications aligned, and as such the data is not directly comparable and should be treated as indicative only. It can be noted that the Health and Medical (Human Health) sector was the largest component of both the Queensland and Australian Life Science industries.

Table 4: Sub-Sector Breakdown of the Queensland and Australian Life Science Industry³

Sector	Queensland Life Science 2009	Australian Life Science 2009
Human Health – Pharmaceuticals or Drug Discovery	28%	49%
Human Health – Complementary Medicines/ Functional Foods/Beverages	10%	
Human Health – Medical Devices	17%	13%
Animal Health	4%	ND
Biotechnology	13%	30%
Industry Service Provider	19%	8%
Other	8%	ND

Publicly-Listed Queensland Life Science Companies

17 companies (17% of the 99 responding to this question) identified themselves as spin-outs from a Queensland university or research institution. The majority of these (77%) were formed after 2000 and most (82%) have remained private companies with three (Tissue Therapies Ltd, C-Bio Ltd and Impedimed Ltd) now listed on the ASX.

Approximately 8.3% of Life Science companies listed on the Australian Stock Exchange (ASX) at June 2009 (10 of 120 companies) were headquartered in Queensland or had a majority of their assets in Queensland (Figure 3).⁴

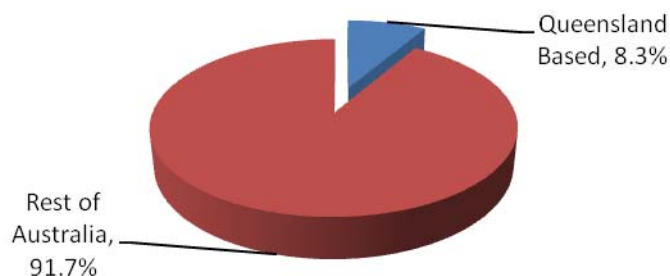


Figure 3: Queensland Based ASX-Listed Life Science Firms in 2009

³ Source: IBISWorld, X0001 Biotechnology in Australia, August 2009

⁴ ASX-Listed companies by sector at <http://www.asx.com.au/asx/research/listedCompanies.do>; Duplicity Consulting, <http://www.duplicityconsulting.com/QLD-based-ASX-listed-companies.html>, 30/06/2009

5.2 Comparing Queensland and Australian ASX-Listed Life Science Companies

The ASX-listed Life Sciences companies headquartered in Queensland at 30 June 2009 are shown in Table 5. Most of these listed firms (7 of 10 companies; 70%) could be considered 'micro cap' – with a market capitalisation of less than \$50 million. Half of the listed Queensland Life Sciences companies were operating in 'pharmaceuticals or drug discovery'; while 30% were in the medical devices sector and 20% were in biotechnology.

Since the previous Queensland Biotechnology Industry Report 2008, Impedimed Limited has listed on the ASX, while Occupational & Medical Innovations Limited has joined the table by virtue of the inclusion of the Therapeutic Medicines and Devices sector in the current report. PanBio Limited exited the list due to a US\$37 million trade sale of the company in January 2008 to Inverness Medical.

Subsequent to 30 of June 2009 the following significant events occurred:

- (a) Peplin Limited was acquired by Leo Pharma in Denmark (11/2009) for US\$287.5 million (AU\$348.4 million). This transaction represented a significant positive outcome for Peplin Limited and the Queensland Life Sciences industry. The sale price was at a 75% premium to the company's 30-day volume weighted average share price (at 3 September 2009).
- (b) Occupational & Medical Innovations Limited was placed in voluntary administration.
- (c) Incitive Limited announced their purchase of Hawley Oil and Gas in February 2010, and their effective exit from the Life Sciences sector.

Table 5: Market Capitalisation of ASX-Listed Queensland Life Sciences Companies⁵

Company	Code	Life Science Sector	Market Cap (\$M)
Analytica Limited	ALT	Medical Devices	7.51
Alchemia Limited	ACL	Pharmaceuticals or Drug Discovery	56.96
Anteo Diagnostics (previously Biolayer Corporation)	ADO	Pharmaceuticals or Drug Discovery	1.80
BioProspect Limited	BPO	Biotechnology	8.28
Impedimed Limited	IPD	Medical Devices	62.72
Incitive Limited	ICV	Pharmaceuticals or Drug Discovery	3.05
OMI Limited	OMI	Medical Devices	5.24
Peplin Limited	PEP/PLI	Pharmaceuticals or Drug Discovery	87.11
Progen Pharmaceuticals Ltd	PGL	Pharmaceuticals or Drug Discovery	21.00
Tissue Therapies	TIS	Biotechnology	12.50
<i>Total</i>			<i>\$266.17</i>
<i>Average</i>			<i>\$26.62</i>

According to PricewaterhouseCoopers' BioForum publication,⁶ the listed Australian Life Sciences industry, which is comprised of 120 Biotechnology/Pharmaceutical and Medical Devices companies, had a total market capitalisation of \$31.0 billion at 30 of June 2009. Excluding major companies, CSL Limited (CSL), Cochlear Limited (COH) and Resmed Limited (RMD), the market capitalisation of the remaining 117 companies was \$4.5 billion.

The 73 pharmaceutical/biotechnology companies listed on the ASX reached a market capitalisation of \$22.8 billion, including CSL. When CSL is excluded, the market capitalisation of the remaining pharma/biotech companies was \$3.4 billion. The medical device sector (47 companies) was capitalised at \$8.2 billion or \$1.1 billion excluding major companies, COH and RMD (Figure 4).

⁵ Market Capitalisation data provided PricewaterhouseCoopers BioForum Jun09

⁶ BioForum Q4 FY09, PricewaterhouseCoopers, Jun 2009,
http://www.pwc.com.au/industry/technology/assets/BioForum_Jun09.pdf

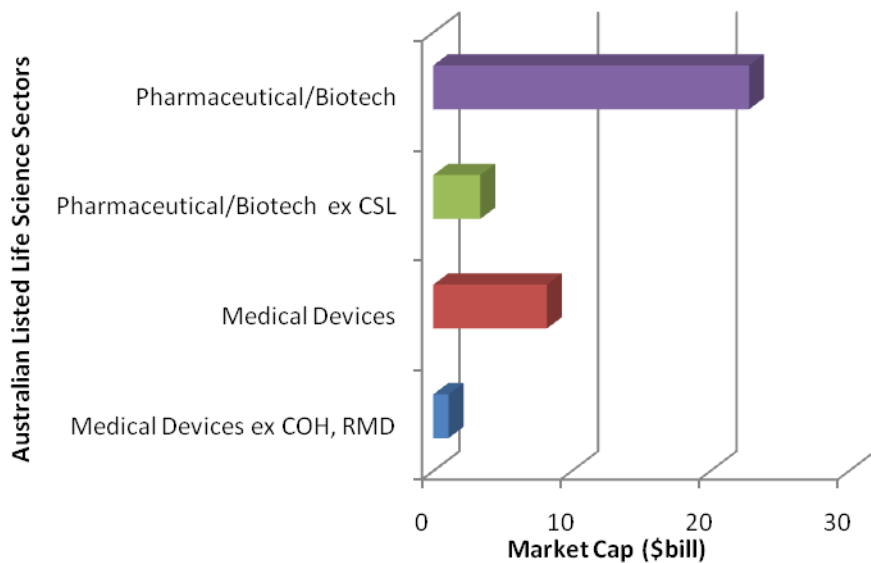


Figure 4: Total Market Capitalisation of Australian Listed Life Science Companies by Sector, 30 June 2009

Figure 5 compares the average market capitalisation of Queensland's listed firms with that of all ASX-listed Life Sciences firms in Australia, split into (1) Australian Life Science; (2) Australian Life Science without CSL; (3) Australian Life Science without CSL, RMD, COH; and (4) Queensland.

The average market capitalisation of Queensland firms was approximately 31% less than that of all Australian ASX-listed Life Sciences firms (when CSL, COH and RMD were excluded from the analysis).

Over the past three financial years, the average market capitalisation of Queensland listed Life Sciences companies has decreased relative to the nationwide average market capitalisation (without majors, CSL, Cochlear and Resmed). This is in part due to a substantial decline in the market capitalisation of Progen Pharmaceuticals and Alchemia over this period and the exit of PanBio from the market as a consequence of their acquisition by Inverness Medical (Figure 6).

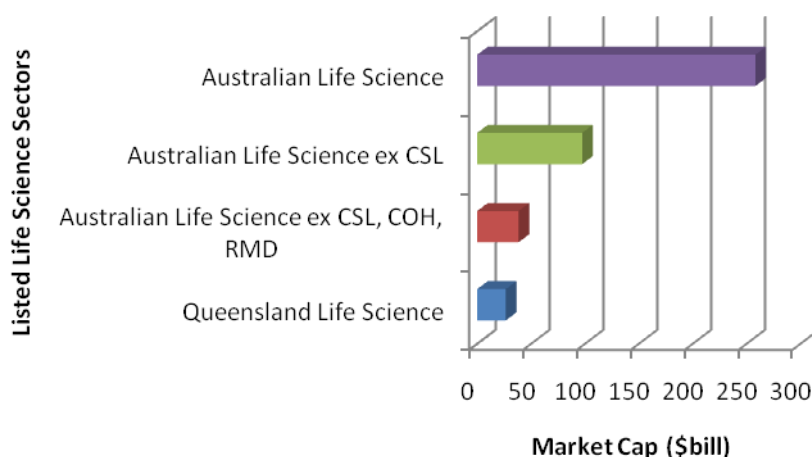


Figure 5: Average Market Capitalisation of ASX-Listed Life Science Firms, Queensland vs. Australia, 30 June 2009

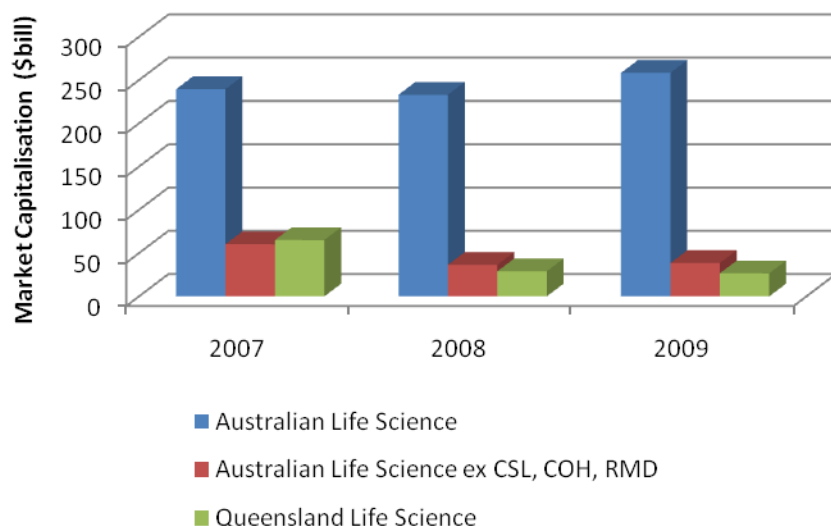


Figure 6: Average Market Capitalisation of ASX-Listed Life Science Firms, Queensland vs. Australia, at Q4 2007, 2008 and 2009

To put the listed market cap figures into perspective, the Queensland average was compared to those for New Zealand and Canada. The average size of publicly listed Life Sciences companies in Canada was higher than both Queensland and Australia (excluding majors) at \$89 million (Table 6). This likely reflects the higher maturity of the Canadian sector. Both Queensland and Australia reported a higher average market capitalisation compared to New Zealand where the figure was \$23 million. In some respects, the New Zealand Life Sciences industry may provide a useful comparator with the Queensland Life Sciences sector. Both regions have a similar population base and a similar number of resident Life Sciences organisations.⁷

Table 6: Market Cap of Queensland and Australian Life Science Firms - International Comparison (AU\$)⁸

Region	Year	Total Market Cap (\$M)	Avg Market Cap (\$M)
Queensland	06/2009	\$266	\$27
Australia	06/2009	\$31,012	\$258
Australia (ex majors; RMD, COH, CSL)	06/2009	\$4,500	\$39
Canada	12/2009	\$12,038	\$89
New Zealand (ex major; FPH)	11/2008	\$300	\$23

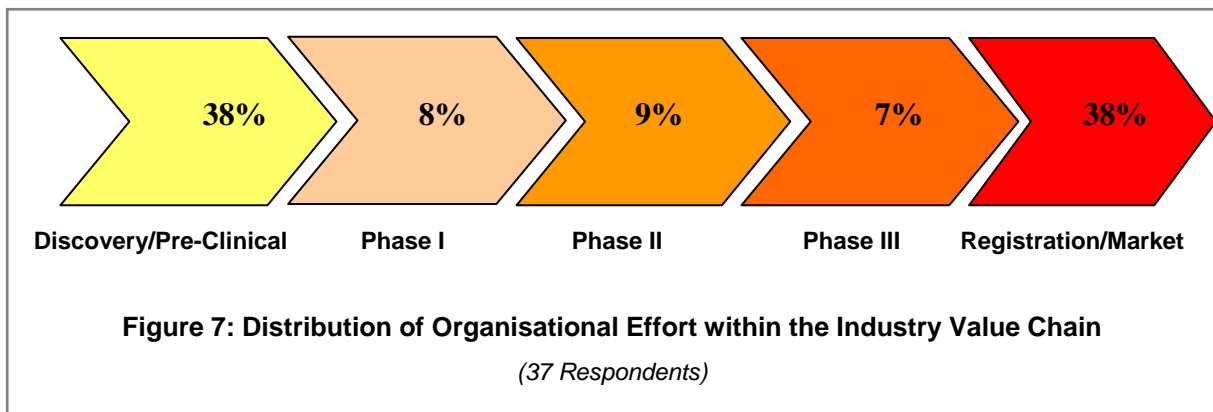
Industry Development Stage

5.3 Therapeutic Goods

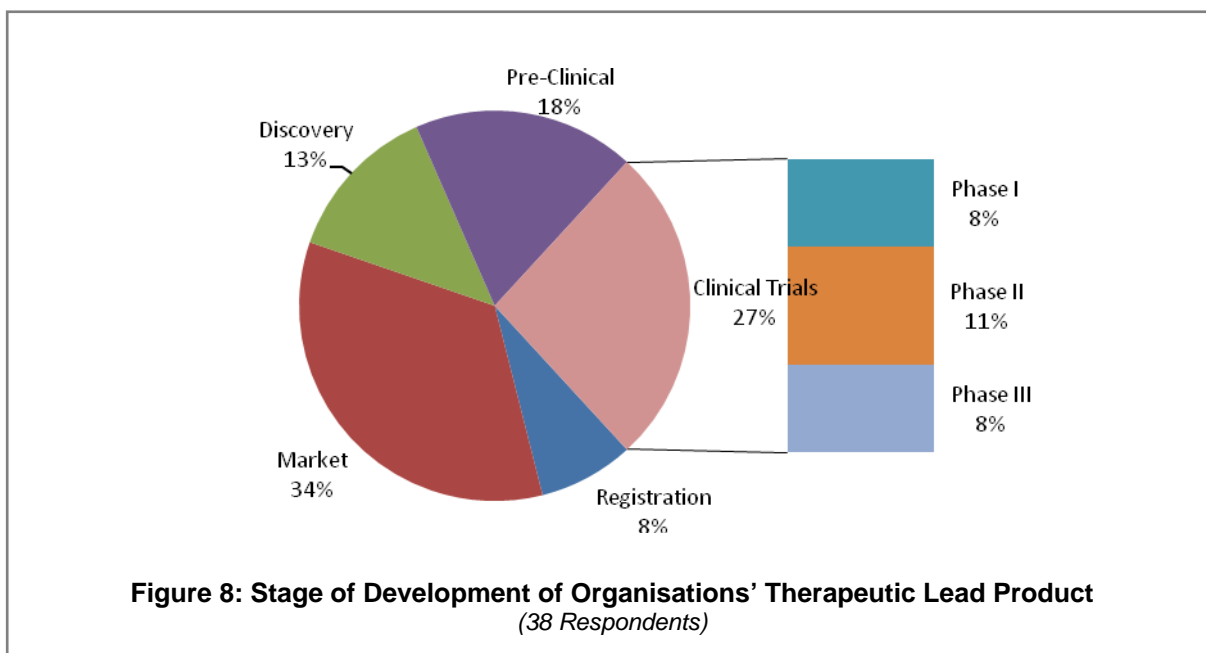
Organisations developing therapeutic goods surveyed reported that they expended equal effort in both the very early 'discovery/preclinical' phase of therapeutic development (38%) and the very late phase of the value chain i.e. Registration/Market (38%). Figure 7 shows the average for the proportion of effort dedicated to each stage of development.

⁷ NZBio New Zealand Biotechnology Industry Growth Report 2008

⁸ PwC BioForum Publication June 2009, Canadian TSX/TSXV listed life science sector data December 2009 accessed at www.tmxmoney.com/en/sector_profiles/life_science.html, NZBio New Zealand Biotechnology Industry Growth Report 2008

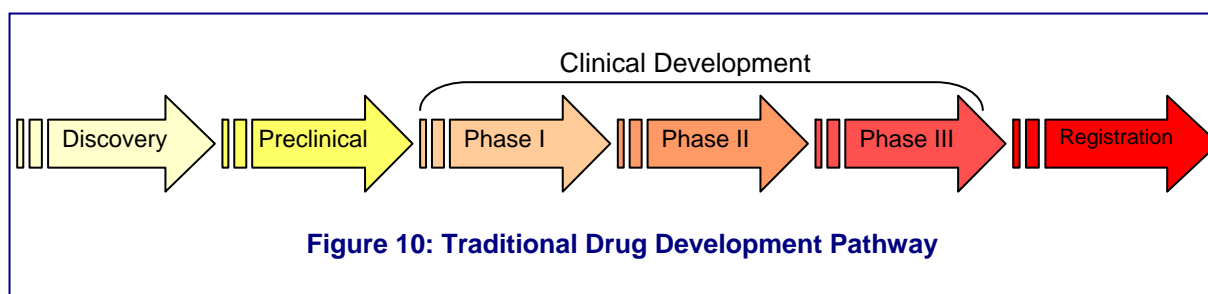


Organisations developing therapeutic goods were also asked to identify the stage of development of their lead product. 34% of respondents indicated that their lead product was already on the market. The next significant stage for lead product development was clinical trials (27%), with these products fairly evenly distributed through the three pre-registration clinical trial phases (Figure 8).



5.4 Queensland Companies in Clinical Development Phase

Development of new therapeutic products is a long, expensive and heavily regulated process. At a simplified level, drug discovery/optimisation and preclinical development is followed by clinical development and registration (Figure 10).



To achieve product registration, a new drug or biopharmaceutical product must undergo clinical development. There are three major pre-registration clinical trials phases, which are designed to

demonstrate the safety, tolerability and effectiveness of new drugs and biologicals. Estimates suggest that clinical development of a new drug candidate can cost between US\$100 - \$800 million.⁹

Pre-Registration Clinical Trial Phases

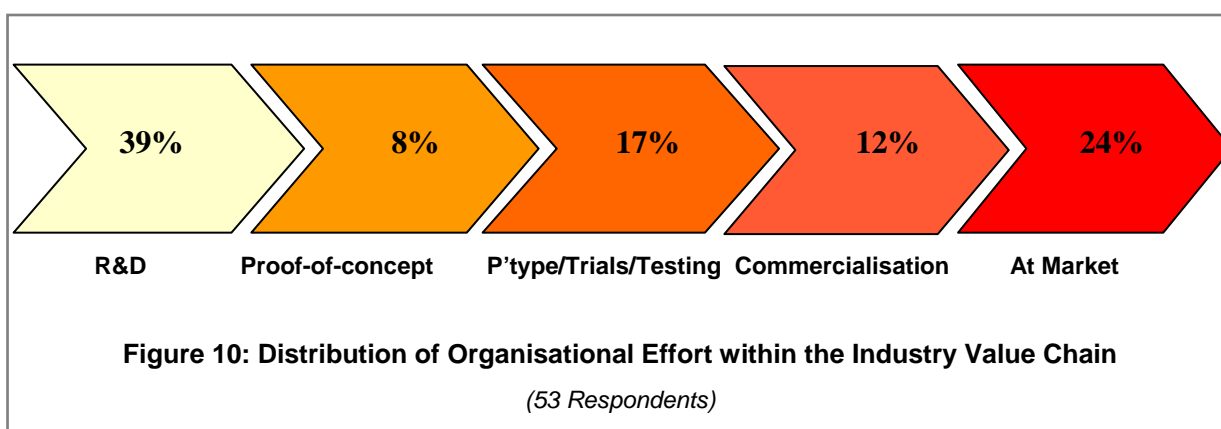
- **Phase I** clinical trials involve the administration of the new drug/biological to small numbers (e.g. 15-40) of healthy volunteers. The object of a Phase I clinical trial is to assess the safety and tolerability of the new drug or biological. Phase I trials will also provide information on routes of administration and dosage. Some Phase I trials also examine drug safety in a small segment of the target population.
- **Phase II** clinical trials are designed to investigate the efficacy and safety of the new drug or biological. Phase II trials (sometimes called proof-of-concept trials) enrol a small number (e.g. 50-200) of patients suffering the target disease, and are conducted by investigators who are specialists in the target disease.
- **Phase III** clinical trials are designed to assess whether the new drug provides a clinical benefit in the target disease in a larger number of patients (e.g. 500-3,000) and is assessed against the current standard treatment. This is also a large safety trial in which the side effects in the trial population are assessed.

Phase IV clinical trials, which are post-registration trials undertaken after the drug or biological has been approved for the treatment of a particular disease, assess the post-market safety of the drug and may examine the drug in additional disease states. These post-registration trials were not subject to analysis in the survey.

Based on data from the survey, there are at least ten therapeutics which originated in Queensland that are currently in clinical development. Organisations were originally only asked to identify the stage of development for their lead product. However since one or more of these organisations may have multiple therapeutics in clinical development, each was contacted subsequently to indicate whether this was the case. The primary data was also cross-checked against publicly available information for those respondents in order to determine if additional products are in clinical development. One of the respondent research organisations reported a further 6 therapeutics in clinical development in FY2009. In addition, a biotechnology company, which did not respond to the survey, has three formulations of their lead therapeutic in clinical trials for various indications.

5.6 Non-Therapeutic Goods

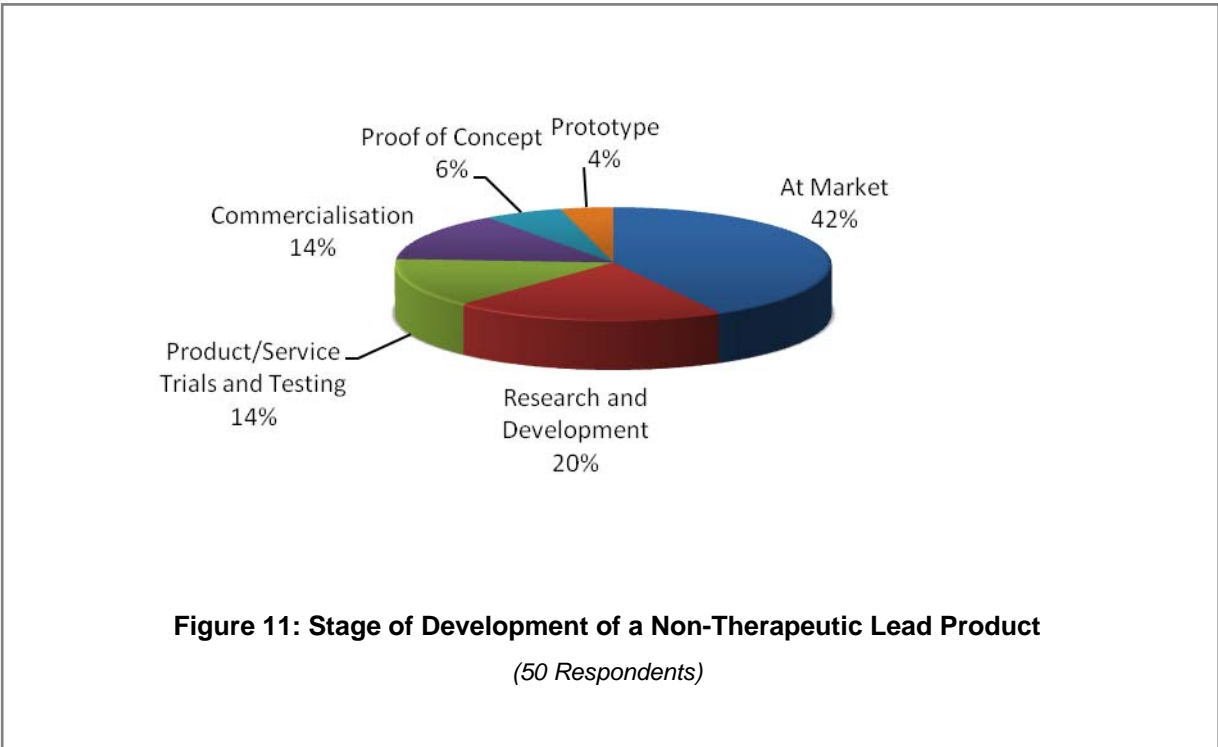
Of the surveyed organisations that were developing non-therapeutic goods, the majority reported that they operated primarily in the early 'R&D' phase of development (39%). A high percentage of effort was also dedicated to products and services already at market (24%). Figure 10 shows the proportion of effort dedicated to specific activities.



Organisations developing non-therapeutic goods were also asked to identify the stage of development of their lead product. 42% of respondents indicated that their lead product was already on the market.

⁹ Fee, R., "The Cost of Clinical Trials", *Drug Discovery & Development* (2007) March 10 (3) 32.

The next most significant stage for lead product development was R&D (20%), followed by commercialisation and product/service trials and testing (both 14%; Figure 11).



Case Study 1

Institute of Health and Biomedical Innovation

The Institute of Health and Biomedical Innovation (IHBI) is the largest research institute at the Queensland University of Technology (QUT). It is based in a \$70 million facility at the Kelvin Grove Urban Village in Brisbane.

Opened in 2006, IHBI research encompasses three broad areas of human health research – prevention, mind and body health, and recovery. Professor Ross Young is the Executive Director of the Institute. With more than 750 institute members including 360 PhD students, IHBI draws from a wide base of leading health and biomedical researchers including engineers, medical practitioners, molecular biologists, infectious disease specialists, nurses, psychologists, public health experts, vision scientists, movement physiologists and statisticians.

IHBI's researchers are clustered into five flexible research domains or teams that emphasise multidisciplinary collaboration:

- Cells & Tissue (C&T)
- Human Health & Wellbeing (HHWB)
- Injury Prevention & Rehabilitation (IP&R)
- Medical Device (MD)
- Vision Improvement (VI)

IHBI has ongoing links with local and interstate hospitals, health researchers' worldwide, clinical specialists and industry professionals. IHBI also benefits from QUT's highly successful track record in commercial partnerships and sustainable biotechnology companies. By working with a broad network of health and medical professionals, IHBI believes it is possible to bridge the gap between science and better health for everyone.

IHBI has been designed as an institute that fosters creativity, innovation and collaboration in biomedical research. The Institute is involved in developing products such as vaccines and tests; medical, ophthalmic and rehabilitation devices; and health management systems.

Recent Success

IHBI's track record of achievements demonstrates a commitment to 'making better health a reality in our lifetime'. Recent successes include:

- A \$28 million Commonwealth Government grant to establish the Wound Management Innovation Cooperative Research Centre (WMICRC) to be based at IHBI. The WMICRC will bring together an interdisciplinary network of researchers, clinicians and health service providers from across Australia who will deliver new techniques and technologies that will greatly improve outcomes and the quality of life of Australians with chronic wounds.
- IHBI's expertise in prostate cancer researcher has culminated in a \$7.5 million Commonwealth Government grant to establish the Australian Prostate Cancer Research Centre – Queensland (APCRC – Q). IHBI researcher Professor Colleen Nelson is the Centre's Executive Director, and was awarded a Smart Futures Premier's Fellowship in 2009 of \$1.25 million over five years to develop new, targeted treatments for advanced prostate cancer.
- OnTrack (www.ontrack.org.au), a new online program to support people with a mental illness or alcohol use disorder, was launched in November 2009, based on IHBI research. The OnTrack website provides a confidential 24-hour online treatment service utilising multimedia technology. The website offers a number of tools and resources designed to help people with alcohol and depression problems self manage their condition. Development of the OnTrack programs was supported by a \$600,000 grant from Queensland Health.



6.0 Employment

SNAPSHOT

- *Survey respondents employed a total of 6,673 Full Time Equivalent (FTE) personnel.*
- *Queensland-wide, the sector employed an estimated 19,731 people, with 13,442 (69%) of those estimated to be employed by private industry.*
- *An estimated 9,802 FTEs were employed in the TMD sector while an estimated 9,929 FTE's were employed in the biotechnology sector.*
- *Employment estimates for the Queensland Life Sciences industry increased by 27% from those reported in the 2007 study.*
- *32.0% of all staff employed by survey respondents were classified as R&D professionals or technical support staff.*
- *An estimated \$1,078 million was expended on salaries across the entire Queensland Life Sciences industry in FY2009 including \$149 million by research organisations and \$929 million by companies.*

Life Science Sector Employment Indicators

6.1 Reported Life Science Sector Employment

The 119 organisations that provided employment data in the survey employed a total of 6,673 Full Time Equivalent (FTE) employees. The number of FTEs per organisation ranged from one in some start-up companies to several hundred employees in university and research institutes.

The total number of FTE employees reported by 52 respondents from the TMD division of the Life Sciences sector was 2,833, or an average of 54 employees per organisation. The 67 biotechnology organisations reported 3,839 FTE employees, or an average of 57 employees per organisation.

The total number of FTEs employed in each of the six industry sub-sectors is tabulated below (Table 7). For this analysis, organisations were defined by only one industry sub-sector. The Pharmaceuticals or Drug Discovery sub-sector was the largest employer with 45% of all FTEs reported to be working in this area.

	Number of Organisations	Number of FTEs	Proportion of Total FTEs
Pharmaceuticals or Drug Discovery	30	3,006	45.0%
Biotechnology	17	1,205	18.1%
Industry Service Provider	24	849	12.7%
Complementary Medicines	12	742	11.1%
Other	9	418	6.3%
Medical Devices	21	291	4.4%
Animal Health	6	162	2.4%
Total	119	6,673	100%

The average number of FTEs employed by surveyed research organisations was 112; approximately 2.9 times that of surveyed companies at 39 FTEs per organisation (Table 8).

Companies (91)		Research Organisations (28)	
Total FTEs	3,538	Total FTEs	3,135
Average FTEs	39	Average FTEs	112
Median FTEs	10	Median FTEs	65
<i>All Queensland Life Science Companies (Estimated*)</i>	<i>13,442</i>	<i>All Queensland Life Science Research Organisations (Estimated*)</i>	<i>6,289</i>

* Total population estimates were derived using multiple imputation methods. See section in Appendices entitled 'Analysis of Primary Survey Data' for a description of the methodology

6.2 Total Estimated Life Science Industry Employment

Based on the average employment per organisation across all respondents, it was estimated that 19,731 FTEs were employed by the 295 Life Sciences companies, universities and research institutions across the State in 2009.

Of the estimated 19,731 Queensland Life Sciences employees, 9,929 were employed in the biotechnology sector and an estimated 9,802 were employed across the TMD sector of the industry. As expected, estimates indicate that the majority of biotechnology employees (61%) were employed by research organisations. Estimates indicate that almost all employees in the TMD sector (99%) were employed by companies (Table 9).

Queensland Life Science Industry Commentary

	Companies	Research Organisations	Total
Biotech	3,760	6,169	9,929
TMD	9,682	120	9,802
Total Life Science Industry	13,442	6,289	19,372

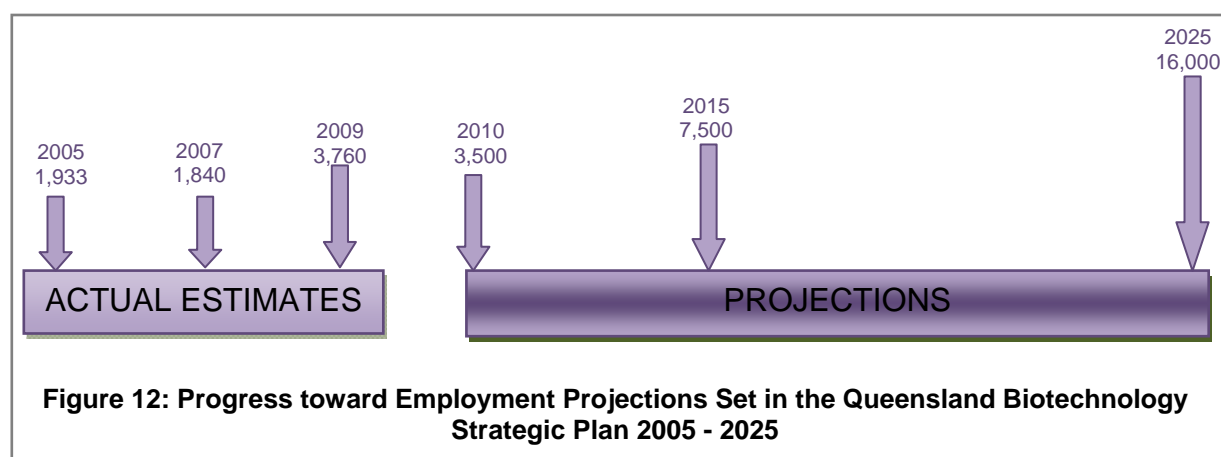
	2007	2009	Change
Biotech			
All respondents	7,630	9,929	30%
Companies	1,840	3,760	104%
Research Organisations	5,790	6,189	7%
TMD			
All respondents	7,939	9,802	23%
Companies	ND	9,682	N/A
Research Organisations	ND	120	N/A

The current FY2009 employment estimate of 19,731 suggests an additional 4,162 employees have joined the industry since 2007 (combined estimate of 15,569 employees from the previous Biotechnology and TMD Surveys in FY2007) (Table 11).

Year/Sector	Reported FTEs	Average No. of FTEs	Estimated Total FTEs	Estimated Total Life Science FTEs	Change
2007	TMD	1,888	38	15,569	
	Biotech	3,154	45		
2009	TMD	2,833	54	19,731	27%
	Biotech	3,839	57		

* Total population estimates were derived using multiple imputation methods. See section in Appendices entitled 'Analysis of Primary Survey Data' for a description of the methodology

Figure 12 shows the projections for employment set in the *Queensland Biotechnology Strategic Plan: 2005–2015*. Overlaid onto this is the estimated employment attributed to Queensland biotechnology companies (i.e. excluding research organisations) in 2005, 2007 and 2009.



6.3 Employment in the Australian Life Science Industry

It is difficult to accurately ascertain the total number of FTE employees across the Australian Life Sciences industry.

According to IBISWorld data reported in 2009, the Australian Life Sciences industry supports approximately 40,000 jobs in the Biotechnology (7,025), Pharmaceutical (including pharmaceutical manufacturing) (19,100) and Medical and Surgical Equipment manufacturing (12,776) sectors.¹⁰ Medical Devices contributes a further 11,500 jobs to the total Australian Life Sciences industry.¹¹ Whilst this total of 50,401 employees would suggest that the Queensland sector (at 19,731 FTEs estimated in the current survey) represents over a third of the industry, the current Queensland employment estimates are not directly comparable to IBISWorld estimates. In particular, it is unlikely that IBISWorld would include, for example, estimates from all of the university units involved in Life Sciences. Moreover, activities within industrial or white biotechnology for example, may not be comprehensively captured in the IBISWorld classifications.

Table 12 below shows the location of the various sectors of the Australian Life Sciences industry by state or territory, according to IBISWorld.

State	Biotechnology	Pharmaceutical Manufacturing	Medical and Surgical Equipment Manufacturing	Pharmaceutical Wholesaling
Victoria	48%	42%	35.8%	40%
New South Wales	20%	26%	26.8%	25%
Queensland	15%	16%	17.8%	15%
South Australia	9%	8%	11.1%	10%
Western Australia	6%	6%	6.7%	7%
Tasmania	1%	2%	1.8%	1%
ACT	1%	1%	-	1%
NT	-	-	-	1%

NB: IBISWorld Data is sourced directly from their reports. The total of their figures exceeds 100% in one case.

The Australian Government Department of Innovation, Industry, Science and Research (DIISR) also provide a range of statistics on various segments of the Australian Life Sciences industry. According to their website, the Australian Life Sciences industry supported almost 66,000 employees in FY2007. This figure comprised the Pharmaceutical (40,000, with a third in manufacturing), Biotechnology (14,189) and Medical Devices and Technology (11,500) sectors.¹² These figures would place Queensland's contribution to the Australian Life Sciences sector in 2007 at approximately 24% (combined figures from 2007 Biotechnology and TMD Surveys). More recent figures from DIISR are not available.

6.4 Industry Estimates of Employment Growth

Respondents to the survey forecast an average growth in the number of FTEs employed of 4.3% over the next 12 months. The number of FTEs was forecast to rise to 6,956 (up from 6,673) or an average of 57 (up from 56) employees per surveyed organisation.

¹⁰ IBISWorld, X0001 Biotechnology in Australia, June 2009; IBISWorld, C2543 Pharmaceutical Product Manufacturing in Australia, June 2009; IBISWorld, C2832 Medical and Surgical Equipment Manufacturing in Australia, August 2009; IBISWorld, F4797 Pharmaceutical Wholesaling in Australia, October 2009

¹¹ Medical Devices and Medical Technology Fact Sheet, Department of Innovation, Industry, Science and Research, at <http://www.innovation.gov.au/Industry/MedicalSurgicalandOpticalEquipment/Pages/MedicalDevicesandMedicalTechnology.aspx>

¹² <http://www.innovation.gov.au/Pages/default.aspx>; accessed 1st May 2010

Queensland Life Science Industry Commentary

The average increase in FTEs employed in the sector over the next three years was forecast to be 36% (compound annual growth rate of 10.8%). This would bring total FTEs across the respondents to 9,056 in 2012 (an average of 75 employees per organisation) (Table 13).

Table 13: Predicted Employment Growth in the Queensland Life Science Industry (121 Respondents)						
	Actual - FY2009		Forecast - 12 Months		Forecast - 3 Years	
Total FTEs Across ALL Respondents	6,673		6,956		9,056	
Average per Respondent	56		57		75	
Increase (CAGR*) Across ALL Respondents			4.3%		10.8%	
	Actual - FY2009		Forecast - 12 Months		Forecast - 3 Years	
	Company	RO	Company	RO	Company	RO
New FTEs	-	-	260	24	1,516	868
Total FTEs	3,538	3,135	3,798	3,158	5,054	4,002
Increase for the Period			7.4%	0.8%	42.9%	27.7%
CAGR*					12.8%	8.5%

* Compound annual growth rate
'RO' = Research Organisation

The employment growth forecasts by respondents to 2012 were extrapolated for the whole State. These industry estimates suggest that a total of 26,816 people may be employed across all companies and research organisations in the Queensland Life Sciences industry by the end of 2012. This represents an increase of 7,085 full-time jobs in the sector over the next three years, up from the 2009 estimate of 19,731 FTEs.

6.5 Employment Categories

Almost one third (31.7%) of employees across surveyed organisations were employed in administrative/human resources and management/executive roles. Another third (32.0%) were employed as R&D professionals, other technical staff, or in R&D support roles. Marketing and sales roles accounted for 10.6% of employees and manufacturing and bioprocessing, 9.2%. Remaining staff were employed in quality assurance (7.2%), regulatory (2.7%) and other categories (6.6%; Table 14).

Table 14: Breakdown of Work Categories by Organisation Classification (118 Respondents)			
	All Respondents	Company	RO
Administration/Human Resources	14.9%	14.5%	16.3%
Quality assurance and clinical trials	7.2%	8.7%	2.4%
Management/Executive	16.8%	20.0%	6.3%
Manufacturing and bio processing	9.2%	11.7%	1.2%
Marketing and sales	10.6%	13.8%	0.3%
R&D professionals and technical staff	25.8%	18.5%	49.3%
Regulatory professionals	2.7%	2.7%	2.4%
Support staff delivering R&D related services	6.2%	3.9%	13.7%
Other	6.6%	6.2%	8.0%

Queensland Life Science Industry Commentary

As might be expected, companies and research organisations reported disparate distributions of staff among work categories. In research organisations, 63.0% of all staff were involved in performing or supporting R&D and technical work. Only 22.4% of company employees were engaged in such activities. This is a reflection of several factors including: (1) the fact that R&D is the core business activity of research organisations; (2) smaller Life Sciences companies are likely to be outsourcing some or all of their R&D activity to research institutions; and (3) companies reported considerable activity at the later stages of the value chain (i.e. at market; see section 5.4 and 5.6) necessitating the allocation of staff resources across various marketing and administrative roles. Accordingly, roles in marketing/sales and manufacturing/bioprocessing were almost exclusively found in companies.

The comparative breakdown of work categories across the sector in FY2007 and FY2009 is provided in Table 15. The 2007 Queensland Biotechnology Industry Survey showed a relatively high percentage of staff engaged in R&D roles compared to the Therapeutic Medicines and Devices sector. The TMD sector includes established companies (97% of respondents in 2007 were companies), whose core activities typically focus on the sale of existing products already on the market, while the Biotechnology sector generally operates earlier in the development cycle (only 67% of respondents were companies), requiring greater numbers of R&D and technical staff.

Work Category	Biotechnology Survey FY07	TMD Survey FY07	Life Science Survey FY09
R&D Professionals and Technical Staff	43.3%	17.1%	25.8%
Support Staff Delivering R&D Related Services	3.1%	4.5%	6.2%
Marketing and Sales	7.6%	26.6%	10.6%
Management/ Executive	19.0%	19.1%	16.8%
Administration and Human Resources		10.7%	14.9%
Quality Assurance and Clinical Trials	6.6%	7.1%	7.2%
Regulatory Professionals	3.7%	ND	2.7%
Manufacturing and Bioprocessing	5.3%	14.9%	9.2%
Other*	11.4%	ND	6.6%

* Other includes mentoring, business support, capital raising, commercialisation, directors and IT support.

6.6 Wage and Salary Expenditure

Respondent organisations (77) reported \$250 million expenditure on wages/salaries, an average of \$3.2 million per organisation with a median of \$570,000. Wage and salary expenditure equated to 29% of total expenditure per organisation.

Large research organisations (14) reported an average annual wage and salary expenditure almost twice that of companies (63) and a median annual wage expenditure almost eight times that of companies (Table 16).

	Companies	RO	Total
Number of Organisations	63	14	77
Total Wage and Salary Expenditure (\$M)	\$174.4	\$75.7	\$250.1

Queensland Life Science Industry Commentary

Average Salary Expenditure per Organisation (\$M)	\$2.8	\$5.4	\$3.2
Median Salary Expenditure per organisation (\$M)	\$0.43	\$3.4	\$0.57

It was estimated that Queensland Life Science organisations spent approximately \$1,078 million on wages/salaries in their last financial year (Table 17). This amount is 37% higher than the combined estimates in the Queensland Biotechnology Industry and TMD Industry Reports 2008.

Table 17: Total Wage and Salary Expenditure (\$M) by Queensland Life Science Organisations

	2007		2009	
	Biotechnology	TMD	Biotechnology	TMD
Total Reported Salary Expenditure	\$104	\$62.6	\$104	\$146
	\$167		\$250	
Average Salary Expenditure per Organisation	\$2.4	\$1.4	\$2.5	\$4.1
	\$1.9		\$3.2	
Total Salary Expenditure Queensland Life Science Industry (Estimated)	\$502	\$287	\$387	\$691
	\$789		\$1,078	

The survey data suggested an average annual salary of \$78,107 for the private sector (n=58) compared to research organisations (n=14), where the average annual salary was \$75,819 (Table 18). The reliability of this data cannot be assured as university units will typically have to approximate the number of staff deemed to be working in Life Sciences and then estimate salary expenditure, whereas companies will typically have a more defined workforce in that regard and therefore more accurate data.

Table 18: Average Wages of Life Science Industry Employees in Queensland 2007 and 2009

Organisation	2009			2007	
	Life Sciences	Biotechnology	TMD	Biotechnology	TMD
All respondents	\$77,732	\$84,022	\$70,383	\$65,045	\$48,523

6.7 Comparative Life Science Wages

Respondents to the Queensland Life Sciences Industry Survey 2010 reported employment and expenditure estimates that yielded an average annual salary estimate of \$77,732. Across all industries, the average annual salary in Australia and Queensland in 2009 was \$62,618 and \$61,464, respectively.¹³ For the purposes of this report, a measure of the Australian Life Sciences wage was determined by taking a simple average of three ABS salary data reporting categories (i.e. Scientific, Education, Health-related) to arrive at an average annual Australian Life Sciences salary of \$67,392.¹⁴

A comparison of the average Queensland Life Sciences industry wage to selected countries is presented in Table 19. The wage reported for the US *Life Sciences industry* is substantially lower than that reported in the 2007 Biotechnology Report for the US *Biotechnology industry* (2006 data – \$71,205). This may be due to the inclusion of the large pharmaceutical manufacturing sector and a higher exchange rate. The data presented below suggests that the average Queensland Life Sciences salary is higher than average Life Sciences wages in several other countries. However, this is a simple average of survey data and it does not take into account any additional economic factors.

¹³ Australian Bureau of Statistics, 6302.0 - Average Weekly Earnings, Australia, Aug 2009, Persons; Full Time; Adult; Total earnings ; Professional, Scientific and Technical Services, Education and Training; and Health Care and Social Assistance.

¹⁴ Ibid.

Queensland Life Science Industry Commentary

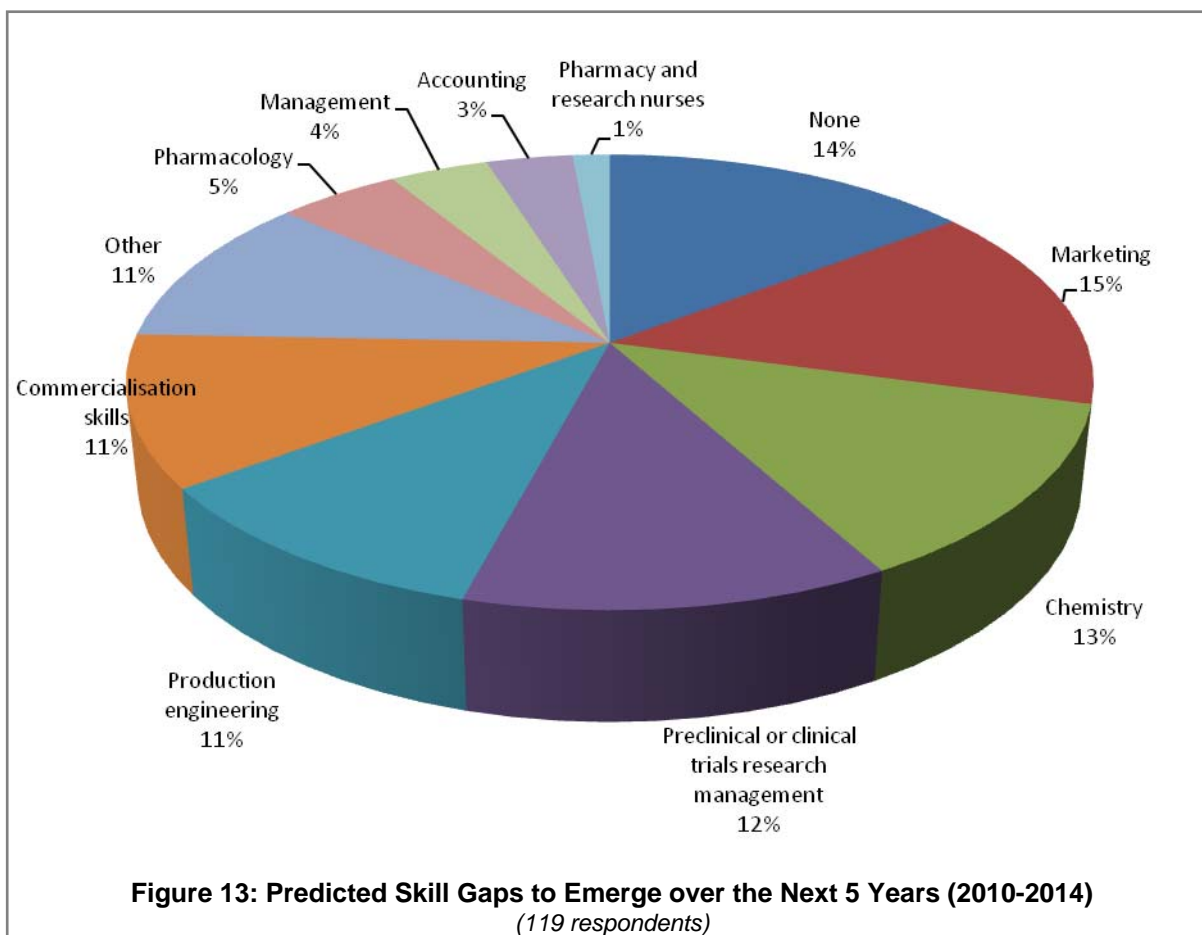
Table 19: Estimated Average Life Science Wages: An International Comparison¹⁵

Region	Source	Year	Average Annual Salary (AU\$)
Queensland	Current Survey	2009	\$77,732
Australia	ABS	2009	\$67,392
USA	US Dept. of Labor	2008	\$56,888
Canada	Statistics Canada	2009	\$56,761
Sweden	Statistics Sweden	2008	\$60,317

6.8 Predicted Skill Gaps

Respondents (119) identified numerous skill gaps, which likely reflect the breadth of the organisations surveyed. In some cases, respondents nominated two or more specific anticipated skill gaps. As a consequence, each skill gap was analysed as a percentage of the total for all gaps nominated, rather than against the number of respondent organisations.

Marketing skills (15%) were identified as the most significant expected gap over the next five years (Table 20). 14% of respondents did not anticipate any skill shortages for their organisation over the next 5 years (Figure 13).



¹⁵ Note that the estimated wages presented are based on proxies for the Life Sciences industry. Detail on the approach used to calculate these estimates is provided in the methodology section in the appendix to this report.

Table 20: Anticipated Skill Gaps over the Next 5 Years (2010/14) (119 Respondents)

Ranking	Skill Gap	Percentage*
1	Marketing	15%
2	Chemistry	13%
3	Preclinical/Clinical trial management	12%
4	Production Engineering	11%
5	Commercialisation skills	11%

* Proportion of the total number of nominated skill gaps, rather than total number of respondents to the question

Companies and research organisations showed differences in their expectations for future skill deficits (Table 21). For companies, 'Marketing' was anticipated to be the largest skill gap, while research organisations identified 'Chemistry' as the skill area of greatest predicted shortage.

Table 21: Top 3 Anticipated Skill Gaps by Organisation Classification 2009-2014

Rank	Companies		Research Organisations	
1	Marketing	(18%)	Chemistry	(22%)
2	Production Engineering	(13%)	Preclinical/Clinical Trial Management	(15%)
3	Commercialisation	(11%)	Commercialisation Skills	(9%)
	Preclinical/Clinical Trial Management	(11%)	Pharmacology	(9%)
	None (14%)		None (15%)	

There are several possible reasons for the potential deficit of chemistry skills predicted by surveyed research organisations. Chemistry skills are essential in many diverse industries including mining, pharmaceuticals, biotechnology, chemicals and plastics, energy, food and agriculture and the future shortage of chemistry skills predicted by the research sector may reflect the demand for chemists in industries outside biotechnology/pharmaceuticals, such as in mining. Conversely, this skill shortage may indicate the movement of chemists from research institutions to public and private industry or to careers outside of their specialisation e.g. patent attorney, teacher.

Additionally, it is possible that research organisations may be observing a shortage in chemistry skills as a result of a long term decline in the number of tertiary qualified chemistry graduates. The 'Future of Chemistry Study: Supply and Demand for Chemists' Report, commissioned by The Royal Australian Chemical Institute (2005), heralded major challenges facing the discipline of chemistry. It was reported that the number of students studying chemistry at secondary and tertiary levels had fallen over the 10 years until 2005 and, consequently, Australia was not training sufficient chemists to meet the future demands of the biotechnology, nanotechnology, mining and energy sectors. The report indicated that a similar 'supply problem' was identified in many OECD countries.



Case Study 2

BioGlobal Ltd.

BioGlobal was established in March 2000 to commercialise technology developed by Stephen Sexton, BioGlobal Director and Principal Scientist. Since 2000, BioGlobal has progressively developed its product portfolio, which is focused on insect behaviour modifying chemicals (IBMC). Although these biochemicals have a long history in various research and scientific institutions around the world, BioGlobal is at the forefront of this exciting field leading the development of a comprehensive range of products for pest and insect management.

BioGlobal aims to become a profitable global bioscience company by developing biochemical technologies for the major pest management market opportunities created by the trend to clean, green and naturally-based products. BioGlobal focuses on the development and marketing of the next generation of environmentally friendly biochemical products for the global crop protection, animal health and consumer markets. The model is to create environmentally safe pesticide products from the commercialisation of Intellectual Property either generated by BioGlobal's Research and Development program, or by acquisition.

The Company's novel and innovative products are created by combining chemistry, entomology (insect behaviour) and polymer engineering. Products that replace normal toxic chemicals are based on two green technology platforms - Mating Disruption and Attract and Kill. Mating disruption describes the use of pheromone chemicals (insect smells) in dispensers to disrupt the mating habits of insects. Attract and Kill involves the use of Pheromones and Kairomones (plant smells) to attract insects to insecticide-laced baits or mass traps. BioGlobal's pest management products can reduce conventional chemical use by up to 98%. The technology can overcome challenges associated with pest resistance to conventional chemicals while protecting the delicate balance of the eco-system.

BioGlobal has established competitive, cutting edge manufacturing facilities in Australia and China. The Company has successfully completed trials of their Attract & Kill technology in South Africa and the registration process is underway. A similar development and registration process is significantly advanced in China. The Company sells or intends to sell, into priority global markets via exclusive distribution agreements with companies who have in place direct access to the end-user. In this way the company uses the existing chemical distribution network to launch, penetrate, consolidate and support its products. In turn, these companies provide feedback on market trends and product targets to focus on profitable, major category sales opportunities.

7.0 Economic Performance

SNAPSHOT

- *The estimated total income received by the Queensland Life Sciences industry was \$4.94 billion in FY2009, up from \$3.13 billion in FY2007 (combined total).*
- *Surveyed organisations generated a total of 78% of total income from the sale of goods and services in FY2009.*
- *The estimated total income received from sales of goods and services across the entire Life Sciences sector in Queensland in FY2009, was \$3.25 billion for companies and \$0.75 billion for research organisations.*
- *The estimated total grant income received by the Queensland Life Sciences industry was \$508 million in FY2009.*
- *The estimated Life Sciences R&D expenditure across the entire Queensland industry in FY2009 was \$803 million.*
- *Research organisations accounted for 28% of all capital expenditure reported by respondents for FY2009. It was estimated that capital expenditure across the entire Queensland industry in FY2009 was \$253 million.*
- *Overall business sentiment was positive with the majority of respondents (71%) expecting income to increase over the following year and over the next 3 years (88%; CAGR 40%).*

Queensland Life Science Industry Survey Results

Income

7.1 Total Reported Income

The income recorded for the 2009 financial year by the survey respondents (91) totalled \$1.246 billion. The average revenue across respondents was \$13.7 million and the median revenue was \$1.5 million (range \$40,631 - \$390 million).

The income reported by biotechnology respondents (50) totalled \$447 million, while their average revenue was \$9.0 million and their median revenue was \$2.3 million.

TMD respondents to the survey (41) reported a total income of \$799 million. Their average revenue was \$19.5 million and their median revenue was \$1.1 million.

The average income reported for companies was similar to that reported by research organisations (Table 22). By contrast, the median income for companies was approximately 5-fold lower than that reported for research organisations (Table 23).

Table 22: Income in the Queensland Life Science Industry, Companies vs. University/Research Institutions FY2009 <i>(91 Respondents)</i>			
Companies (74)		Research Organisations (17)	
Total Income	\$1,003 million	Total Income	\$243.3 million
Average Income	\$13.6 million	Average Income	\$14.3 million
Median Income	\$1.2 million	Median Income	\$6.2 million

Table 23 shows the total income reported for organisations within six industry sub-sectors.

Table 23: Total Income by Industry Sub-Sector FY2009 <i>(91 Respondents)</i>				
	Number of Organisations	Organisations reporting income	Income (\$M)	Average (\$M)
Pharmaceutical and Drug Discovery	37	21	\$652	\$31
Complementary medicine, functional foods /beverages	13	9	\$122	\$14
Medical Devices	23	15	\$72	\$5
Animal Health	6	5	\$16	\$3
Biotechnology	18	16	\$185	\$12
Industry Service Provider	26	20	\$66	\$3
Other	11	5	\$133	\$27
Total	134	91	\$1,246	N/A

Based on the average total income per organisation, it was estimated that the Queensland Life Sciences industry generated a total of \$4.94 billion in income in the year to June 2009 including \$3.84 billion by companies and \$1.10 billion by universities and research institutions (Table 24 and 25).

Table 24: Estimated Queensland-Wide Life Science Industry Income (\$M) FY 2009			
	Companies	Research Organisations	Total
Biotech	\$1,093	\$1,092	\$2,185
TMD	\$2,751	\$7	\$2,758
Queensland Life Science Industry (Estimated)	\$3,844	\$1,099	\$4,943

Queensland Life Science Industry Survey Results

	2007	2009	Change
Biotech			
All respondents	\$896	\$2,185	144%
Companies	\$395	\$1,093	177%
Research Organisations	\$501	\$1,092	118%
TMD			
All respondents	\$2,234	\$2,758	23%
Companies	ND	\$2,751	N/A
Research Organisations	ND	\$7	N/A

Compared to the estimates for the Biotechnology Industry in 2007, total income generated by companies was \$395 million in 2007 (44% of total) and \$1,093 million in 2009 (50% of total). Total income generated by Queensland Biotechnology research organisations was \$501 million in 2007 (56% of total) and \$1,092 million in 2009 (50% of total).

Figure 14 shows the projections for revenue set in the *Queensland Biotechnology Strategic Plan: 2005–2015*. Overlaid onto this is the estimated income attributed to Queensland biotechnology companies (i.e. excluding research organisations) in 2007 and 2009.

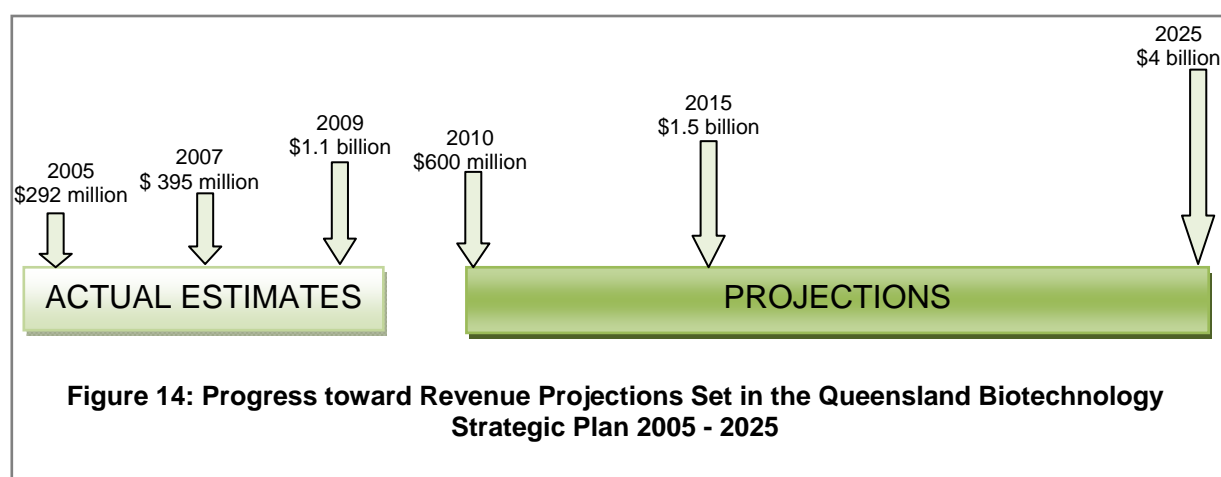


Figure 14: Progress toward Revenue Projections Set in the Queensland Biotechnology Strategic Plan 2005 - 2025

7.2 Sources of Income

The majority of income across all respondents (90) was generated from the sale of goods or services (78%). Grant income provided 13% of income, while a relatively small proportion (4%) was derived from licenses or royalties. Other income sources, including interest, consultancy fees, state government funding allocation, central institutional funding, philanthropy and the R&D Tax concession, represented 5% of the total income of the industry (Figure 15).

Queensland Life Science Industry Survey Results

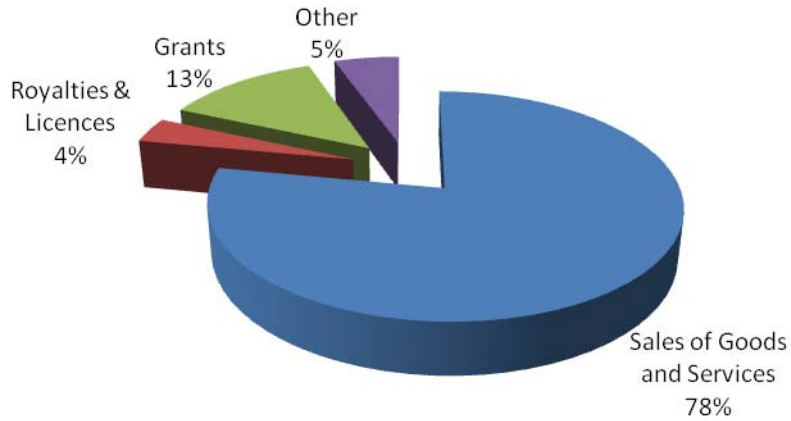
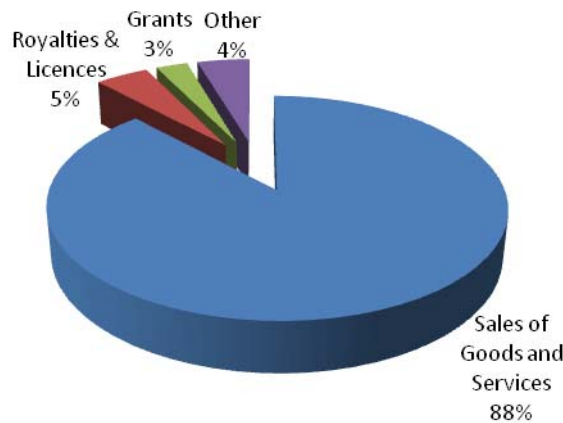


Figure 15: Total Income Generated by Respondent Organisations, by Income Category
(90 Respondents)

Income sources reported for companies and research organisations differed markedly. Companies reported that 88% of their income in FY2009 was sourced from the sale of goods and services with 3% sourced from grants (Figure 16A). Research organisations reported 37% of income from the sale of goods and services and 54% of total income derived from grants (Figure 16B).

A



B

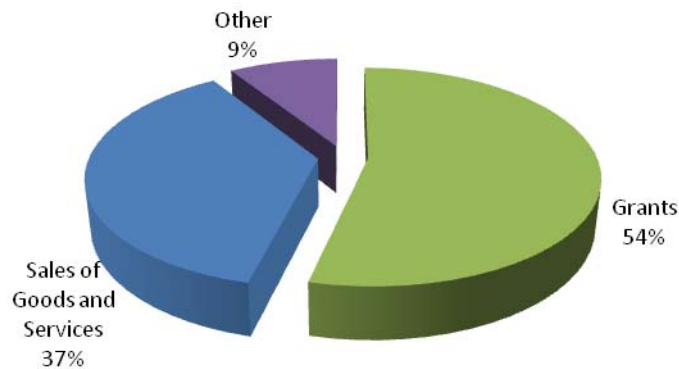


Figure 16: Total Income Generated by (A) Companies and (b) Research Organisations, by Income Category
(90 Respondents)

Queensland Life Science Industry Survey Results

Revenue from the sale of goods and services was estimated to have made up the majority of the \$4.94 billion in estimated total income in FY2009 (Table 26).

Type of Income	Estimated Income (\$M)
Goods and Services	\$3,997
Royalties	\$222
Grants	\$508
Other	\$216

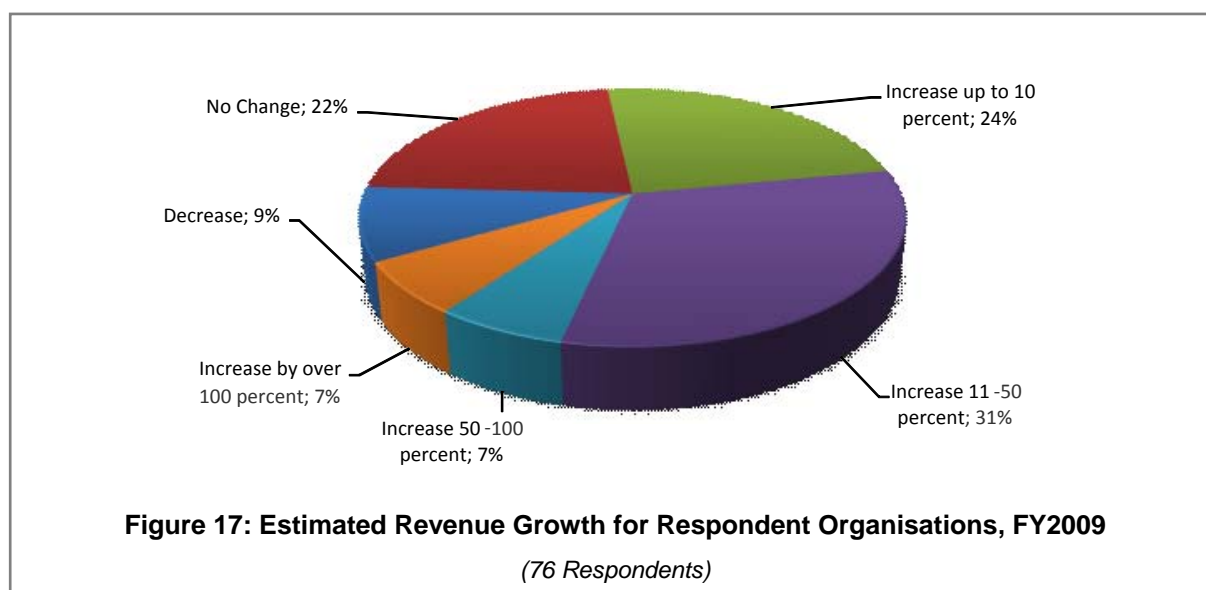
Queensland-wide estimates for income were also determined separately for (a) companies and research organisations; and (b) biotechnology and TMD organisations (Table 27).

	Company	RO		Biotech	TMD
Total Income (\$M)	\$3,844	\$1,098	Total Income (\$M)	\$2,185	\$2,758
Goods and Services (\$M)	\$3,249	\$748	Goods and Services (\$M)	\$1,352	\$2,646
Royalties (\$M)	\$222	\$0	Royalties (\$M)	\$221	\$1
Grants (\$M)	\$202	\$306	Grants (\$M)	\$462	\$47
Other (\$M)	\$172	\$44	Other (\$M)	\$150	\$65

7.3 Income Growth FY2009

The majority of respondents (69%) reported revenue growth in the 12 months to June 2009 (Figure 17). 24% of respondents saw income growth of up to 10 percent, a further 31% reported growth of between 11 and 50 percent. 14% of respondents reported growth exceeding 50 percent; 22% of respondents reported no change in revenue and 9% reported a fall in income.

Ten percent of responding companies reported negative revenue growth for the 12 month period to June 2009. No research organisations reported negative growth for the same period.



Queensland Life Science Industry Survey Results

Positive outcomes in terms of employment and income in the Life Sciences sector are supported by other analyses. According to an article in the March/April issue of Australian Life Scientist,¹⁶

“As of December 2009 the All Ordinaries had recovered much of its losses experienced since the dive of September 2008, although it's still well below its peak in October 2007. By comparison biotechnology stocks have fared remarkably well. Through to the end of 2009, biotechs clawed back the ground lost in 2008....the life sciences index has consistently outperformed the All Ordinaries over the past 12 months....much of this rebound was fuelled not by the titans of the life sciences industry – CSL, Cochlear and ResMed – but by the ‘ex majors’, i.e. everybody else.

According to PricewaterhouseCoopers, “The life sciences ex-majors continued positive growth across the last four quarters was a stellar result outperforming the All Ordinaries index for the same period by 85%.” Says Craig Lawn Life Sciences partner at PricewaterhouseCoopers. “This performance resulted in a return, for the past two years, of close to pre-GFC levels of late 2007. However the market has been a little less ebullient since the back end of 2009. The life sciences index was only up 1.6 per cent in the last quarter of ‘09...”

...CEO of AusBiotech, Anna Lavelle, is generous in her praise directed towards the management of beleaguered Australian biotechs during the challenging period. “The CEOs were under pressure but ... they went off shore and raised capital and they did all the things that a mature sector should do. We’ve now moved from an emerging industry to a more mature, with a number of CEOs with more than 10 years experience demonstrating that in the last 18 months with their steady hand...”

Grant Income

Federal and State government and non-government grant programs are an important part of industry support in high-technology and high-risk sectors such as Life Sciences. For research organisations, grants typically represent a significant source of the funding required for basic and applied research. For companies, grant programs provide the leveraged (non-dilutive) funding to support or encourage investment in research projects of high technical risk.

7.4 Total Grant Income

Total grant income across all respondents (88) in the FY2009 year was \$157.8 million. Companies reported \$26.9 million in grant income and research organisations reported \$130.9 million. The entire Queensland Life Sciences industry was estimated to have generated a total of \$508 million in grant income in FY2009.

Respondents were formally awarded a total of \$75.3 million in new grant funding during 2009. Of the new grant funds awarded in FY2009, \$66.7 million was drawn down during that year.

7.5 Grant Programs

Forty-eight survey respondents nominated at least one grant program from which funds were secured during the past year, while many also nominated a second and third funding program accessed by their organisation. Where additional programs were reported, these data were aggregated (Figure 18).

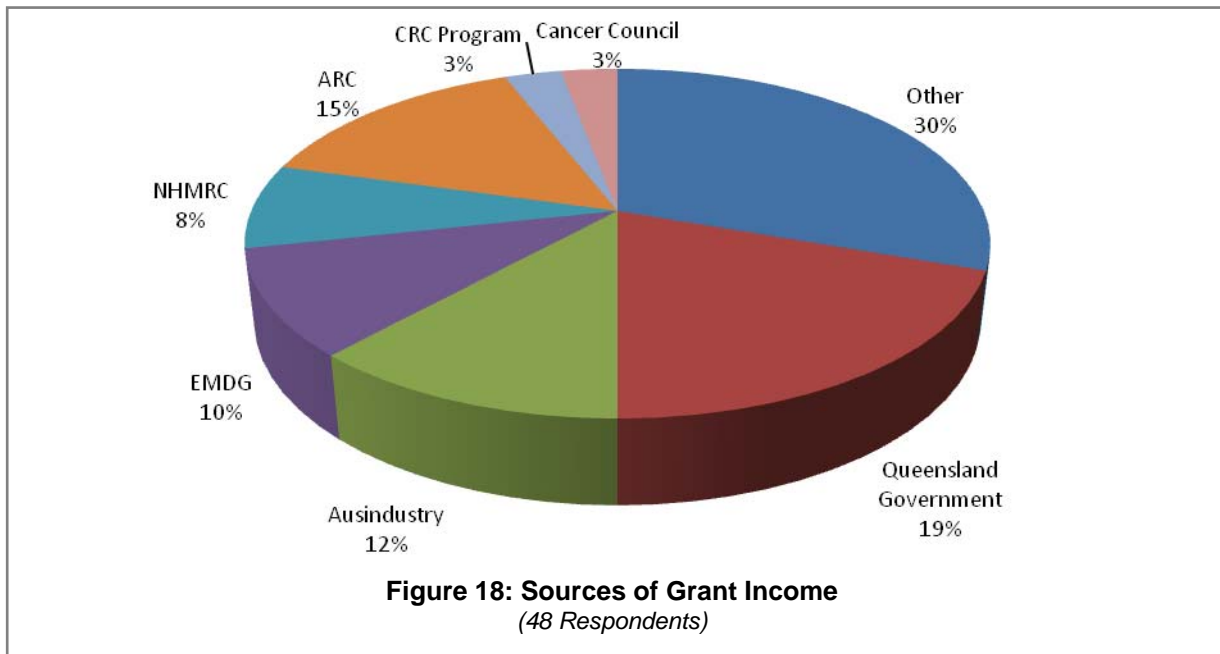
The top three Australian and State Government grant schemes accessed by respondents were:

1. **Queensland Government grant programs** (e.g. NIRAP, RIPP, QSEIF) (19%)
2. **AusIndustry-administered grants** (e.g. Climate Ready, COMET) (12%)
3. **Austrade-administered Export Market Development Grant** (EMDG) (10%)

The ‘Other’ category (30% of the grants accessed), includes 28 individual grant programs, which are listed in the Appendices to this report.

¹⁶ Dean, T., 2010. Biotechs ready themselves for recovery, Australian Life Scientist, 7(2):26-30.

Queensland Life Science Industry Survey Results



7.6 Federal Funding for Institutional Medical and Biotechnology Research

Federal Government grants administered by the National Health and Medical Research Council (NHMRC) and the Australian Research Council (ARC) are a significant source of funding for medical and biotechnology research conducted at research institutions.

NHMRC funding levels, as a percentage of total Commonwealth Government science and innovation funding, had been increasing since 2000-01 and seems to have now stabilised at approximately 8%.

Commonwealth Government expenditure on health and medical research was approximately 0.11% of gross domestic product (GDP) in 2006, positioning Australia fourth behind the United States, United Kingdom and Iceland (Figure 19).

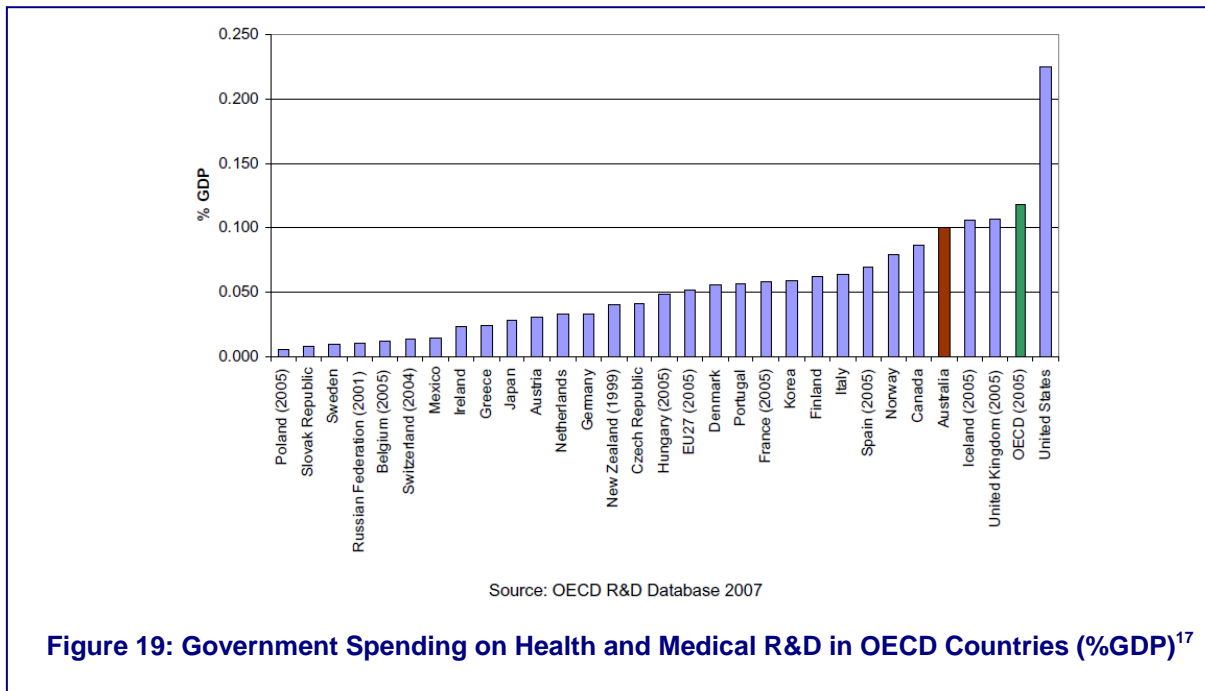


Figure 20 illustrates the share of NHMRC grants (in terms of value) attracted by Queensland institutions for the years 2006 – 2009. Over the past three years, the value of NHMRC grants awarded

¹⁷ OECD R&D Database 2007

Queensland Life Science Industry Survey Results

to Queensland researchers has increased by \$42.5 million, from \$60 million in 2006 to \$102.5 million in 2009 (Figure 20). Queensland's share of the total national NHMRC grants awarded was 13.3% in 2006 and 14.5% in 2009.

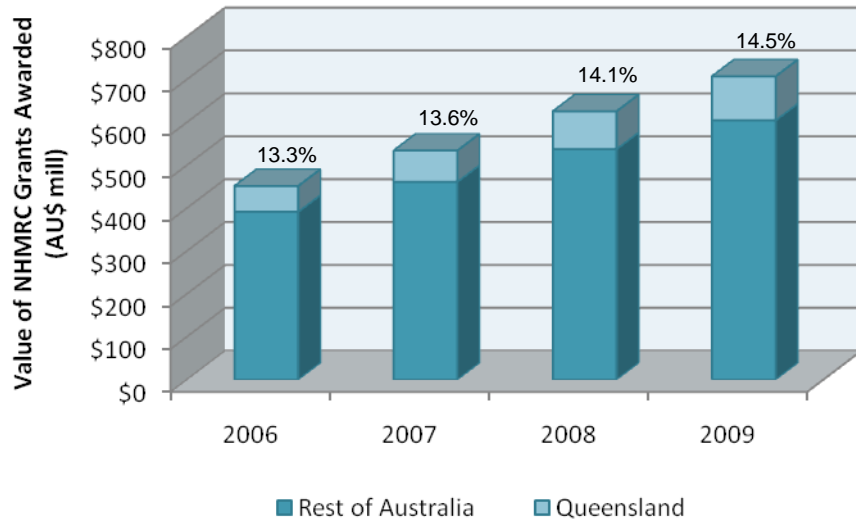


Figure 20: Value of NHMRC Grants Awarded, Queensland vs. Australia 2006 – 2009¹⁸

Figures 21 and 22 illustrate the share of ARC grants in terms of number and value that have been awarded to Queensland institutions for the years 2005 – 2008.

The total number of ARC grants awarded to Queensland researchers was 265 in 2005 and 244 in 2008, and this is in line with an overall decline in the actual number of grants awarded nationally.

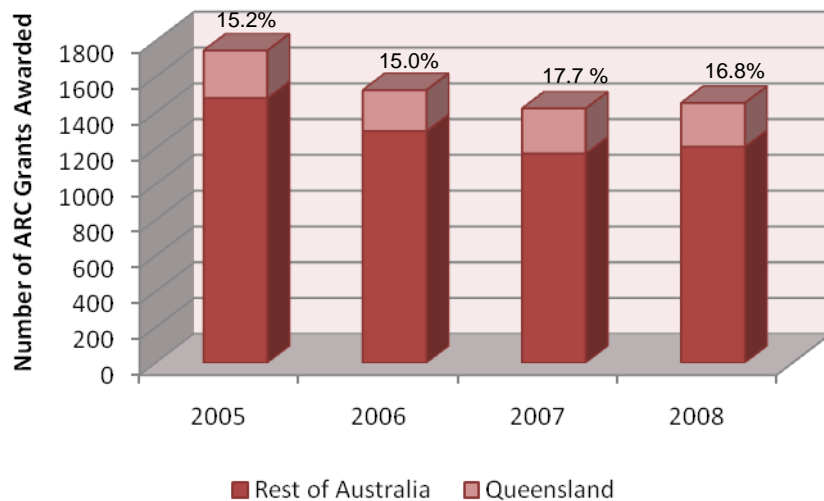


Figure 21: Number of ARC Grants Awarded, Queensland vs. Australia 2005 - 2008¹⁹

The value of ARC grants awarded to Queensland researchers was \$78.9 million in 2005 and \$88.1 million in 2008 (Figure 22). As a percentage of the national total, Queensland's share of ARC grants, by value, was 15.1% in 2005 and 21.9% in 2008.

¹⁸ Source: Australian Government, National Health and Medical Research Council, Successful NHMRC Grant applications for 2004 – 2009, <http://www.nhmrc.gov.au/funding/funded/outcomes/projects.htm>

¹⁹ Source: Australian Government, Australian Research Council, ARC Funded Research Projects - Trends Data Set 2002 – 2008, http://www.arc.gov.au/general/searchable_data.htm

Queensland Life Science Industry Survey Results

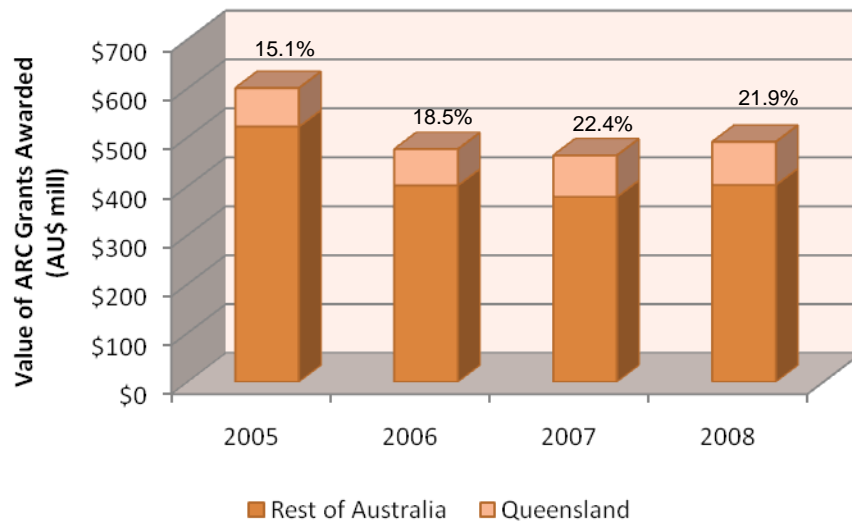


Figure 22: Value of ARC Grants Awarded, Queensland vs. Australia 2005 – 2008²⁰

²⁰ Source: Australian Government, Australian Research Council, ARC Funded Research Projects - Trends Data Set 2002 – 2008, http://www.arc.gov.au/general/searchable_data.htm

Queensland Life Science Industry Survey Results

Expenditure

7.7 Reported Expenditure

Tabulated below is the total expenditure reported by respondents to the survey (\$877 million) and also the total expenditure estimated to have been made across the entire Queensland Life Sciences industry (\$4.6 billion), as determined through imputation methods (Table 28).

Table 28: Expenditure in the Queensland Life Science Industry			
	Respondents	Total (\$M)	Average (\$M)
TOTAL EXPENDITURE			
All Respondents	76	\$877.0	\$11.5
Companies	62	\$720.7	\$12.0
Research Organisations	14	\$156.3	\$11.2
<i>Queensland Life Science Industry (Estimated)</i>		\$4,682	<i>N/A</i>
SALARY & WAGE EXPENDITURE			
All Respondents	77	\$250.1	\$3.2
As a proportion of total expenditure			29%
Companies	63	\$174.4	\$2.8
As a proportion of total expenditure			23%
Research Organisations	14	\$75.7	\$5.4
As a proportion of total expenditure			48%
<i>Queensland Life Science Industry (Estimated)</i>		\$1,078	<i>N/A</i>
CAPITAL EXPENDITURE			
All Respondents	49	\$48.4	\$0.99
Typical proportion of total expenditure			
Companies	40	\$22.1	\$0.55
As a proportion of total expenditure			
Research Organisations	9	\$26.3	\$2.9
As a proportion of total expenditure			
<i>Queensland Life Science Industry (Estimated)</i>		\$253	<i>N/A</i>
R&D EXPENDITURE			
All Respondents	73	\$216.2	\$3.0
As a proportion of total expenditure			28%
Companies	60	\$94.2	\$1.6
As a proportion of total expenditure			13%
Research Organisations	13	\$122.0	\$9.4
As a proportion of total expenditure			78%
<i>Queensland Life Science Industry (Estimated)</i>		\$803	<i>N/A</i>

The total reported expenditure on wages and salary, capital items and R&D by respondents classified as being part of either the Biotechnology or TMD sectors of the Life Sciences industry in FY2009 is shown in Table 29. Expenditure data was also analysed according to the sub-sector within which the respondent organisation fell – this breakdown is shown in Table 30.

Queensland Life Science Industry Survey Results

	Respondents	Total (\$M)	Average (\$M)
TOTAL EXPENDITURE			
All Respondents	76	\$877.0	\$11.5
Biotech	40	\$303.6	\$7.6
TMD	36	\$573.4	\$15.9
SALARY & WAGE EXPENDITURE			
All Respondents	77	\$250.1	\$3.2
Biotech	41	\$104.0	\$2.5
TMD	36	\$146.1	\$4.1
CAPITAL EXPENDITURE			
All Respondents	49	\$48.4	\$0.99
Biotech	27	\$28.2	\$1.0
TMD	22	\$20.2	\$0.92
R&D EXPENDITURE			
All Respondents	73	\$216.2	\$3.0
Biotech	39	\$154.9	\$4.0
TMD	34	\$61.3	\$1.8

	Respondents	Total (\$M) (Rounded)
TOTAL EXPENDITURE		
TOTAL	76	\$877
Pharmaceuticals and Drug Discovery	16	\$490
Complementary Medicines/Functional Foods	8	\$103
Medical Devices	14	\$21
Animal Health	3	\$10
Biotechnology	15	\$134
Industry Service Provider	17	\$39
Other	3	\$80
SALARY & WAGE EXPENDITURE		
TOTAL	77	\$250
Pharmaceuticals and Drug Discovery	14	\$117
Complementary Medicines/Functional Foods	9	\$31
Medical Devices	15	\$16
Animal Health	3	\$7
Biotechnology	15	\$55
Industry Service Provider	18	\$23
Other	3	\$2
R&D EXPENDITURE		
TOTAL	73	\$216
Pharmaceuticals and Drug Discovery	14	\$90
Complementary Medicines/Functional Foods	9	\$1
Medical Devices	15	\$4
Animal Health	3	\$1
Biotechnology	15	\$114
Industry Service Provider	14	\$5
Other	3	\$1

Queensland Life Science Industry Survey Results

7.8 Estimated Queensland-Wide Expenditure in the Life Science Industry

Based on the data collected from survey respondents, the total, wages, R&D and capital expenditure for the entire Queensland Life Sciences industry was estimated (Table 31). These values cannot be directly compared to historical estimates (FY2007) as some of these figures are not available for the TMD sector. Moreover, the data will not directly mirror the FY2009 estimates as, in some cases, the questions asked required different inputs necessitating some alterations in the statistical methodology utilised.

	Estimates for 2007		Estimates for 2009	
	Biotechnology (\$M)	TMD (\$M)	Biotechnology (\$M)	TMD (\$M)
Total Expenditure	ND	ND	\$1,751	\$2,930
Wage/Salary Expenditure	\$502	\$287	\$389	\$691
Capital Expenditure	\$469	\$235	\$173	\$80
R&D Expenditure	\$641	ND	\$550	\$253

A fall in wages expenditure in Biotechnology despite an increase in income and employment warrants some discussion. It is possible that founders of small SMEs stopped drawing salaries or reduced their salaries as a result of the global financial crisis and/or that some staff reduced their time at work while still being considered full time employees. With regard to a lower R&D expenditure this matches the trend identified in the Ernst and Young Global Biotechnology Report 2010. General caution may have led to the cut back on R&D expenditure even though revenues were maintained or increasing. The Ernst and Young report found that two-thirds of US biotech firms and nearly as many European firms reduced spending on research:²¹

Deviating from previous trends, US biotech revenues grew 10% in 2009, but overall R&D spending was down by 13%. "As long as we've been tracking the industry, the R&D growth rate has tracked revenue growth," said Glen T. Giovannetti, Ernst & Young's global biotechnology leader.

7.9 Capital Expenditure by Australian Industry

Capital expenditure by the Queensland Life Sciences industry in FY2009 was estimated to be 64% lower than that estimated for the Queensland industry in FY2007. A reduction in capital expenditure may reflect the impact of the global financial crisis during 2008/2009. Similar results were reported across the Australian economy with ABS data indicating capex on equipment, plant and machinery fell a seasonally adjusted 7.1 percent in the 12 months to June 2009.²²

Capital expenditure is an important indicator of economic conditions and ABS data shows increased capex by Australian private companies in Q4 FY2009 vs. Q3 FY2009 (seasonally adjusted). The ABS predicts this trend will continue during FY2010.²³

Business Sentiment

7.10 Business Sentiment

7.10.1 Income Expectations

The majority of respondents (61 of 86 respondents, 71%) expected their organisations' total revenue to increase over the subsequent 12 months, with the average predicted increase being 70%. A majority of respondents (75 of 86, or 88%) also predicted significant revenue growth over the next three years with a compound annual growth rate (CAGR) of 40% (Figure 23).

²¹ QCTN2775 Optimism Grows For Biotech, see www.qctn.com.au

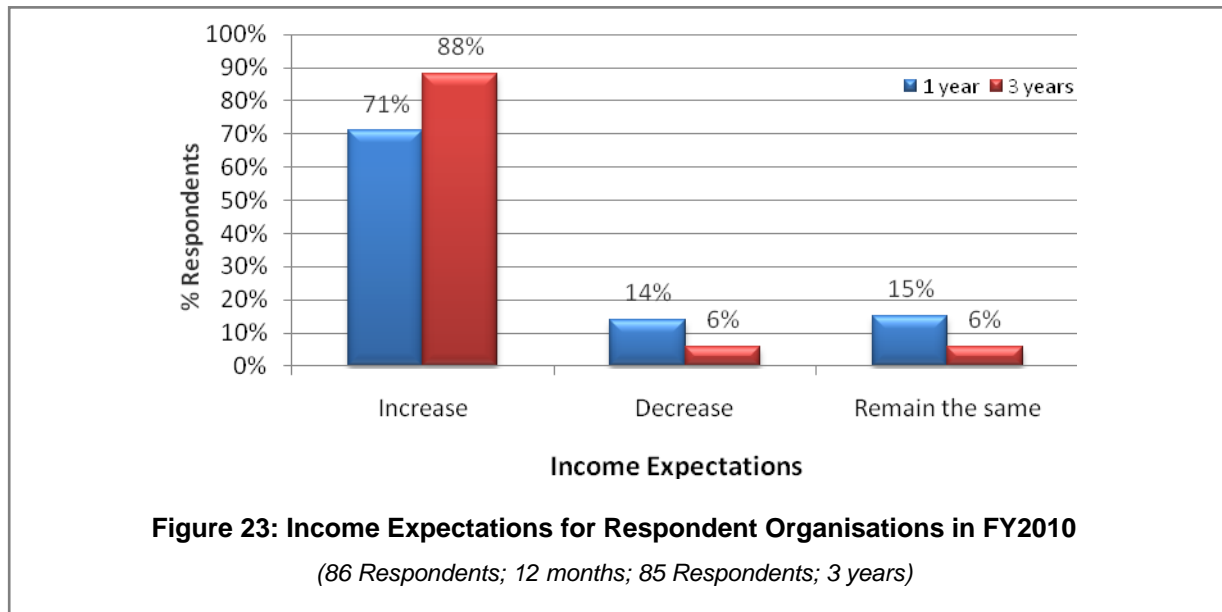
²² Australian Bureau of Statistics, 5625.0 - Private New Capital Expenditure and Expected Expenditure, Australia, Jun 2009

²³ Ibid.

Queensland Life Science Industry Survey Results

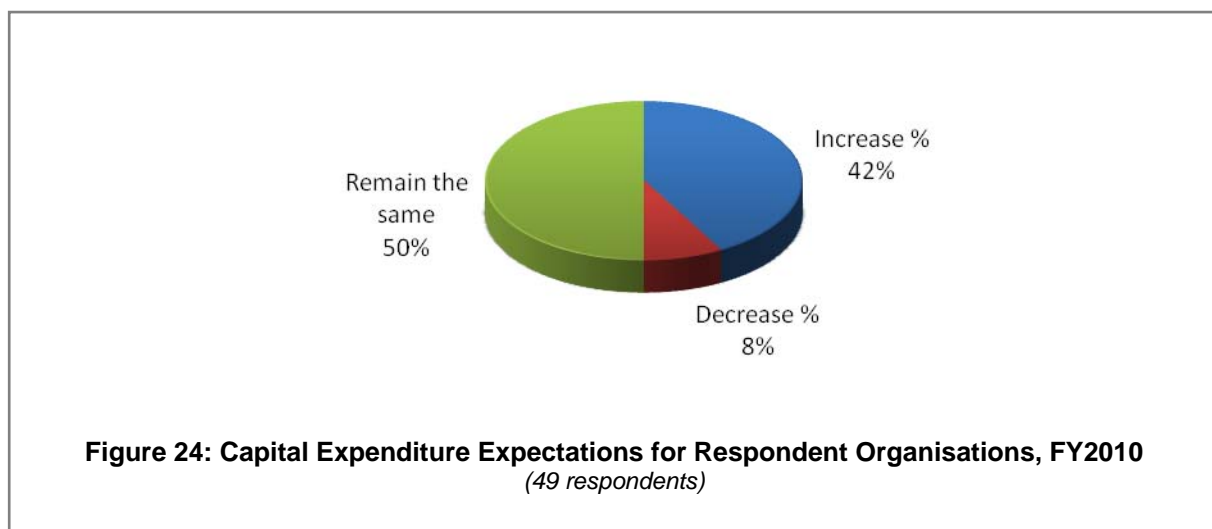
Thirteen respondents (15%) expected their income to remain the same over the next *12 months* and 12 (14%) expected income to decrease, by an average of 33%.

Five respondents (6%) expected their income to remain the same over the next *3 years*, and another five respondents (6%) predicted a CAGR over the next 3 years of negative 9%.



7.10.2 Capital Expenditure (Capex)

Twenty-six respondents (42%) expected that their total capex in FY2010 would be greater than that in FY2009 and the average expected increase was approximately 124%. Five respondents (8%) expected their total capex in FY2010 would be less than in FY2009 and the average predicted decrease was 40%. Thirty-one respondents (50%) did not anticipate a change in their capex in FY2010 (Figure 24).



7.10.3 Research and Development

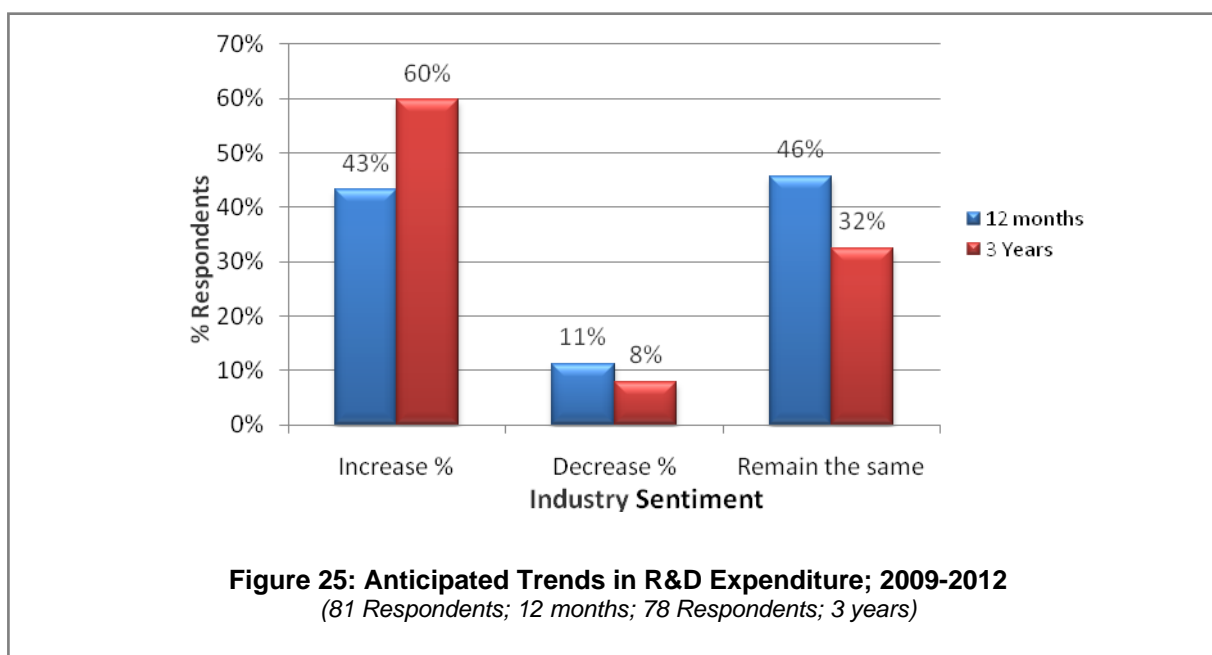
Surveyed organisations (81 respondents) were equally divided between those who anticipated that their spending on R&D would increase over the next 12 months (43%) and those who expected R&D expenditure to remain the same (46%) (Figure 25).

Of those who anticipated an increase, 36 respondents nominated an average predicted growth of 76%. Only 11% of respondents expected to reduce their R&D spend over the coming 12 months, and of those, eight predicted R&D expenditure would fall by an average of 55%.

Almost two thirds (60%) of surveyed organisations (78 respondents) expected their expenditure on R&D over the next 3 years to increase by an average CAGR of 30% (n = 46). Almost one third (32%)

Queensland Life Science Industry Survey Results

expected expenditure on R&D to remain the same over the next 3 years. The remainder (8%) expected their R&D expenditure to decrease by an average CAGR of negative 13% (n = 6) over the next 3 years.



7.11 Overall Business Sentiment

The majority of survey respondents forecast increases in income over both the next 1 and 3 years. Although nearly half of the respondents expect their capital and R&D expenditure to remain the same over the coming year, the majority forecast increased R&D expenditure over the next 3 years.

More conservative expenditure forecasts for the coming 12 months may reflect the recent challenging economic climate. However, overall, these results indicate positive business sentiment within the Queensland Life Sciences industry.

7.12 Business Sentiment in the Australian Life Science Industry

The positive business sentiment observed across the surveyed Queensland Life Sciences industry may in part reflect the recent positive economic indicators, which suggest an easing of the negative impact of the financial crisis in the wider economy.

In 2008, the Australian Life Sciences sector was reported to have had a difficult year. The value of the listed Australian Life Science sector fell 48.3% in 2008, greater than the Australian All Ordinaries; (43%) and the US NASDAQ Biotechnology Stock Index (12.6%).²⁴ Intersuisse attributed the dramatic drop in the share price of Australian-listed Life Sciences companies to a lack of adequate capital rather than the high debt levels in other industries at this time. There were a number of ASX-listed company failures during this period including Ventracor Ltd., Polartechnics Ltd. and Fermiscan Ltd.

As a consequence of the economic downturn, R&D expenditure reported by listed Life Sciences companies fell for three straight quarters in 2009. This reduction in R&D expenditure was expected to have been mirrored in the non-listed Life Sciences sector.²⁵

Recently, promising positive indicators for the sector have begun to emerge with the listed sector reporting improved investor confidence, increased secondary raisings during 2009²⁶, rebounding share prices and a Life Sciences IPO in Q1 2010 (CBio Ltd.). However, these positive indicators do not necessarily reflect the environment for smaller, early stage Life Sciences companies with inadequate access to capital.

²⁴ Intersuisse

²⁵ Compiled by *Biotechnology News* (www.biotechnologynews.net) from quarterly filings to the Australian Securities Exchange

²⁶ PwC BioForum Report, February 2010

8.0 Commercial Performance

SNAPSHOT

- *A total of 143 complete patent applications were filed by, or granted to, surveyed organisations in FY2009. The majority of these (108; 82%) were with companies rather than research organisations.*
- *Eleven Queensland Life Science organisations reported 39 out-license agreements, while nine organisations reported 49 in-license agreements in FY2009.*
- *33% of respondents reported utilising a contract manufacturing organisation during FY2009, while 29% reported outsourcing activity to a contract research organisation.*

Research and Development

8.1 Outsourcing R&D

Respondents (78) reported that an average of 27% of their total R&D was outsourced. As would be expected, companies (64) outsourced significantly more of their total R&D (30%), than research organisations (14), who outsourced 9%.

For respondents who indicated that they did outsource some R&D (49 of 91 respondents), the areas most likely to be outsourced were ranked as follows:

Table 32: Top 5 Outsourced R&D Activities

1.	Clinical Trials
2.	Analytical Lab Work
3.	cGMP Manufacturing
4.	Preclinical Research
5.	All R&D

29 respondents offered reasons for their decision to outsource R&D. Recurring themes in these responses included:

- (1) A lack of internal resources or capability;
- (2) A desire to contract specialised R&D activities to experts with optimal skill sets;
- (3) Controlling costs during start-up and growth stages; and
- (4) Ensuring independent, arm’s length results.

8.1.1 Contract Manufacturing

Of 91 respondents, the majority (67%) indicated that they had not used a contract manufacturing organisation (CMO) during the past year. 30 respondents (33%; all except one were companies) reported that they had engaged a CMO, with 23 spending a combined total of \$15.0 million in their last financial year. The average expenditure on CMO services per organisation was \$789,658 and the median expenditure was \$500,000.

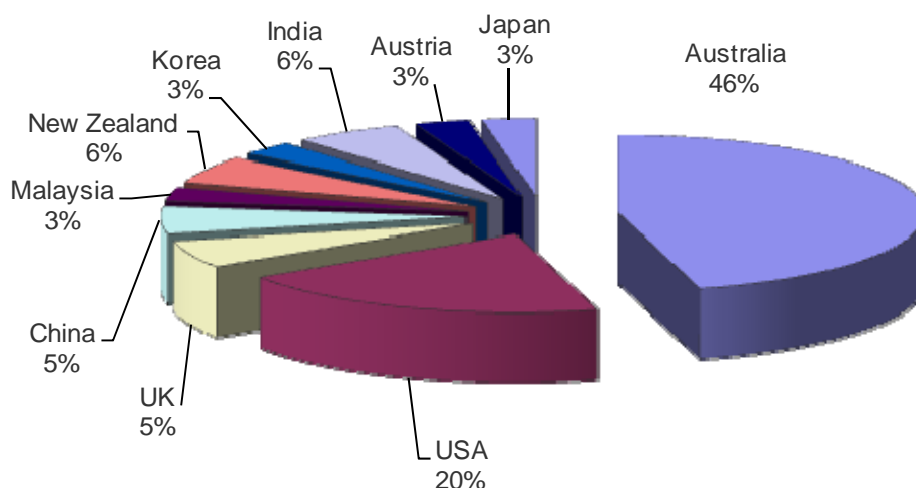
Almost half (46%) of those who utilised a CMO indicated that the supplier was located in Australia. The USA (21%) was the second highest provider of CMO services to Queensland Life Sciences organisations. China, United Kingdom, New Zealand and India (all at 6%) rounded out the top 5 providers. Four other countries were also represented.

Figure 26 shows the use of CMOs by their location and by the proportion of CMO expenditure in each location. Where multiple countries were specified, the company's expenditure was assumed to be split evenly. While China comprised 5% of CMO engagements, they made up less than 1% of expenditure. This could imply that the cost of CMO services is lower in China or that the types of services sought in China do not require highly sophisticated infrastructure or stringent GMP requirements. By contrast, Korea garnered 12% of expenditure with only 3% of CMO engagements.

Note that there was no expenditure of cash on CMO services obtained from two countries - India and Austria since the organisations naming those countries received services as part of broader licensing agreements.

Queensland Life Science Industry Survey Results

Proportion of Countries Named as Providing CMO Services



Proportion of Expenditure of All CMO Services Reported

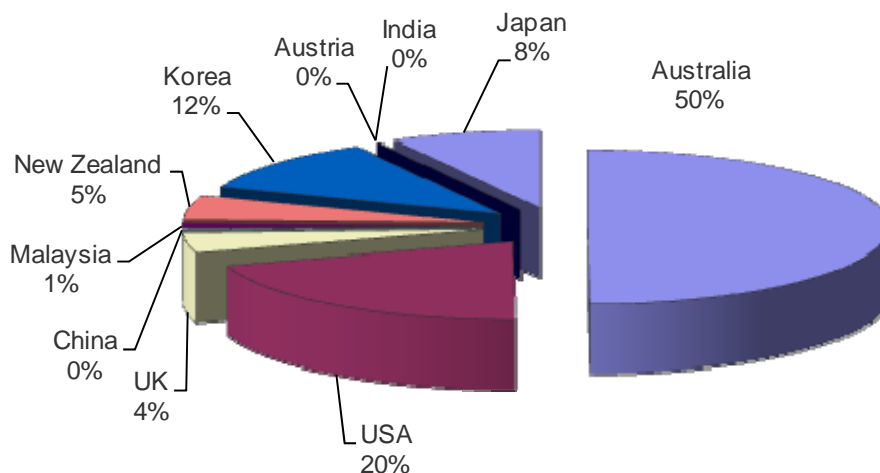


Figure 26: Countries where CMO Providers utilised by Queensland Life Science Organisations were located

(23 Respondents)

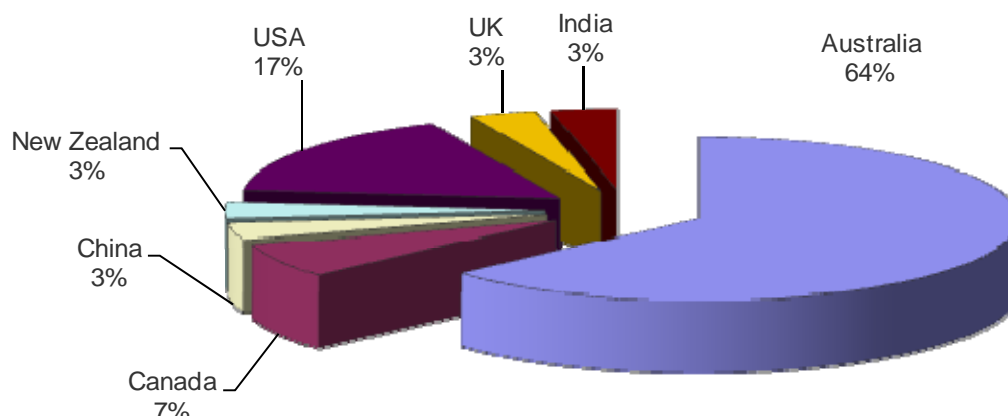
8.1.2 Contract Research

The majority of respondents (63 of 89 respondents; 71%) indicated that they had not used a contract research organisation (CRO) during the previous year. 26 of 89 respondents (29%) reported that they had engaged a CRO, with 22 of these spending a combined total of \$14.5 million, with an average expenditure of \$657,599.

Of the 26 respondents that did utilise a CRO service, 64% indicated that their CRO was located in Australia. The USA (17%) and Canada (7%) rounded out the top 3 providers of CRO services. Four other countries, India, New Zealand, United Kingdom and China (all at 3%), were also represented.

Figure 27 shows the use of CROs by their location and by the proportion of CRO expenditure in each location. Where multiple countries were specified, the company's expenditure was assumed to be split evenly. Note that there was no expenditure of cash on CRO services obtained from two countries - India and the UK, since the organisations naming those countries received services as part of broader licensing agreements.

Proportion of Countries Named as Providing CRO Services



Proportion of Expenditure of All CRO Services Reported

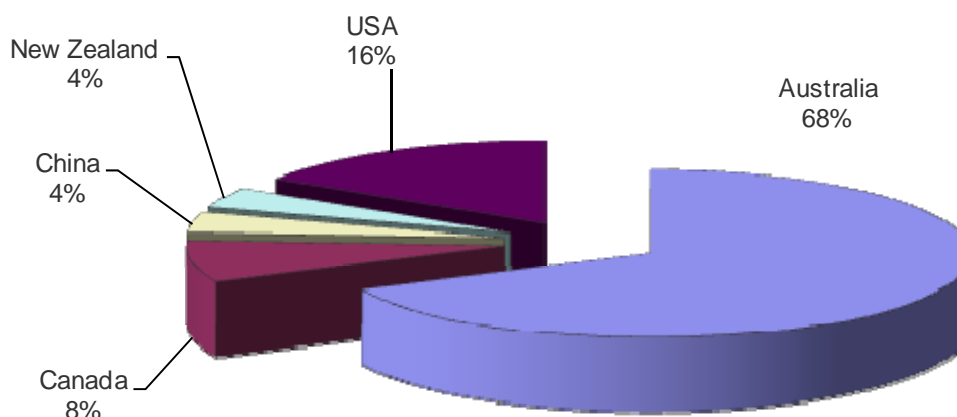


Figure 27: Countries where CRO Providers utilised by Queensland Life Science Organisations were located

(22 Respondents)

8.2 Business Expenditure on R&D

Based on data provided by the ABS, Australian Business Expenditure on R&D (BERD) totalled \$14.8 billion or 1.27% of GDP in FY2008. This represents an increase of \$2.3 billion (or 0.07% of GDP) over FY2007 levels, which were \$12.5 billion or 1.2% of GDP.²⁷ There has been an increase in BERD as a percentage of GDP between 2004 and 2008 (Figure 28). The ABS data also revealed that 69.8% of BERD was carried out by large firms employing greater than 200 people.

The average business expenditure on R&D across OECD countries is 1.59% of GDP. Japan leads business R&D spending (2.68%), followed by Sweden (2.66%), Korea (2.65%), Finland (2.51%) and USA (1.93%). Australia (1.27%) is currently in 14th (of 30) place in the OECD rankings ahead of UK (1.15%) and Canada (1.05%).

²⁷ Source: Australian Bureau of Statistics, 8104.0 Research and Experimental Development, Business Australia, 2007-2008

Queensland Life Science Industry Survey Results

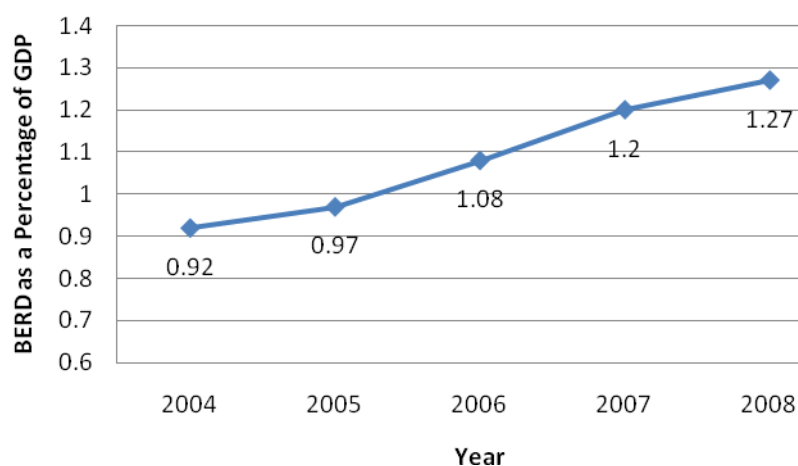


Figure 28: Business Expenditure on Research and Development as a Percentage of GDP 2004 - 2008²⁸

It was estimated that from 2005 to 2008, Queensland businesses made up an average of 13.1% of total national business expenditure on R&D (Figure 29 and Table 33). Queensland BERD as a percentage of the Australian BERD was 12.4% in 2005 and 13.6% in 2008.



Figure 29: Business Expenditure on Research and Development, Queensland vs. Australia 2005 - 2008²⁹

Table 33: Business Expenditure on R&D (BERD), Queensland vs. Australia (\$M)				
	2004/05	2005/06	2006/7	2007/08
BERD – Queensland	1,073	1,346	1,682	1,950
BERD – Australia (all)	8,676	10,434	12,549	14,380

In comparison with other Australian states, Queensland ranked fourth in terms of total business expenditure on R&D in FY2008 (Figure 30).

²⁸ Source: Australian Bureau of Statistics, 8104.0 Research and Experimental Development, Business Australia, 2007-2008

²⁹ Source: Australian Bureau of Statistics, 8104.0 Research and Experimental Development, Business Australia, 2007-2008

Queensland Life Science Industry Survey Results

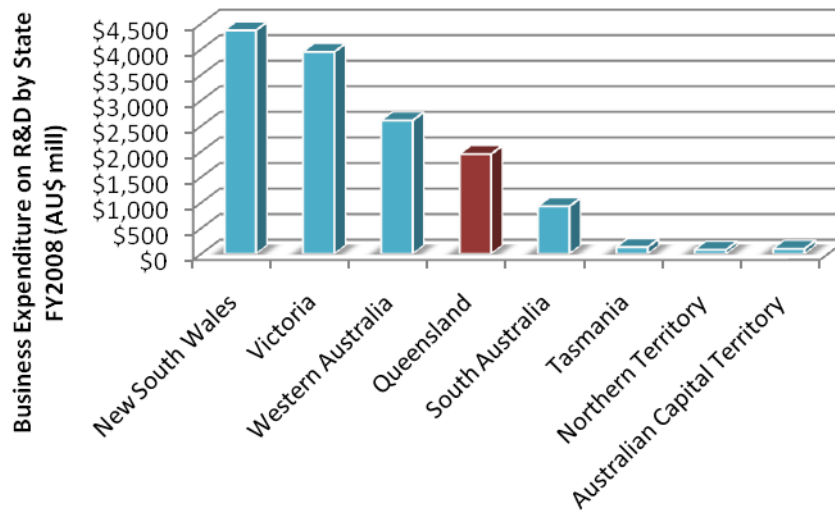


Figure 30: Business Expenditure on Research and Development, Queensland vs. Other Australian States, 2007/2008.³⁰

Queensland ranked third in terms of business expenditure on R&D in Scientific and Technical industries (Figure 31).

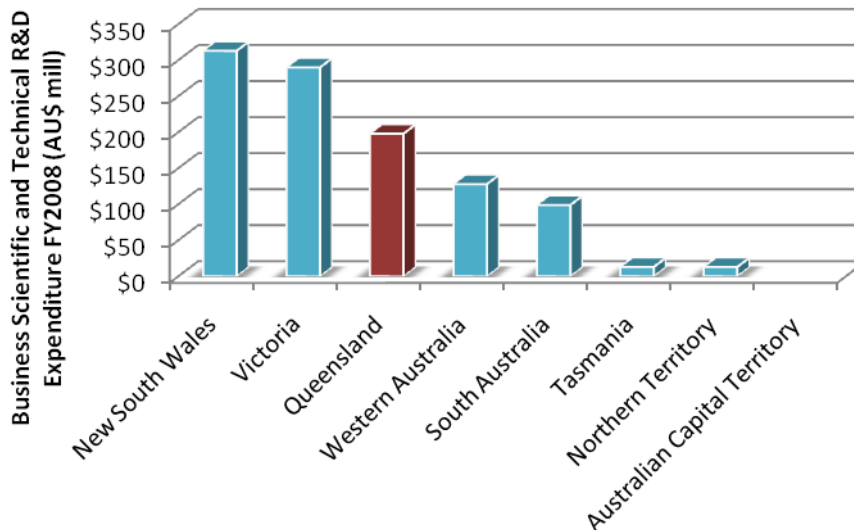


Figure 31: Business Expenditure on Scientific and Technical Research and Development in Queensland vs. Other Australian States, 2008.³¹

8.3 Government Expenditure on R&D

Based on ABS data, it was estimated that in 2007, Australian Commonwealth and State Governments expended a total of \$2.95 billion on R&D nationally including \$0.41 million in Queensland.³²

In FY2007, Australian GOVERD as a proportion of GDP remained steady at 0.28%. Australia's GOVERD/GDP ratio continued to be above the OECD average of 0.26% for FY2007. For the latest

³⁰ Source: Australian Bureau of Statistics, 8104.0 Research and Experimental Development, Business Australia, 2007/2008

³¹ Source: Australian Bureau of Statistics, 8104.0 Research and Experimental Development, Business Australia, 2007/2008

³² Source: Australian Bureau of Statistics, 8109.0 - Research and Experimental Development, Government and Private Non-Profit Organisations, Australia, 2006-07

Queensland Life Science Industry Survey Results

reported year (FY2007) Australia was ranked 9th in the OECD for government expenditure on R&D as a proportion of GDP.³³ Iceland, France and Korea were the top three countries.

Expenditure on R&D by Commonwealth government organisations increased by 23% from 2004-05 to \$1,893 million in 2006-07. Over the same period, expenditure by State or Territory government organisations increased by 13% to \$1,061 million.

South Australia had the highest increase in GOVERD as a proportion of Gross State Product (GSP) from 2004-05. In absolute terms, Queensland experienced an increase in GOVERD between FY2005 and FY2007 (Figure 32). However, Queensland Government expenditure on R&D as a ratio of Gross State Product, decreased from 0.24 in FY2005 to 0.21 in FY2007.

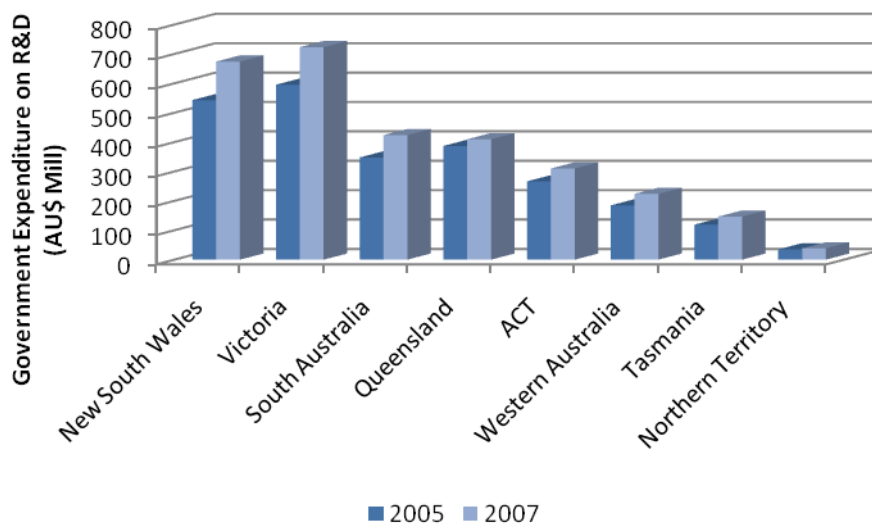


Figure 32: Government Expenditure on R&D, by State, 2005 and 2007

Intellectual Property

Intellectual property is usually a key asset for a life sciences company. In many cases, the company's patent portfolio is the only company asset with inherent value.

Patent application filings are one parameter used as an indicator of innovative activity. Worldwide, the number of Patent Cooperation Treaty (PCT) applications grew by 2.3% in 2008 to 163,600 applications. Although the growth in patent filings has slowed since 2005, the total number of international applications filed in 2008 represents the highest number of applications yet received in a single year.³⁴ However, recent provisional data shows that the number of PCT patent applications filed in 2009 was 159,900, a fall of 4.5%. This decline is likely a consequence of the global financial crisis and its impact on the availability of capital to fund innovation leading to reduced R&D expenditure and focused intellectual property expenditure.

In Australia, World Intellectual Property Organisation (WIPO) reports that the number of patents filed by Australian inventors per billion dollars (US\$) of Australian GDP has dropped from a high of 4.03 patents per \$billion GDP in 2002 to 3.95 in 2006 and 2007 (last available year). Similarly, the number of patents filed by Australian inventors per million dollars (US\$) spent on R&D expenditure has declined over the past 6 years, from a high of 0.24 in 2001 (Figure 33). This may be the consequence of a number of factors including the increased cost of R&D activities reducing apparent productivity, and increased patent costs leading to more focused patenting strategies.

³³ Main Science and Technology Indicators, 2008/1, OECD, Paris, 2008

³⁴ World Intellectual Property Organisation, World Intellectual Property Indicators, 2009, <http://www.wipo.int/ipstats/en/>.

Queensland Life Science Industry Survey Results

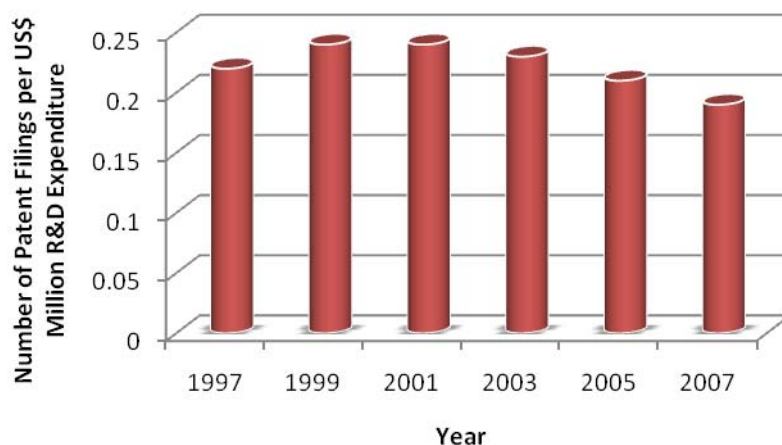


Figure 33: Number of Patents Filed by Australians per US\$ Million R&D Expenditure, 1997-2007

Granted patents provide their assignees with a period of protection from others infringing the claimed invention. This enables commercialisation of the invention and a period of market exclusivity. Granted patents, particularly granted US, EU or Japanese patents, are valuable indicators of success in the Life Sciences industry and are critical for partnering. The US is the largest and most lucrative pharmaceutical and healthcare market in the world and Australian organisations target US patents as this is a key market for potential products and partnerships. Figure 34 shows the total patents granted by the US Patent and Trademark Office (USPTO) to Australian companies between 2005 and 2008.

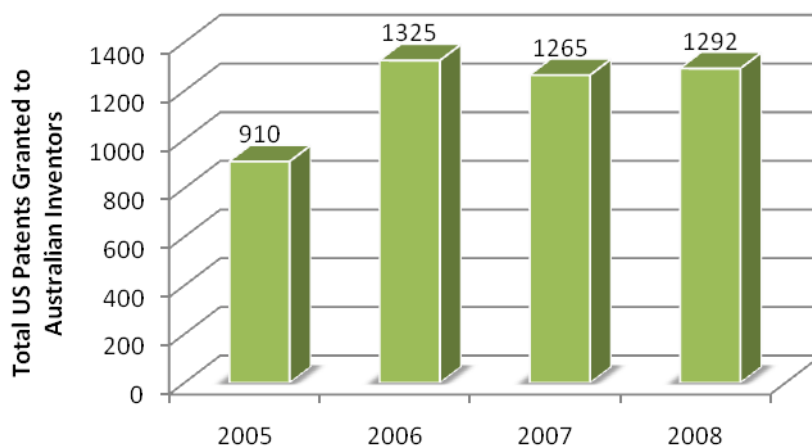


Figure 34: US Patents Issued to Australian Organisations, 2005-2008³⁵

8.5 Patents and License Agreements

A total of 143 complete patent applications were reported as filed or granted by 38 respondent organisations in FY2009. Of those patents, 17% (24 patents) were filed/granted to Queensland universities and research institutions and 83% (119 patents) were filed/granted to companies.

8.6 Out-License Agreements

Surveyed organisations (81) reported a total of 39 out-license agreements negotiated by 11 organisations, in their last financial year. Respondent universities and research institutions established 18% of out-license agreements while companies established the majority (82%) of agreements (Figure

³⁵ US Patent and Trademark Office, 'Granted US Utility Patents by Inventor Country', 31st December 2008, <http://www.uspto.gov>

Queensland Life Science Industry Survey Results

35). Six respondent organisations nominated a combined value of \$4.13 billion for their out-license agreements (with \$4 billion being from a single company).

Biotechnology organisations (10) reported 38 out-license agreements (97%) while a single TMD organisation reported one out-license agreement.

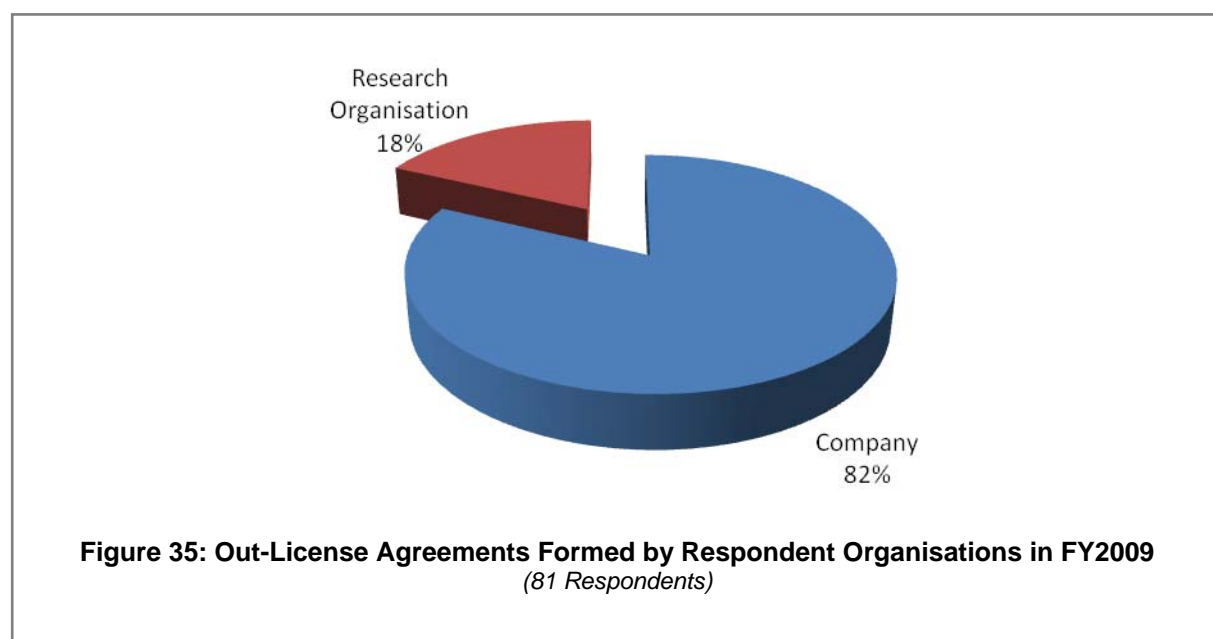


Table 34: Comparison of Out-license Agreements Reported by Biotechnology Organisations in FY2005, 2007 and 2009

Service	No. of Respondents	Out-License Agreements
Biotechnology 2005	58	17
Biotechnology 2007	65	20
Biotechnology 2009	81	39

Comparable longitudinal data is not available for the TMD sector

8.7 In- License Agreements

Nine surveyed organisations (out of 83 respondents) reported a total of 49 in-license agreements, in their last financial year – most of these (94%) were established by companies (Figure 36).

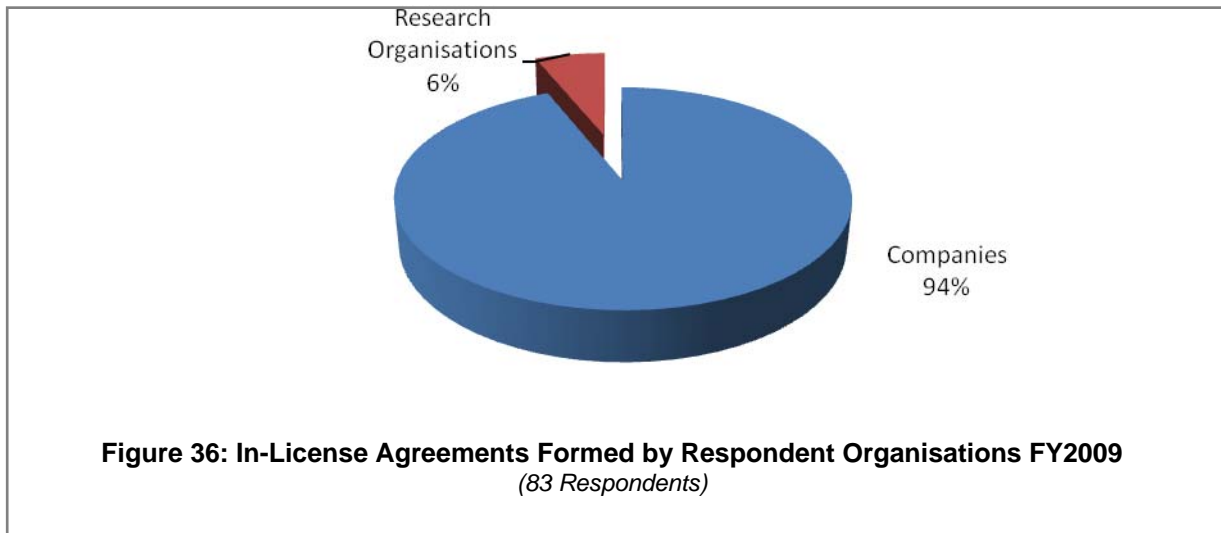
Biotechnology organisations reported 47 in-license agreements (96%) while TMD organisations reported 2 in-license agreements.

Table 35: Comparison of In-license Agreements Reported by Biotechnology Organisations in FY2007 and 2009

Service	No. of Respondents	In-License Agreements
Biotechnology 2007	65	35
Biotechnology 2009	83	49

Comparable longitudinal data is not available for the TMD sector

Queensland Life Science Industry Survey Results



Commercialisation Strategy and Funding

8.8 Commercialisation

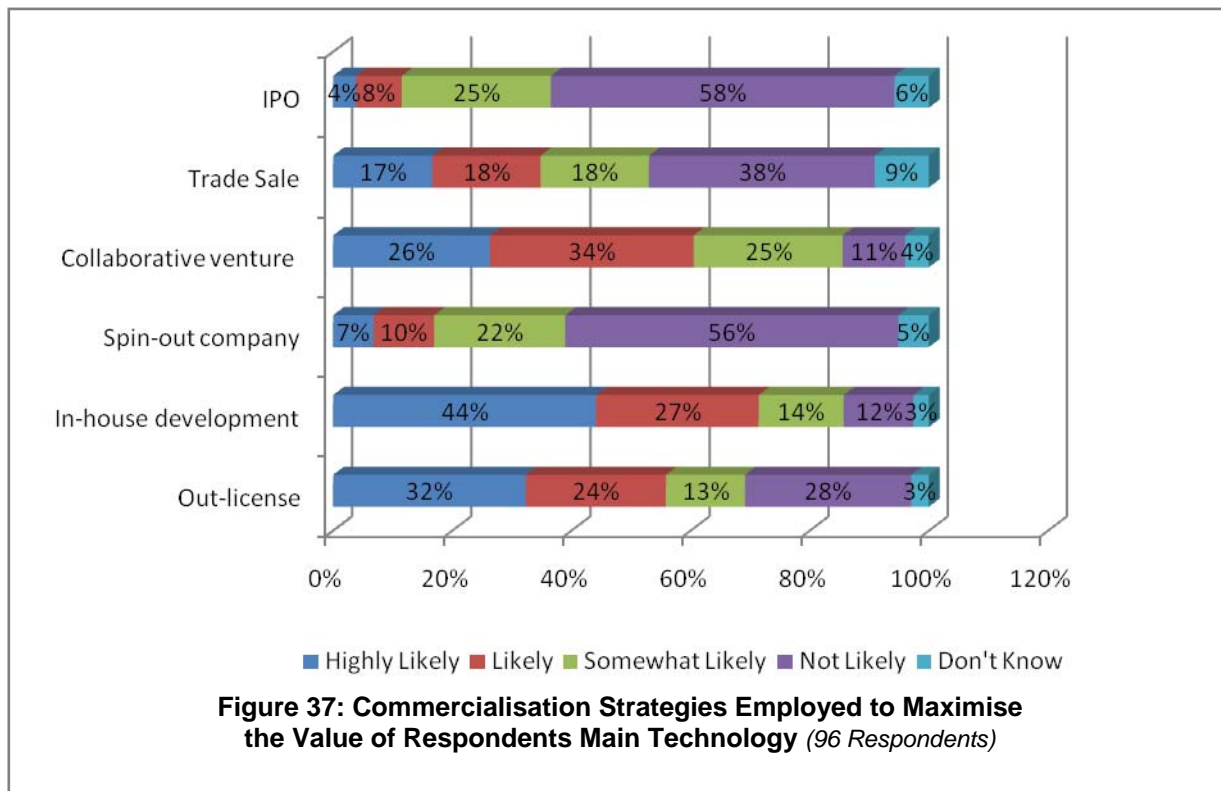
96 respondents reported the strategies they intend to use to maximise the value or potential of their main technology, product or service (Figure 37).

The most likely strategy to be employed was:

1. In-house development
2. Out-Licensing
3. Collaborative venture (partnering, joint venture)

The least likely strategy to be utilised was:

1. IPO
2. Spin-out company
3. Trade Sale

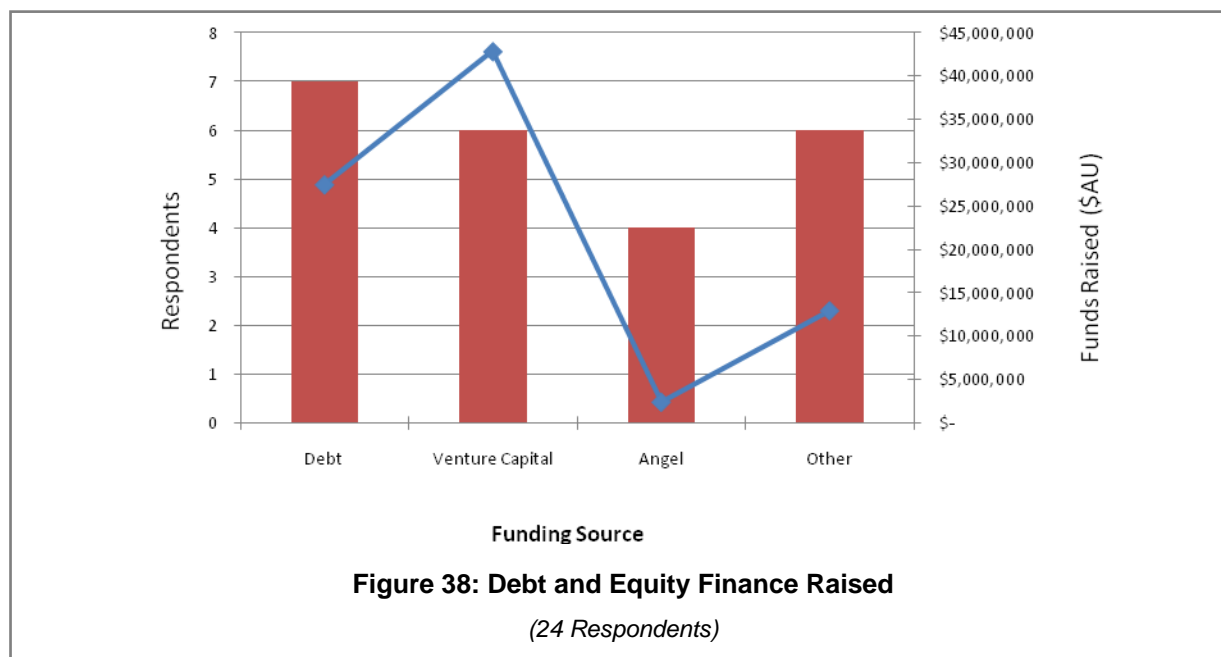


Queensland Life Science Industry Survey Results

Respondents intended to complete **R&D** (e.g. discovery, preclinical development etc; 49%) or **Early Stage Commercialisation** (e.g. later stage clinical development, pilot plant etc.; 39%), prior to realising their primary commercial outcome. Over one third of respondents (35%) indicated that they would intend to complete proof-of-concept activities prior to seeking to commercialise their product on the market.

8.9 Sources of Debt and Equity Finance

Twenty-four companies reported a total of \$85.6 million in funds raised through debt financing, venture capital and angel investment and other investment instruments in FY2009 (Figure 38).



Venture capital was the greatest source of finance for surveyed companies and venture capitalists invested the highest average amount per organisation. Debt was the second largest source of funding (Table 36). As expected, angel investors, who typically operate at an early stage in the value chain, invested smaller amounts per organisation than venture capital investors.

Source of Funds	Amount Raised (\$M)	Average Amount Raised per Organisation (\$M)
Debt	\$27.5	\$3.9
Venture Capital	\$42.8	\$7.1
Angel investment	\$2.4	\$0.6
Other	\$12.9	\$2.2
TOTAL	\$85.6	N/A

Of 99 respondents, 38% indicated that they intended to raise debt or equity finance in the coming two years. For these organisations, debt instruments, private equity and venture capital were the three most likely ways they would seek to raise this capital (Figure 39).

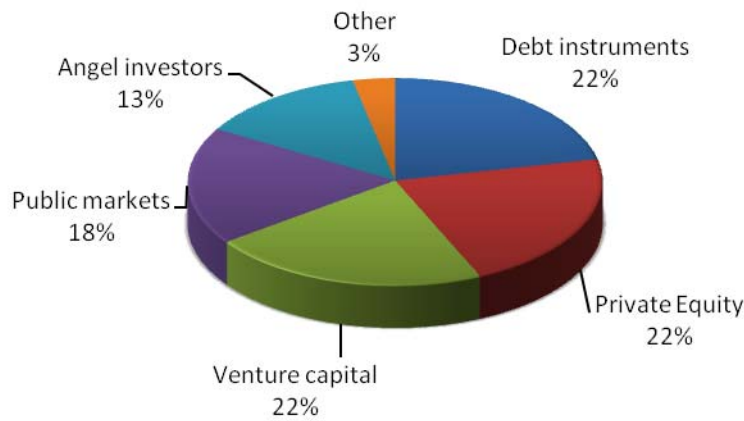


Figure 39: Most Likely Vehicles for Raising Debt or Equity Finance in the next 2 years
(58 Respondents)

51% of respondents (43 of 85) indicated that they may access government assistance programs as part of their capital raising strategy. 32 respondents indicated one or more specific state or federal government programs of interest. These included the Queensland Government's 'Mentoring for Growth' and 'Smart Futures Fund' programs and the Commonwealth's 'Commercialisation Australia' initiative (Figure 40).

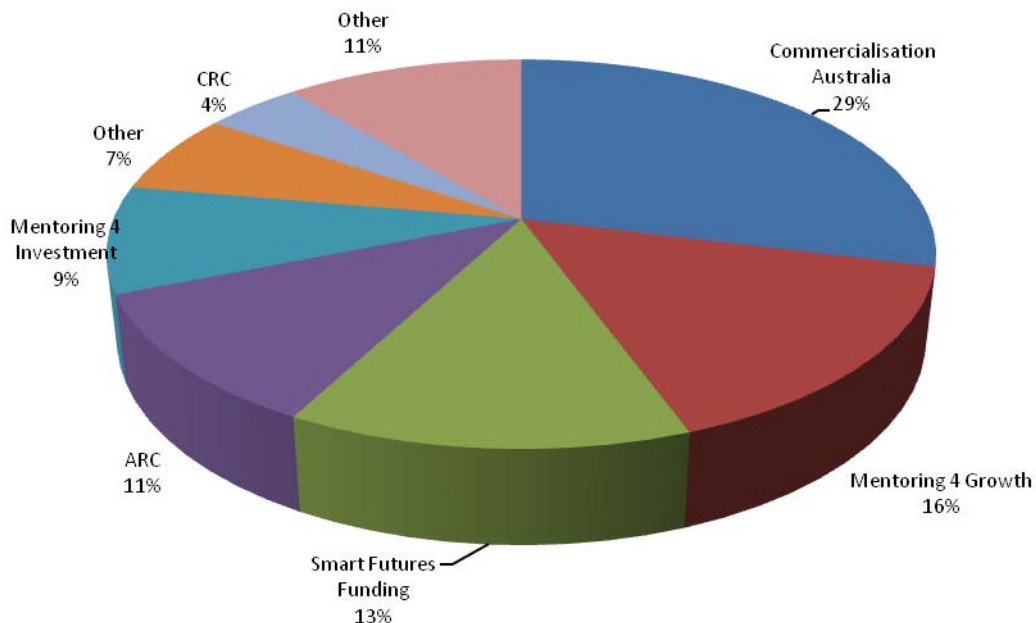


Figure 40: Government Assistance Programs that Respondents Intend to Access
(32 Respondents)

8.10 Venture Capital and Private Equity Funding in Australia

The recent global financial crisis had a significant effect on (1) the availability of capital for the Life Sciences sector; (2) the feasibility of seeking public funds through an IPO; and (3) the likelihood of engineering a successful exit.

Queensland Life Science Industry Survey Results

The reported total private equity and venture capital (VC) funds raised during FY2009 fell by 74% when compared to FY2008.³⁶ Capital raised by Australian VC firms fell by 19% compared to FY2008.

Although overall investments made in FY2009 across all sectors did not decline from FY2008 values, the nature of these investments tended to favour later stage companies, later stage funding rounds and existing investee companies. Data indicates that exits were down by 64% in FY2008 compared to FY2007.³⁷ Figure 41 illustrates the total investment in Life Sciences (biotech, pharmaceutical and health) in Australia over the past 5 years.³⁸

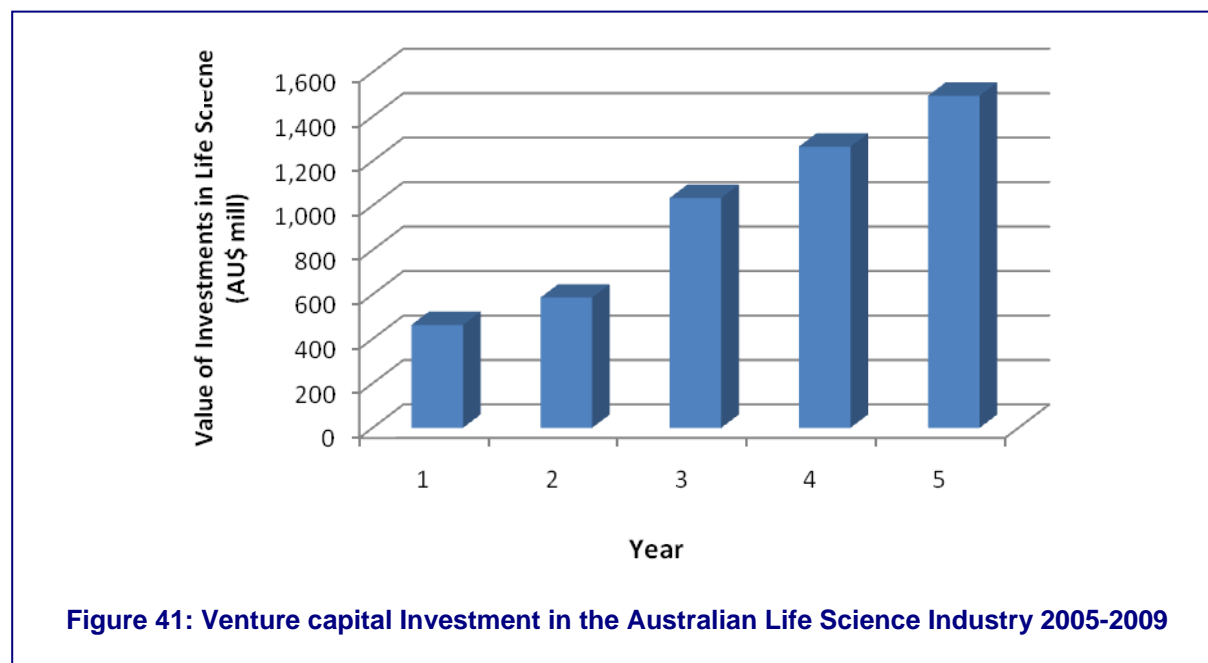


Figure 41: Venture capital Investment in the Australian Life Science Industry 2005-2009

The total investment by state across all industries is presented in Table 37 below.

State	2005	2006	2007	2008	2009
New South Wales	1,174	1,450	2,386	3,029	3,044
Victoria	978	1,020	1,571	1,905	1,787
Queensland	413	646	939	1,123	1,059
Western Australia	300	473	391	424	333
South Australia	133	150	264	173	135
Tas., ACT and NT	133	95	160	136	132

Australia's performance (per capita) in attracting VC investment in Life Sciences is compared to select other countries in Figure 42. VC investment by this measure grew consistently in Australia between 2005 and 2009.

Venture capitalists in the USA invested a record \$9.1 billion into biotechnology and medical devices companies in 2007 representing a 20% increase on the total funds invested in the sector in 2006.³⁹ The increase in investment was said to be driven, in part, by increasing demand for biotechnology acquisitions from 'Big Pharma' which is seeking to supplement development pipelines and replace blockbuster drugs for which patent protection will lapse in the next few years. The 20% increase in VC funding for biotechnology/medical devices companies was not replicated in subsequent years. With the onset of the global financial crisis in 2008/2009, US VC investment declined to 2005 levels.

³⁶ Australian Private Equity & Venture Capital Association

³⁷ Ibid.

³⁸ Australian Bureau of Statistics, 56780 Venture Capital and Later Stage Private Equity, Australia, 2009

³⁹ Timmerman, L., 'Biotechnology Companies Raise Record Venture Capital in 2007', Bloomberg.com, 2008

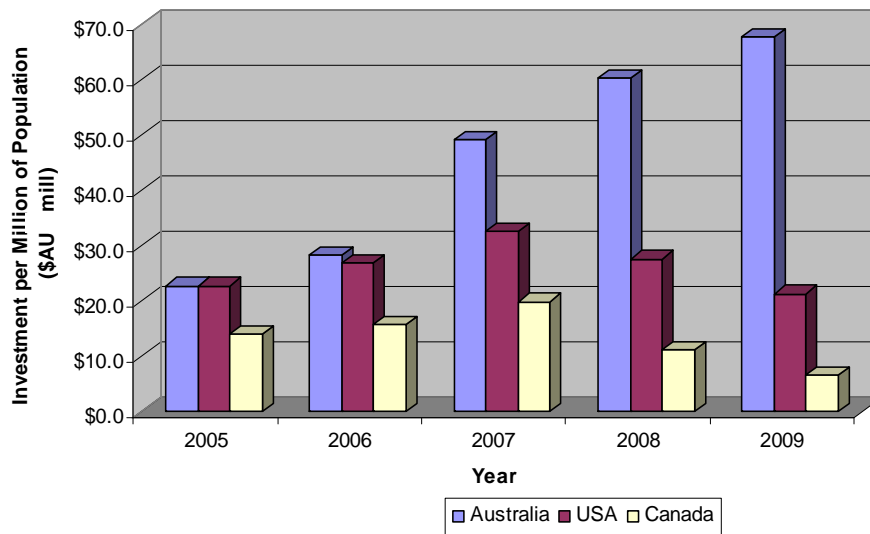


Figure 42: Venture capital Investment in Life Science per Million Population, Australia vs. USA and Canada 2005-2009 (AU\$)

9.0 Exports and International Collaborations

SNAPSHOT

- *Survey respondents reported that an average of 33% of their income was derived from exports.*
- *The top 5 largest export markets reported were:*
 1. *United States of America*
 2. *New Zealand*
 3. *United Kingdom*
 4. *Japan/Singapore*
 5. *Europe*
- *The top 5 future target export markets reported were:*
 1. *United States of America*
 2. *Japan*
 3. *New Zealand*
 4. *United Kingdom*
 5. *Europe*

Export Markets

9.1 Export Revenue

Thirty-seven organisations (of 71 respondents) reported an average of 33% of income being derived from exports. For the Queensland Biotechnology Report 2007, an average of 15% of total income was generated from international business deals or exports. Data from the Queensland TMD Report 2007 are not directly comparable. In that survey, almost half (49% or 26) of the organisations surveyed indicated that exports were not a significant part of their revenue stream (representing <5%). However, 15% of TMD organisations reported greater than 50% of revenue being from exports, while 13% reported between 35 and 50% of revenue was generated from exports for FY2007.

9.2 Export Earnings

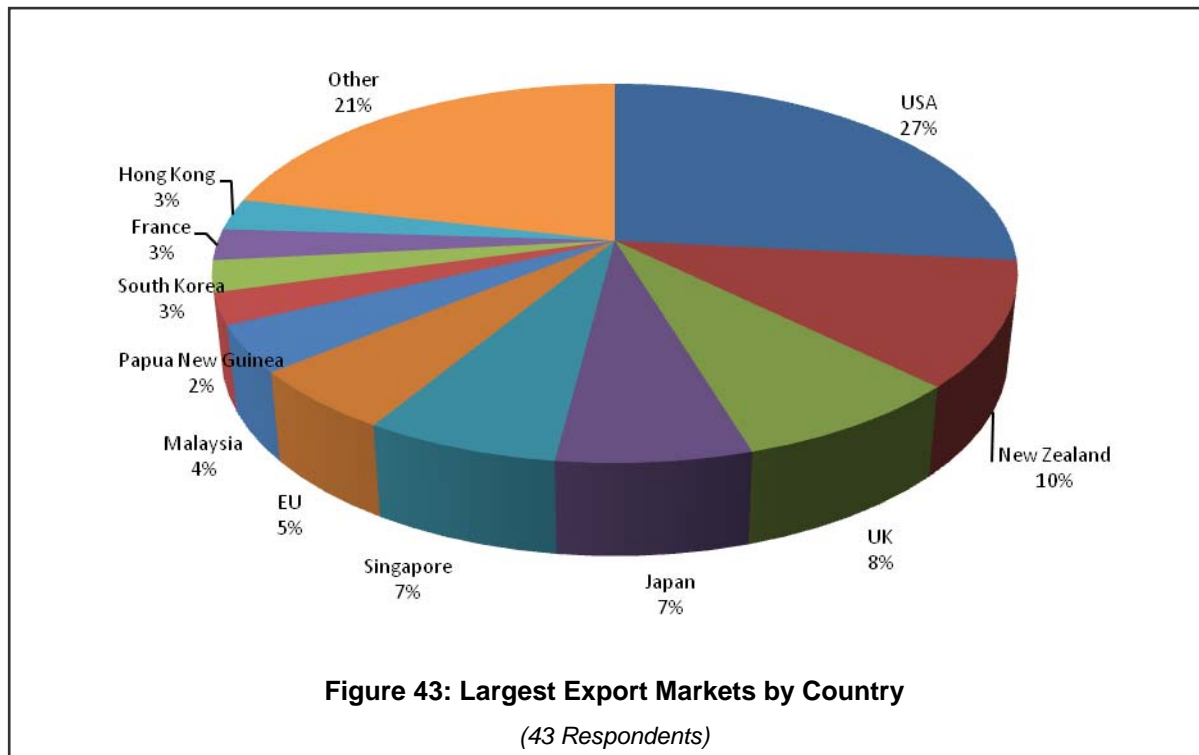
The total value of export earnings reported in the current survey was \$139.7 million (37 respondents) and the average export earnings per organisation were \$4.1 million. Of the 36 companies that reported export earnings, 33 nominated a total combined export revenue of \$139.3 million, accounting for an average of 33% of total revenue for these companies or \$4.2 million per company. Only one research organisation reported export revenue of \$371,000, equating to 11% of their total revenue.

9.3 Export Markets

Survey respondents (43) nominated the countries that represented their largest export markets. The top 5 largest export markets reported were as follows:

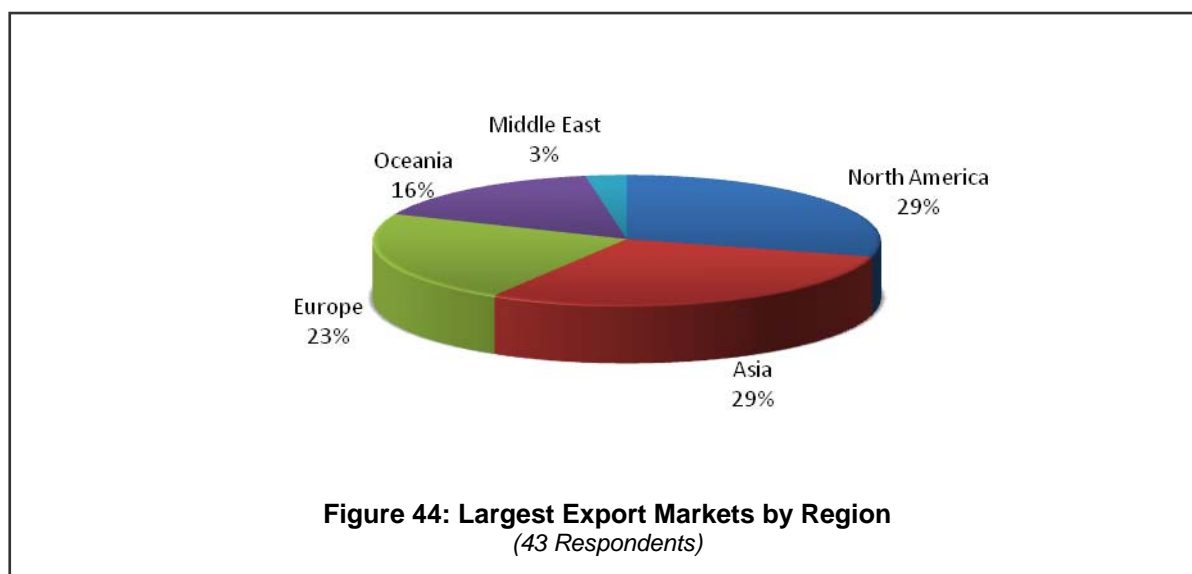
1. United States of America
2. New Zealand
3. United Kingdom
4. Japan/Singapore
5. Europe

The 'Other' category included in Figure 43 below represents 16 individual countries (see the Appendices to this report for a list of these countries).



By region, North America and Asia were the largest export markets for Queensland life science organisations (Figure 44).

Queensland Life Science Industry Survey Results



Comparisons with results from the previous Queensland Biotechnology and TMD Industry Surveys 2007 (Table 38) reveal that the USA, UK and New Zealand continue to be top export markets for the industry.

Rank	Top Ranking Export Destination		
	Biotechnology FY2007 [#]	TMD FY2007	Life Science FY2009
1	United States of America	United States of America	United States of America
2	New Zealand	United Kingdom	New Zealand
3	France	New Zealand	United Kingdom
4	United Kingdom	Singapore/Hong Kong/Japan	Japan/Singapore
5	Japan	Europe	Europe

[#] Defined in the Queensland Biotechnology Report 2008 as International Business Deals or Exports

In relation to future export markets, survey respondents (143) nominated those markets they planned to target, with the top 5 being as follows:

1. United States of America
2. Japan
3. New Zealand
4. United Kingdom
5. Europe

Comparisons with results from the previous Queensland Biotechnology and TMD Surveys 2007 (Table 39) reveal that the USA, New Zealand, UK and Japan continue to be key industry target markets.

Rank	Top Ranking Future Export Target Markets		
	Biotechnology FY2007 [#]	TMD FY2007	Life Science FY2009
1	United States of America	United States of America	United States of America
2	United Kingdom	Europe	Japan
3	China	New Zealand	New Zealand
4	Japan	United Kingdom	United Kingdom
5	New Zealand	Asia	Europe

[#] Defined in the Queensland Biotechnology Report 2008 as International Business Deals or Exports

International Business Deals, Research Collaborations & Alliances

9.4 Revenue from International Business Deals

31 of 63 respondents noted that they earned revenue from international business deals or research collaborations. Twenty-six organisations reported total revenue from international business deals of \$16.2 million, with an average of \$623,000 per organisation, and representing 23% of total revenue on average.

Companies (22 respondents) reported an average of 27% of total revenue being derived from international business deals or research collaborations. Twenty companies reported revenue from international business deals totalling \$13.2 million, or an average of \$659,000 per organisation.

Nine research organisations noted that they earned revenue from international business deals or research collaborations. Six research organisations reported total revenue from international business deals of \$3.0 million, with an average of \$504,000 per organisation, and representing 13% of total revenue on average.

9.5 Target Markets for International Business Deals and Collaborations

International Business deals and research collaborations for Queensland Life Sciences organisations were most commonly located in the following countries: (1) USA; (2) China; (3) UK; (4) New Zealand; and (5) Japan. Asia, North America and Europe were the top three regions for deals and collaborations (Figure 45 and Table 40).



Respondents (54) also reported the countries their organisation planned to target for international business deals or research collaborations within the next three years (Table 40). The top 3 target countries were (1) USA; (2) United Kingdom; and (3) China.

Queensland Life Science Industry Survey Results

Table 40: Location of Current Collaborations reported in FY2009 and those targeted for future collaboration

Location of Current Collaboration		Location Targeted for Future Collaboration	
USA	27	USA	44
China	8	UK	15
UK	7	China	14
New Zealand	6	Europe	12
Japan	5	New Zealand	11
Germany	4	Japan	9
Singapore	4	India	7
Denmark	3	Germany	6
Indonesia	3	Korea	6
Canada	3	Canada	4
Korea	3	Singapore	3
France	3	UAE	3
Malaysia	2	Malaysia	3
Europe	2	South Africa	3
Thailand	2	France	2
Switzerland	2	Taiwan	2
Sweden	2	Thailand	2
Guatemala; Armenia; Austria; Taiwan; Ireland; Hong Kong; and Italy	1 each	Belgium; Asia; Hong Kong; Brazil; Indonesia; Ireland; Jordan; Middle East; Pacific Nations; SE Asia; Spain; Syria; The Netherlands	1 each

Survey participants were asked to nominate areas in which they may engage in collaborations, alliances or partnerships in the future. Respondents were able to select more than one response. 60% of the 76 respondents noted the intention of new collaborations or partnerships in R&D (Table 41).

Table 41: Future Collaborations, Alliances or Partnerships

RANK	Area	Proportion of Responses
1	R&D	60%
2	Marketing and Distribution	48%
3	Technology or IP Licensing or Development	43%
4	Manufacturing /Outsourcing	42%
5	Preclinical and Clinical Trials	35%
6	Other	8%



Case Study 3

Magnetica Limited

Magnetica Limited has specialist skills and IP in relation to design and development of superconducting magnet and magnet systems for the global human Magnetic Resonance Imaging (MRI) market.

Magnetica was launched in 2005 to commercialise IP and knowledge originating from The University of Queensland (UQ). Since inception, Magnetica has raised over \$10 million from investors and also received strong government support including a Smart State grant (\$598.5k), which allowed the company to demonstrate the feasibility of and accelerate commercialisation of its technology and a TeQstart investment (\$250k, matched by private investors). Additionally Magnetica has been a member of the State Governments technology incubator, i.lab, which has provided excellent company support, networks and innovative environment from which to operate. The company and its partners were delighted to be awarded a \$1million research industry partnerships program grant in the latest Queensland Government round of funding to support development of a new exciting magnet system.

The Company has built key strategic partnerships with UQ, which provides innovative high technology solutions to new product design, and with Japan Superconducting Technologies Inc (Jastec), which provides experienced superconducting prototyping and manufacture.

Magnetica's team, skills and IP, together with its partners, create a globally unique package. There are no other truly independent companies or groups with demonstrated product development expertise that are capable of providing innovative magnet designs and magnet production solutions for the superconducting MRI market.

Magnetica's first product, developed in partnership with Jastec, is currently in production under a supply contract. This supply contract was originally with a small US based systems integrator. In November 2009, the business assets of this company were purchased by GE Healthcare. Magnetica believes that GE's purchase of the systems integrator after release of the product incorporating our magnet demonstrates our technology. The company expects to receive its first revenues for this product shortly through a profit share agreement with Jastec. This is a new-to-the-world product in a defined market, with no comparable competing product.

Magnetica has received design fees for work on a second prospective product currently at prototyping phase at Jastec, and will receive royalties on any future production orders received (expected to commence in 2011).

The Company is also currently seeking to develop a subsequent product that incorporates new proprietary technology, representing a totally new approach to magnet and magnet system design. If successful, the base technology could be used in other future Magnetica products and has the potential for further licensing opportunities (as a 'platform technology') to MRI solution provider(s). The Company has applied for patent protection to cover this approach and are working on developing the first product in this range.

10.0 Education and Skilling

SNAPSHOT

- *Queensland universities accounted for 14,165 (25.3%) Australian science graduates in 2007 and 10,179 (17.8%) in 2008.*
- *The proportion of Australian bioscience completions from Queensland universities decreased from 9,188 (21.7%) in 2007 to 7,950 (18%) in 2008.*

Education and Skilling

The Australian Government Department of Education, Employment and Workplace Relations (DEEWR) collects data on the number of higher education course completions across 12 fields of education. For the purposes of this report, higher education ‘science’ courses were broadly defined as those falling within the categories of Natural and Physical Sciences, Information Technology, Engineering and Related technologies, Agriculture, Environmental and Related Studies and Health.

Based on this definition it was estimated that 55,829 students graduated from science degrees in Australia in 2007 and 57,166 in 2008. Queensland universities accounted for 14,165 (25.3%) science graduates in 2007 and 10,179 (17.8%) in 2008.

For the purposes of this study, ‘bioscience’ courses were defined as those falling within the categories of Natural and Physical Sciences, Agriculture, Environmental and Related Studies and Health. Based on this assignment, the number of bioscience completions nationally increased by 4.4% from 42,282 graduates in 2007 to 44,126 in 2008. The proportion of bioscience completions from Queensland universities decreased from 9,188 (21.7%) in 2007 to 7,950 (18%) in 2008 (Figure 47).

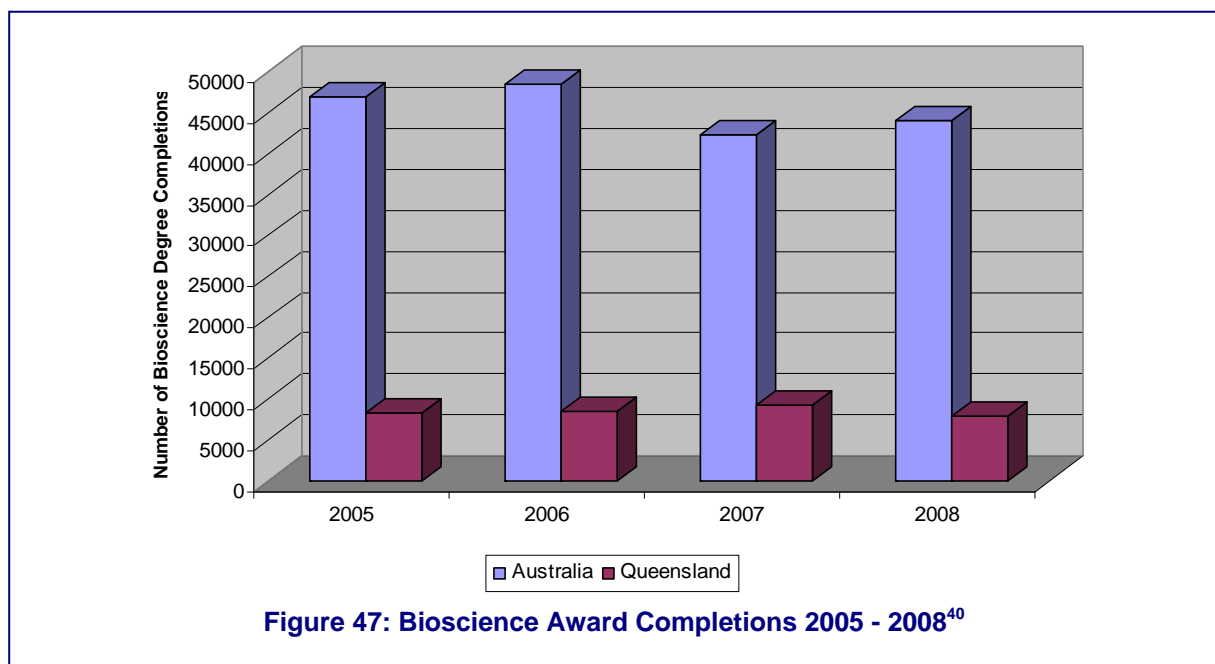


Figure 47: Bioscience Award Completions 2005 - 2008⁴⁰

Figure 48 shows the trend of estimated Queensland science and bioscience graduations per year from 1998 to 2008. While DEEWR does not provide figures for graduations by State and discipline for years prior to 2005, it is possible to approximate the number of graduations per year by applying the proportion of Australian graduations that occurred in Queensland, to Australian totals for each discipline. Based on these assumptions, it was estimated that in 2009 the number of science graduations per annum in Queensland dropped by approximately 2% from the 2008 figure of 14,250. Queensland bioscience graduations remained at similar levels over the same period.

⁴⁰ Department Education, Employment and Workplace Relations, Data Source: <http://www.deewr.gov.au/HigherEducation/Publications/HEStatistics/Publications/Pages/2008FullYear.aspx>

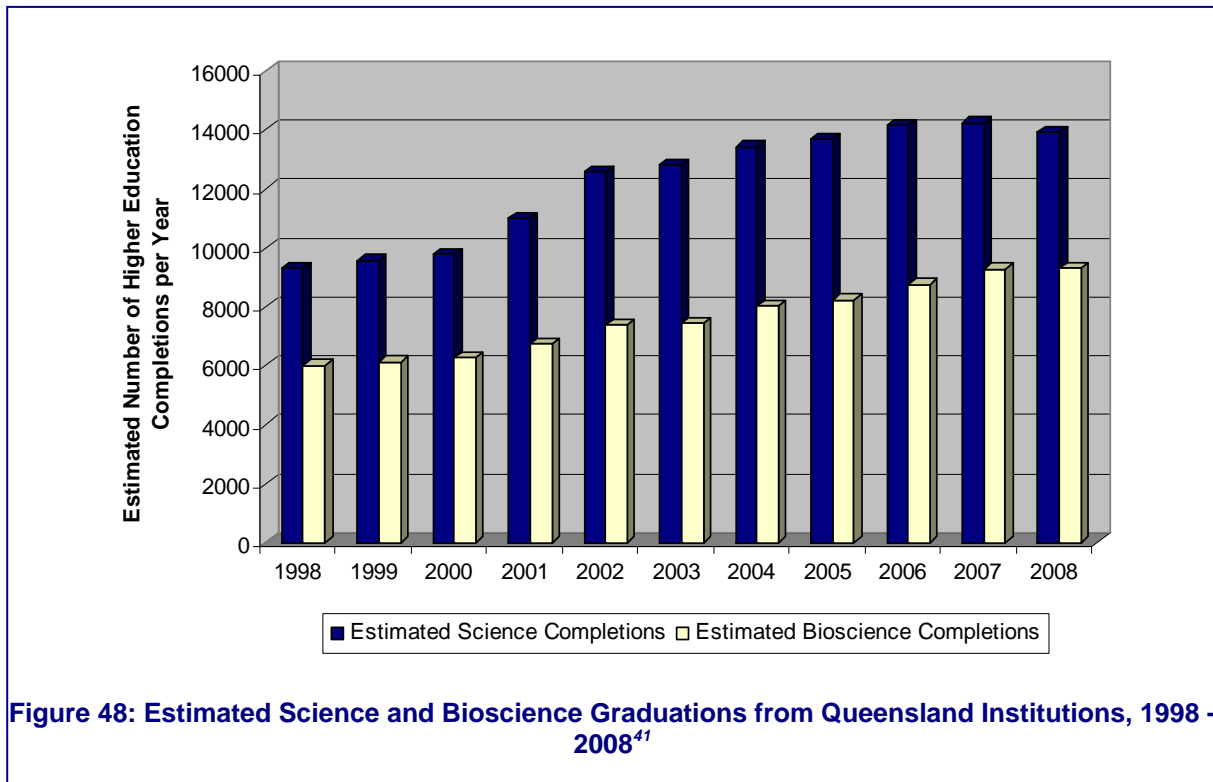


Figure 48: Estimated Science and Bioscience Graduations from Queensland Institutions, 1998 - 2008⁴¹

⁴¹ Ibid.

11.0 Industry Perspectives

SNAPSHOT

- *Respondents identified the following major risks, challenges, barriers to growth and opportunities for their organisations:*
 - *Major risk or challenge – ‘Access to sufficient capital for growth or market entry’*
 - *Major barrier to future revenue growth – ‘Limited access to capital/finance’*
 - *Future Opportunities for expansions of the industry – ‘Improved industry representation, coordination or networking’*
- *63% of respondents were positive about the level of industry engagement offered by the Queensland Department of Employment, Economic Development and Innovation*

Queensland Life Science Industry Survey Results

Risks and Challenges

Survey respondents (90) nominated the issues that they considered to be the major risks or challenges facing their organisation. Respondents were able to select multiple responses. These are tabulated below (Table 42) in order of their ranking of the frequency of selection.

RANK	Area	Proportion of total responses
1	Access to sufficient capital for growth or market entry	60%
2	Competition	34%
3	Other regulatory restrictions	28%
4	Global financial crisis	22%
5	Other	21%
6	Consumer behaviour	19%
7	Technology and systems	12%
8	Transport and distribution	6%
9	Climate change and associated regulatory changes	4%
10	Increases in Interest rates	4%
11	Water restrictions	1%

Barriers to Growth

Survey respondents nominated the major barrier to the future revenue growth of their organisation as '*Limited access to finance/capital*'. This barrier scored considerably higher than all other options. The table below (Table 43) shows the rank given to each barrier nominated by a Life Sciences organisation.

RANK	Area	Proportion of total responses
1	Limited access to finance/capital	27%
2	Small size of domestic market	17%
3	Increased domestic and/or international competition	15%
4	Access to overseas markets	9%
5	Inability to secure skilled technical and managerial staff	8%
6	Increased regulatory compliance costs	7%
7	Lack of commercialisation experience or expertise	4%
8	Increased patent protection costs	4%
9	Inability to outsource sufficient manufacturing capacity	4%
10	Inability to secure Board members with appropriate experience and networks	3%
11	Lack of access to analytical testing, research or clinical trial services	2%

11.1 Barriers to Growth in the Life Science Industry

A lack of access to sufficient capital was identified by Queensland Life Sciences Survey respondents as both the greatest risk/challenge facing their organisation, and the most significant barrier to future growth. This is not a new concern, with limited access to finance or capital also identified as the major barrier to growth by respondents to the Queensland TMD Survey in FY2007.

A lack of adequate follow-on capital was also identified as a challenge of the Australian biotechnology industry.⁴² The impact of a lack of access to sufficient capital was magnified by the close, in May 2008, of the Australian Government's Commercial Ready grant program. Bioshares estimated that over \$300 million was invested in the Australian Life Sciences industry between 1996 and 2008 through the Commercial Ready scheme and its predecessors.⁴³ In January 2010, the Australian Government's 'Commercialisation Australia' initiative was launched with a suite of new programs to replace Commercial Ready and COMET. There will necessarily be some lag time before the value and impact of these programs can be assessed.

The Life Sciences and biotechnology industries in countries such as Canada and New Zealand have also highlighted access to capital as a significant challenge: 78% of respondents to the PwC/BioteCanada survey in 2009 noted this.⁴⁴

Future Opportunities

Respondents (82) commented on future opportunities for expansion of the Life Sciences industry. These are tabulated below (Table 44) ranked in their order of importance.

RANK	Area	Proportion of total responses
1	Improved industry representation, coordination or networking	45%
2	Increased manufacturing capacity	34%
3	Infrastructure such as contract research / manufacturing facilities	33%
	Increased foreign investment into Australia	33%
4	Collaborative training between industry and educational institutions	31%
5	Preclinical and clinical trial services	28%
6	Skills enhancement through TAFE or University courses	18%
7	Other	18%

Responses (direct quotes shown) in the 'Other' category included:

- *Engagement between clinicians and researchers*
- *Prototyping and product development and product design*
- *Leveraging (the) skills and resources of successful Qld based organisations and providing linkages for start-ups with established enterprises that already have strong governance, management and infrastructure*
- *Access to public R&D money outside the university or Government Sector.*

Several respondents offered comments (direct quotes) on the possible role for government in encouraging expansion of the Life Sciences industry:

- *Assistance with capital expansions*

⁴² Biotechnology Australia, Roundtable Summary Report, December 2007 and 'Beyond the GFC: how biotech can overcome the dark days', Australian Life Scientist (2009) March/April page 22

⁴³ Beyond Borders: Global Biotechnology Report 2009, Ernst & Young

⁴⁴ PricewaterhouseCoopers' (PwC) Canadian Life Sciences Industry Forecast 2009 and NZBIO New Zealand Biotechnology Industry Growth Report 2008

Queensland Life Science Industry Survey Results

- *A commitment from the Queensland Government to have a program which actively encourages their departments to become customers for Health companies & products developed in Queensland*
- *Hospitals to buy local innovation - to become early adopters*
- *Continue to strongly support the sector as it takes, on average, 13 years for a new pharmaceutical product to reach the pharmacy shelves after initial discovery. This sector employs highly skilled personnel and with another decade of strong government support, new pharmaceuticals development will almost certainly be a flagship industry in Queensland.*
- *Government Purchasing (tenders). Need to be able to identify rapidly potential acquisitions in our market so we can strategise tender submissions etc*
- *Clear leadership and support from Government (read Premier) to keep this a priority for her Government*
- *Direct grants to assist with projects where there is a direct benefit to the state or nationally.*

Feedback on Government Initiatives

Participants in the survey provided feedback on initiatives of the Queensland Government and made suggestions on future areas for Government intervention to support industry growth.

11.2 Satisfaction with Government Engagement with Industry

Approximately 63% of respondents were positive about the level of engagement with industry that is offered by the Queensland Government DEEDI. 26% provided what might be considered neutral responses and the remaining 11% offered some critical comment. A selection of comments is provided below.

Comments (direct quotes)

- *Very satisfied -- DEEDI is trying very hard, given the financial constraints*
- *Department does a great job, but need political intervention to educate Health Dept on need to become an early adopter of local innovation*
- *The Government has built outstanding infrastructure to support Life Sciences. It is critical that real and substantive support be directed to develop businesses outside the universities and institutes. Without strong business, the full value of the investment in infrastructure will not be realised.*
- *Only recently contacted the department for support. Initial enquiries to state govt during due diligence phase indicated that little or no support would be available until export markets were targeted or employee numbers grew.*
- *Department level is keen and try to help - but ineffectual due to lack of budget and ability to move quickly (when there is budget) - and especially hamstrung because of lack of vigour/interest in the sector by the Government*
- *Role and support of QCTN is critical to continued promotion of Queensland Clinical Trial Service providers*
- *The mentoring programs have helped a number of companies and make them more investor-ready. The proof of concept fund is a very valuable program, particularly in the light of the loss of Commercial Ready but the amount is really too small to benefit a biotech company. POC in biotech would need about \$250,000.*
- *Yes, staff at DEEDI and its predecessor Department are pragmatic, knowledgeable, efficient and easy to work with.*
- *Very significant interaction in discussing business opportunities for Queensland with Departmental staff and politicians.*
- *Queensland government should put pressure on the TGA to allow more nutritional substances to be registered. NZ allows far more products to be registered than Australia. The TGA has hamstrung the manufacturing industry by registering and supporting too many overseas manufacturers that compete with us in Australia. This indicates that the (Federal) government has no interest in our industry. Poor policy, too much regulation and little support.*
- *I am very satisfied with the level of engagement with DEEDI officers with whom we have strong working relationships.*
- *The Queensland Government has been highly supportive of our R&D via RIPP grant funding.*



12.0 Summary of Key Statistics

Queensland Life Science Industry Survey Results

	Sample Size (N)	Mean	Median	Total Reported	Total Estimated
Total Income (\$M)					
All Respondents	91	\$13.7 million	\$1.5 million	\$1,246 million	\$4,943
Companies	74	\$13.6 million	\$1.2 million	\$1,003 million	\$3,844
Research Organisations	17	\$14.3 million	\$6.2 million	\$243 million	\$1,099
Employment (FTEs)					
All Respondents	119	56	12	6,673	19,731
Companies	91	39	10	3,538	13,442
Research Organisations	28	112	65	3,135	6,289
Wages and Salary Expenditure (\$M)					
All Respondents	77	\$3.2 million	\$0.57 million	\$250 million	\$1,078
Companies	63	\$2.8 million	\$0.43 million	\$174 million	\$929
Research Organisations	14	\$5.4 million	\$3.4 million	\$76 million	\$149
Capital Expenditure (\$M)					
All Respondents Reporting Capex	49	\$0.99 million	\$0.10 million	\$48.4 million	\$253
Companies	40	\$0.55 million	\$0.09 million	\$22.1 million	\$181
Research Organisations	9	\$2.9 million	\$1.57 million	\$26.3 million	\$72
Research and Development Expenditure (\$M)					
All Respondents	73	\$3.0 million	\$0.30 million	\$216 million	\$803
Companies	60	\$1.6 million	\$0.23 million	\$94 million	\$417
Research Organisations	13	\$9.4 million	\$3.90 million	\$122 million	\$386

Queensland Life Science Industry Survey Results

	Total Estimated	95% CI (Bias Corrected and Accelerated)	
		Lower	Upper
Income (\$M)			
All Respondents	\$4,943	\$3,880	\$6,770
Employment (FTEs)			
All Respondents	19,731	17,410	22,318
Wages and Salary Expenditure (\$M)			
All Respondents	\$1,078	\$879	\$1,320
Capital Expenditure (\$M)			
All Respondents Reporting Capex	\$253	\$199	\$310
Research and Development Expenditure (\$M)			
All Respondents	\$803	\$632	\$988

13.0 Appendices

Methodology

The following section defines the data sources used in the study; limitations of the data collected; and data that was unavailable.

13.1 Primary Data

All primary data included in this report was collected from Queensland Life Sciences companies and research organisations through an industry survey conducted in December 2009 and January 2010. The methodology employed to conduct the survey is described below.

13.2 Defining the Queensland Life Science Industry

For the purpose of the Queensland Life Science Survey 2010, the Queensland Life Sciences industry was defined as any including company, university group or research institution that is undertaking life science related activities in the categories described below. These categories were adapted from the AusBiotech definition of biotechnology in combination with Pharmaceutical industry definitions.

Industry Sector	Examples
Human Health – Pharmaceuticals or Drug Discovery	<ul style="list-style-type: none"> Diagnostics e.g. immunodiagnostics, gene probes, biosensors. Therapeutics e.g. vaccines, immune stimulants, biopharmaceuticals, rational drug design, combinatorial chemistry. Gene therapy e.g. gene identification, gene constructs, gene delivery, xenotransplants. Genomics/Proteomics/ Bioinformatics/ Bioprospecting - genomics and molecular analysis e.g. DNA/RNA/protein sequencing and databases for humans, plants, animals and microorganisms, structure function studies.
Human Health – Complementary Medicines	<ul style="list-style-type: none"> Nutraceuticals Traditional medicines
Human Health - Functional Foods/Beverages	<ul style="list-style-type: none"> Functional Foods/Beverages: additives, nutraceuticals (e.g. Probiotics, unsaturated fatty acids)
Human Health – Medical Devices	<ul style="list-style-type: none"> Implantable medical devices Diagnostic medical devices e.g. MRI
Animal Health	<ul style="list-style-type: none"> Animal Biotechnology (e.g. Diagnostics, therapeutics, embryo transplantation, genetic markers, genetic engineering, animal breeding, anti-microbials)
Agriculture and Food Biotechnology	<ul style="list-style-type: none"> Plant Biotechnology (e.g. tissue culture, embryogenesis, genetic markers, genetic engineering, plant breeding, floriculture, forestry) Agrichemicals: Biofertilisers, biopesticides, bioherbicides, biological additives, microbial pest control, hormones, pheromones, and other agrichemicals Food Processing (e.g. Food products, food components, enzymes, yeasts, bacteria culture)
Environmental	<ul style="list-style-type: none"> Biofiltration and treatments e.g. treatment of organic emissions to air/water. The development of biological systems for bioremediation of contaminated environments (land, air, water) or toxic waste sites. Diagnostics e.g. detection of toxic substances using bioindicators, biosensors, immunodiagnostics. Environmentally-friendly processes; green manufacturing technologies; cleaner industrial bioprocessing e.g. biopulping, biobleaching
Industrial (White Biotechnology)	<ul style="list-style-type: none"> Biofuels Custom bio-synthesis of biologicals e.g. peptides, proteins, nucleotides, hormones, growth factors. Custom synthesis of fine chemicals e.g. monomers, fuels, lubricants, fine chemical feed stocks, cosmetics. e.g. technologies to improve the efficiency and environmental foot print of industrial production; alternative energy; development of novel biomaterials; use of plants and enzymes to generate industrial products. Industrial Biotechnology enables reductions of material and energy consumption, as well as pollution and waste generation, for the same level of industrial production.
Bioinformatics	<ul style="list-style-type: none"> Broadly defined as the application of information technologies and sciences to an organisation, management, data mining and use of life-science information.
Industry Service Provider	<ul style="list-style-type: none"> Contract research, contract manufacturing, clinical trials, incubators, technology transfer offices

Queensland Life Science Industry Survey Results

13.3 Development of Survey Questionnaire

The survey questionnaire was developed based largely on the question set used in the previous Queensland Biotechnology Industry Survey 2008 and Queensland Therapeutic Medicines and Devices Industry Survey 2008. This approach was adopted so that as much as possible of the data collected would be comparable with that from the previous surveys. Additional questions were added to gather data in new areas of interest for the State.

The questionnaire was submitted to the Office of Biotechnology and Therapeutic Medicines and Devices for review and approval prior to launching the survey online. The questionnaire was designed to gather data on key measures of economic, research, commercialisation and education performance. These measures included:

Core Data

- Industry Performance
 - Number of establishments
 - Years established
 - Industry sector distribution
 - Value / supply chain distribution
- Economic Performance
 - Number of employees
 - Change in employee numbers over previous 12 months
 - Total expenditure on salaries and wages / average wage
 - Revenues
 - Number of ASX-listed companies
 - Market capitalisation of listed companies
 - Exports (value and key markets) / Imports
- Commercialisation Performance
 - Number of products / services in development and associated stage of development
- Education / Skilling Performance
 - Distribution of skills (work categories)
- R&D Performance
 - R&D expenditure

Sector Specific Data

- Economic Performance
 - Life scientists in workforce
 - Revenues to include income from grants
 - Cash forecasting by client
 - Income generated by international business deals
 - Key international collaborations / alliances
- Commercialisation Performance
 - Patents lodged
 - Angel / VC investment secured
 - Spin off companies formed
 - Clinical trials
 - Licences issued
- Education / Skilling Performance
 - Science Higher Education degrees awarded by QLD institutions
 - Bioscience Higher Education degrees awarded by QLD institutions
- R&D Performance
 - Citations / Publications
- Capital Raising Strategy for next 12 months
 - Venture capital
 - Angel investors
 - Mergers and acquisitions
 - In-licensing and out-licensing
 - IPOs
 - Private options
- Commercialisation strategy

Respondents were offered an opportunity to provide feedback on Queensland Government policies and record statements on issues of importance to their organisation.

13.4 Distribution of Survey and Collection of Responses

The online survey platform Survey Monkey,⁴⁵ was used to deliver the survey to organisations on the industry contact database provided by the DEEDI, Office of Biotechnology and Therapeutic Medicines and Devices. The most senior or most relevant, contact within each organisation was selected to receive the survey. Contacts were excluded in cases where a sub-division of that organisation, which has a greater focus on life science, was already represented in the survey. For example, the central administration of Queensland universities were generally excluded since a number of life science focused schools, centres and institutes within each institution were included in the database.

The survey was initially closed on Friday 18 December 2009, with additional responses to be received until 8 February 2010. Prior to the close of the survey and in the following month, brief follow-up telephone calls and/or emails were made to contacts that had not declined to participate in the survey (through the opt-out facility) but had not yet completed the questionnaire. A total of 134 organisations out of the 295 in the DEEDI Life Sciences database (45%) undertook the survey.

⁴⁵ www.surveymonkey.com

13.5 Secondary Research

Secondary research was conducted to gather data to supplement that collected through the industry survey. Wherever possible, the same data source that was used in the previous Queensland Biotechnology Report and Queensland Therapeutic Medicines and Devices Report 2007 was used in the preparation of this report. In cases where these data sources were not available or where the data source had not yet been updated by the publisher, an alternate data source was identified and used in the preparation of the report.

Analysis of Primary Survey Data

At the conclusion of the survey period, the full data set collected through the online industry survey was downloaded from the server of the survey tool provider. All electronic copies of the survey were removed from the server on the completion of the project. Raw survey data was incorporated into a data spreadsheet from which all data outputs and analyses presented in the report were derived. The total, mean and median was calculated for all quantitative data collected.

Total population estimates were derived using multiple imputation methods. A complete list of Life Sciences companies was compiled through consultation with the DEEDI Office of Biotechnology and Therapeutic Medicines and Devices. The organisation classification (company/RO) and estimated organisation size (classified as small, medium or large) were used in a regression equation to estimate missing data points.

Given the non-parametric distribution of the data, the total population estimates and confidence intervals were estimated using bootstrap methods. The organisation classification and size served as strata for the re-sampling. The confidence intervals presented are 95% bias corrected and accelerated to account for the typical right skew of count, and in particular financial data. These methods are superior to mean imputation methods in that known information can be used to inform the missing value, and as such are likely to provide a more accurate representation of the industry.

Secondary Data

The following section describes the secondary data presented in this report.

13.6 Industry Sub-Sector Breakdown

Secondary data was collected on the Australian Life Sciences industry as a whole. This data was extracted from various sources. Due to differences between the industry sub-sector classifications used by IBISWorld and AusBiotech,⁴⁶ the secondary data presented in this report was not comparable with primary data collected through the survey in all cases.

13.7 Market Capitalisation

Data on the market capitalisation of listed biotechnology companies was collected for Queensland, Australia, New Zealand, and Canada. Market capitalisation data was collected from the following sources:

- (a) Market Capitalisation of ASX-Listed Biotechnology Firms: sourced from the PwC BioForum June 2009 publication as at end of the fourth quarter 2009. Queensland based companies were those that either had their head office in Queensland, or a majority of their assets in Queensland.
- (b) Market Capitalisation in countries other than Australia:
 - **Canada:** Canadian listed Life Sciences sector is resident on the Toronto Stock Exchange (TSX/TSXV). The TSX/TSXV listed Life Sciences sector at 31st of December 2009 was accessed online at www.tmxmoney.com/en/sector_profiles/life_science.html.
 - **New Zealand:** The market capitalisation of New Zealand Life Sciences companies listed on both the New Zealand Stock Exchange (NZX) and Australian Stock Exchange (ASX) at November 2008 were defined in the NZBio "New Zealand Biotechnology Industry Growth Report 2008".

13.8 Average Wages

Data on the average wages earned by employees of Life Sciences companies was collected for Queensland; Australia; USA; and Sweden. Wages data for UK and New Zealand was not available in sufficient detail to identify Life Sciences wages over other industries. Average wages data was collected from the following sources:

⁴⁶ the industry sub-sector definitions published by AusBiotech were adopted for the preparation of this report

Queensland Life Science Industry Survey Results

1. *Average Wages, Queensland Life Science Industry vs. Queensland All Industries:*

The average wage calculated from data collected in the primary survey was compared to the average wage paid to Queensland workers across all industries. Queensland average wage data was sourced from the Australian Bureau of Statistics, 6302.0 - Average Weekly Earnings, Australia, Aug 2009, Persons; Full Time; Adult; Total earnings.

2. *Average Life Science Wages, International Comparison:*

- **Queensland:** Average wages for Queensland Life Sciences employees were calculated based on the salary expenditure and employment data collected through the current industry survey. Data was for FY2009.
- **Australia:** Average wages for Australian Life Sciences employees were estimated based on data sourced from the ABS publication 'Australian Bureau of Statistics, 6302.0 - Average Weekly Earnings, Australia, Aug 2009, Persons; Full Time; Adult; Total earnings'. Life Science employees in Australia were defined as those within the occupation categories of Professional, Scientific and Technical Services. Data was current as at August 2009.
- **USA:** Average wages data for biotechnology employees in the USA was sourced from the US Department of Labor, Bureau of Labor Statistics, May 2008 National Industry-Specific Occupational Employment and Wage Estimates. Life Science employees in the US were defined as those within the categories of life scientists, agricultural and food scientists, animal scientists, food scientists and technologists, soil and plant scientists, biological scientists, biochemists and biophysicists, microbiologists, medical scientists, chemists, agricultural and food science technicians, biological technicians and chemical technicians. Data was for the calendar year 2008.
- **Sweden:** Average wages data for Life Sciences employees in Sweden was sourced from the Statistics Sweden publication, private sector, non-manual workers. Average total monthly salary and salary dispersion by occupational group 2008. Life Science employees in Sweden were defined as those within the categories of Life Sciences professionals, Life Sciences technicians, mathematicians and statisticians, architects, engineers and related professionals, physical and engineering science technicians, production and operations managers. Data was for the calendar year 2008.
- **Canada:** Average wages data for Life Sciences employees in Canada was sourced from the Statistics Canada publication, 'Earnings, average weekly, by industry'. Life science professionals in Canada were defined as those within the category - Professional, scientific and technical services. No additional subsectors were available. Data was for 2009.

13.9 Venture Capital Investment

Data on the venture capital (VC) investment in Life Sciences companies was collected for Queensland, Australia (excluding Queensland), USA, and Canada. VC investment data was collected from the following sources:

1. **VC Investment in Life Science, Australia:** sourced from the ABS publication, Venture Capital and Later Stage Private Equity, Australia.
2. **VC Investment by State, All Industries:** sourced from the ABS publication, Venture Capital and Later Stage Private Equity, Australia.
3. **VC Investment in Life Science, International Comparison:** Where international comparisons are made of VC investments in Life Sciences companies, data was presented as investment per million of population to account for the variation in population between countries.
 - **Queensland and Australia:** Data on VC investment in Life Sciences firms in Queensland and Australia was sourced from the ABS publication, Venture Capital and Later Stage Private Equity, Australia. Data was for FY2009.
 - **USA:** Data on VC investments in Life Sciences firms in the USA was sourced from the PricewaterhouseCoopers /National Venture Capital Association, MoneyTree Report 1995 – 2009, Data was for the year 2009. Accessed from <http://www.nvca.org>.
 - **Canada:** Data on VC investments in Life Sciences firms in Canada was sourced from the Canadian Venture Capital Association, Industry Statistics and Venture Capital Investments by Stage of Development in 2005-2009.

13.10 National Competitive Grants

Grants provided by the Australian Government, National Health and Medical Research Council (NHMRC) and Australian Research Council (ARC) were identified as a measure of success in

Queensland Life Science Industry Survey Results

attracting funding for basic and applied life science research. The NHMRC funds institutional medical research of all types while the ARC funds research across all disciplines including Life Sciences. Data on NHMRC and ARC grants awarded to each State by number and value was sourced from the Australian Government, National Health and Medical Research Council Grant Funding 2000 – 2009 (www.nhmrc.gov.au/funding/funded/outcomes/projects.htm) and the Australian Research Council Funded Research Projects – Trends Data Set 2002-2008.

13.11 Business Expenditure on Research and Development (BERD)

Data on BERD and scientific and technical related BERD for Queensland and Australia was sourced from the ABS publication, Research and Experimental Development, Business Australia, FY2008.

13.12 Government Expenditure on Research and Development (GOVERD)

Data on GOVERD for Queensland and Australia was sourced from the ABS publication, Research and Experimental Development, Government and Non-Profit Organisations, FY2007 (later years were not available). Disaggregated data showing expenditure by field of research by state was not available for inclusion in this report. Comparative OECD data was sourced from 'Main Science and Technology Indicators', 2008/1, OECD, Paris, 2008.

13.13 Science Graduates

Data on science degree completions from Queensland and Australian institutions was sourced from the Commonwealth Government, DEEWR publication, Award Course Completions for All Students by Citizenship and Broad Field of Education. Science degrees were defined as the combination of the following fields of education; Natural and physical sciences, Information technology, Engineering and related technologies, Agriculture, environmental and related studies. Data was for the calendar years 2005 - 2008.

Data on bioscience degree completions from Queensland and Australian institutions was sourced from the DEEWR publication, Award Course Completions for All Students by State, Higher Education Provider and Broad Field of Education. Bioscience degrees were defined as the combination of the following fields of education - Health; Natural and Physical Science; and 'Agriculture, Environmental and Related Studies'. Data was for the calendar years 2005 - 2008. Estimated numbers of graduations presented for the years 1996 to 2008 were calculated by applying the percentage of graduations that occurred in Queensland in each year to the number of graduations in each discipline for that year.

13.14 Currency Conversion Rates

Currency	Exchange Rate (AU\$)*	Currency	Exchange Rate (AU\$)*
Canada Dollar	\$1.038	New Zealand Dollar	\$0.787
Sweden Kronor	\$0.156	US Dollar	\$1.081

*Exchange rates were sourced from www.xe.com on 1st December 2009

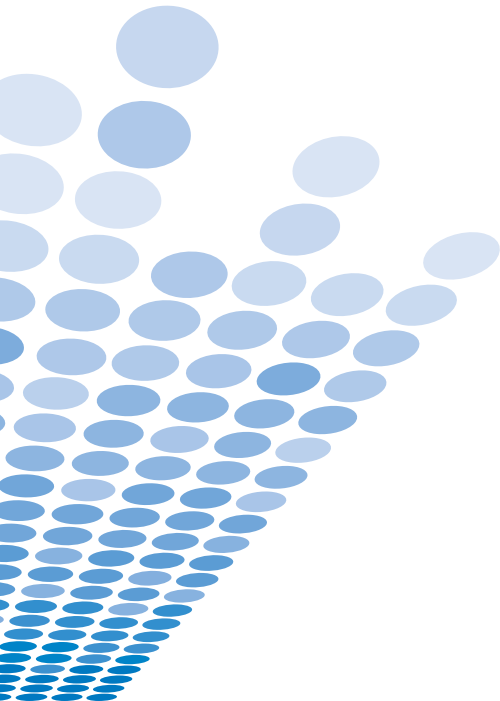
13.15 Grant Schemes Accessed by Respondents and defined as 'Other' in the summary

1	ABRS National Taxonomic Research Grants	15	Manufacturing Microscope
2	ACGI	16	MSRA
3	Apprentice Scheme	17	MTSRF (Commonwealth)
4	BPA Grant	18	National Competitive Grants
5	Cancer Council	19	National Heart Foundation
6	Commonwealth Appropriation	20	Nutricia Foundation
7	Department of Health and Ageing	21	Origin Energy Trial
8	DIISR, National Computational Infrastructure Scheme	22	Reef Rescue
9	Ethnic Communities Council of QLD	23	RIRDC
10	Federal rebates for training	24	Sugar R&D Corporation
11	Foundation grants	25	US NIH
12	GRDC	26	US NSF
13	Leukaemia Foundation	27	WAMSI (WA)
14	Ludwig Institute for Cancer Research	28	Caring for our country

Export Markets defined as 'Other' in the summary

Indonesia	North America	Vietnam	Belgium
Armenia	China	Asia	Canada
Denmark	Austria	Taiwan	Germany
Fiji	Middle East	Solomon Islands	Yemen

Department of **Employment, Economic Development and Innovation**
1300 363 711 (Interstate callers • 07 3001 6359)
www.deedi.qld.gov.au



Toward 
Tomorrow's Queensland



Queensland
Government