



Queensland Government Research and Development Expenditure Report 2011-12

Compiled by the Office of the Queensland Chief Scientist

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Based on information supplied by Queensland Government agencies on their research and development expenditure for the 2011-12 financial year. The Office of the Queensland Chief Scientist would like to thank staff for their continued collaboration in collecting research and development data.

Purpose of the report

Introduction

The Queensland Government invests in research and development (R&D), and partners with Queensland's universities and research institutions, in order to deliver practical research to unlock the state's potential and enable Queenslanders to share in the full benefits of successful resource use.

Queensland will continue to build the state's practical and applied scientific and technology capability, and to capitalise on its natural and intellectual resources to boost the four pillars of the economy – agriculture, resources, construction and tourism.

While much of the required knowledge and many of the tools can be adopted from national and international sources, Queensland has specific issues and opportunities which impact its economy, environment and its residents' health and wellbeing and which require focused R&D efforts.

The Queensland Government's involvement in R&D is three-fold:

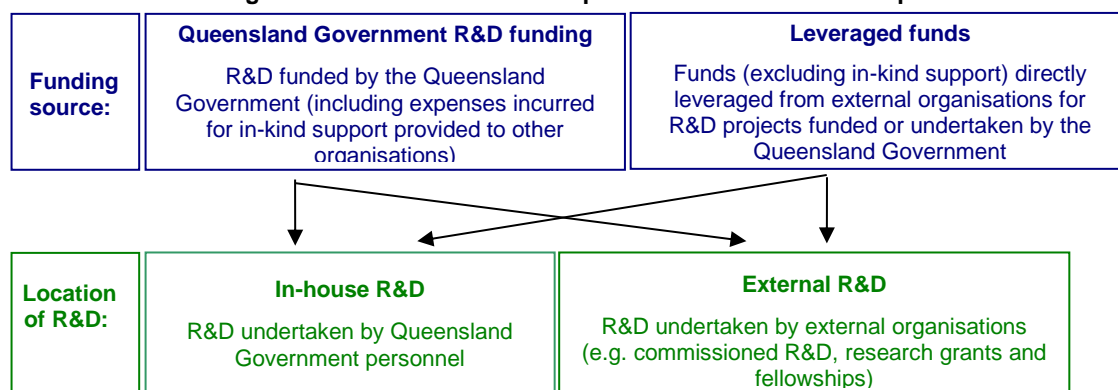
1. undertaking in-house R&D – to guide policy decisions and underpin service delivery
2. commissioning research – to inform policy and decision making
3. facilitating external research – through grants, fellowships, infrastructure investments and a range of initiatives that support Queensland R&D.

This report details the decrease in Queensland Government R&D funding between 2010-11 and 2011-12. The decrease is primarily attributed to the reduction in capital expenditure associated with the completion of major infrastructure projects such as the Ecosciences Precinct at Boggo Road, the Translational Research Institute (TRI) located on the Princess Alexandra Hospital campus in Brisbane, and the Smart State Medical Research Centre (SSMRC) located next to the Bancroft Building at the Queensland Institute of Medical Research (QIMR). The report also details the significant improvement in financial leverage.

Scope

This report provides financial information on the Queensland Government's R&D investments during 2011-12 (Figure 1), and the money these investments have leveraged from external sources. All R&D funding has been attributed back to departments that existed at the beginning of 2011-2012 (i.e. July 2011) as three quarters of the financial year was under this government structure.

Figure 1: Breakdown of R&D expenditure included in the report¹



The report includes an analysis of:

- the level of R&D expenditure reported by Queensland Government agencies
- the breakdown of R&D by the funding source, i.e. who provided the funding
- the breakdown of R&D by location, i.e. the sector² performing the R&D
- the alignment of R&D expenditure with the 14 Queensland R&D priority objectives (see Table 1)
- the alignment of R&D expenditure with the Queensland Government Economic Pillars and the Australian Bureau of Statistics (ABS) classification system.

¹ Queensland Government R&D expenditure reported here differs from that reported by the Australian Bureau of Statistics, which refers solely to Queensland Government in-house R&D (funded by the Queensland Government and external sources).

² E.g. universities, business, private non-profit

Table 1: Queensland Government's current R&D priorities and objectives³

Queensland R&D priorities *	Queensland R&D objectives	to provide the knowledge, tools and technologies required to
Enabling sciences and technologies	Enabling sciences and technologies	<ul style="list-style-type: none"> • <i>support development of capabilities in the enabling sciences and technologies</i>
Environmentally sustainable Queensland	Ecosystems	<ul style="list-style-type: none"> • <i>protect and restore Queensland's diverse ecosystems</i>
	Land	<ul style="list-style-type: none"> • <i>sustain and restore Queensland's land and soil</i>
	Atmosphere	<ul style="list-style-type: none"> • <i>mitigate air pollution and adapt to climate change</i>
	Water	<ul style="list-style-type: none"> • <i>ensure a sustainable balance between water demand and supply</i>
Smart industries	Industry development	<ul style="list-style-type: none"> • <i>build Queensland's knowledge-intensive industries</i>
	Food and fibre industries	<ul style="list-style-type: none"> • <i>enhance productivity and create new value-adding products and services in Queensland's food and fibre industries</i>
	Energy and resources industries	<ul style="list-style-type: none"> • <i>support safe, sustainable and competitive energy and resources industries</i>
	Infrastructure, planning and services	<ul style="list-style-type: none"> • <i>plan for and deliver cost-effective, efficient infrastructure and services</i>
Tropical opportunities	Tropical opportunities	<ul style="list-style-type: none"> • <i>create globally competitive tropical expertise industries</i>
Health and wellbeing	Health	<ul style="list-style-type: none"> • <i>prevent disease and deliver top quality patient care at sustainable cost</i>
	Community wellbeing	<ul style="list-style-type: none"> • <i>identify and address the causes of disadvantage and better integrate the delivery of community services</i>
	Education and training	<ul style="list-style-type: none"> • <i>underpin quality education and training for all Queenslanders</i>
Safeguarding Queensland	Safeguarding Queensland	<ul style="list-style-type: none"> • <i>manage and prevent crime, biosecurity threats and natural and non-natural disasters</i>

* The Queensland R&D priorities and objectives used in this report are under review by the Office of the Queensland Chief Scientist, Department of Science, Information Technology, Innovation and the Arts and the R&D Queensland committee.

³ As of July 2010, the Queensland Government has defined 14 R&D objectives – falling within six R&D priority areas – that address social, environmental and economic issues and opportunities for the State. A profile for each Queensland R&D objective can be found in the [Queensland research and development investment strategy 2010-2020](#).

R&D definition

R&D is defined in accordance with the Organisation for Economic Cooperation and Development (OECD) definition (also used by the Australian Bureau of Statistics) as:

*'creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications.'*⁴

It does not include science activities such as routine monitoring and data collection, quality control, or scientific and technical services. Several Queensland Government departments, such as the Department of Environment and Resource Management, undertake various and important science-related activities that do not adhere to the above R&D definition, so such activities are not captured in this report. The R&D definition also excludes market research, operations research or statistical analyses, policy-related studies, routine computer programming, and the extension or commercialisation of R&D.

Other definitions and categories used

R&D expenditure refers to money expended (excluding Goods and Services Tax) in the indicated financial year. It includes capital expenditure for R&D facilities, such as the acquisition of land and buildings. Current expenditure includes labour costs, project materials, administration and other overheads, and the costs of indirect services (e.g. library materials and computer services).

Leveraged funds refer to cash contributions by external organisations towards R&D projects funded or performed by the Queensland Government and includes direct contributions only, i.e. that expenditure forming part of an R&D contract or agreement. Where the Queensland Government does not hold the financial records for amounts expended by external organisations on a project in 2011-12, leveraged funds are calculated pro rata (based on the proportional overall commitment by organisations to the project and the Queensland Government's expenditure on the project in that year). This does not include in-kind support.

The definitions used for different R&D sectors (e.g. universities, business) referred to in this report are equivalent to those used by the ABS.

In the context of this report, *Queensland Government R&D funding* refers to money provided from departmental budgets. *Total Queensland Government R&D expenditure* includes both Queensland Government funding and leveraged funds.

Data collection

R&D expenditure data are provided to the Office of the Queensland Chief Scientist (OQCS) by each of the Queensland Government's departments, as well as indirectly from statutory authorities and bodies⁵ that fund or perform R&D.

⁴ *Frascati Manual 2002: Proposed Standard Practice for Surveys on Research and Experimental Development*, OECD, Paris, 2002.

⁵ E.g. Queensland Institute of Medical Research (QIMR), Translink, Queensland Museum, Queensland Art Gallery, Office of the Public Advocate, Public Trustee Queensland and Urban Land Development.

Data is not collected from Government-owned corporations⁶, which for R&D reporting purposes are captured under the business sector (i.e. in business expenditure on R&D).

Discussions are underway with the Government Statistician, Queensland Treasury and Trade, to provide a survey for online data submission for the collection of R&D expenditure data from 2012-2013. The Government Statistician would be the core agency through which data collection and monitoring will occur. R&D analysis and reporting will still be performed by OQCS.

Summary

Direct R&D expenditure by the Queensland Government in 2011-12 was \$231 million, of which \$126 million was spent in-house and \$105 million spent externally. Overall, total in-house R&D expenditure equated to \$237 million (Figure 2).

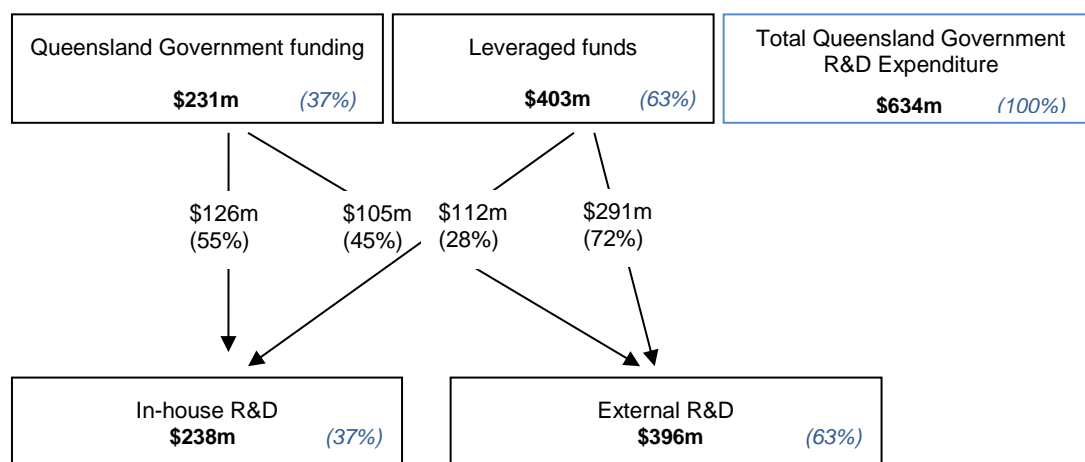
The largest funder of R&D within the Queensland Government was the Department of Employment, Economic Development and Innovation (DEEDI) which invested 73% (\$168 million) of total Queensland Government funding, primarily due to funding associated with large infrastructure projects.

Infrastructure (capital) accounted for \$58 million of the Queensland Government's R&D funding in 2011-12, and current expenditure was \$173 million.

The Queensland Government spent \$634 million on R&D. Of this \$634 million, leveraged funds to the value of \$403 million were obtained from the Australian Government, universities, businesses and other external sources.

2011-12 saw the greatest leveraging of the Queensland Government's investment into R&D since OQCS began compiling this data, with \$1.74 leveraged from external sources for every \$1.00 invested. In-house expenditure leveraged \$0.89 from every \$1.00 spent on in-house R&D. Each \$1.00 spent externally leveraged \$2.76.

Figure 2: Summary of R&D expenditure for 2011-12*



* Numbers have been rounded, resulting in individual amounts not always adding up to totals.

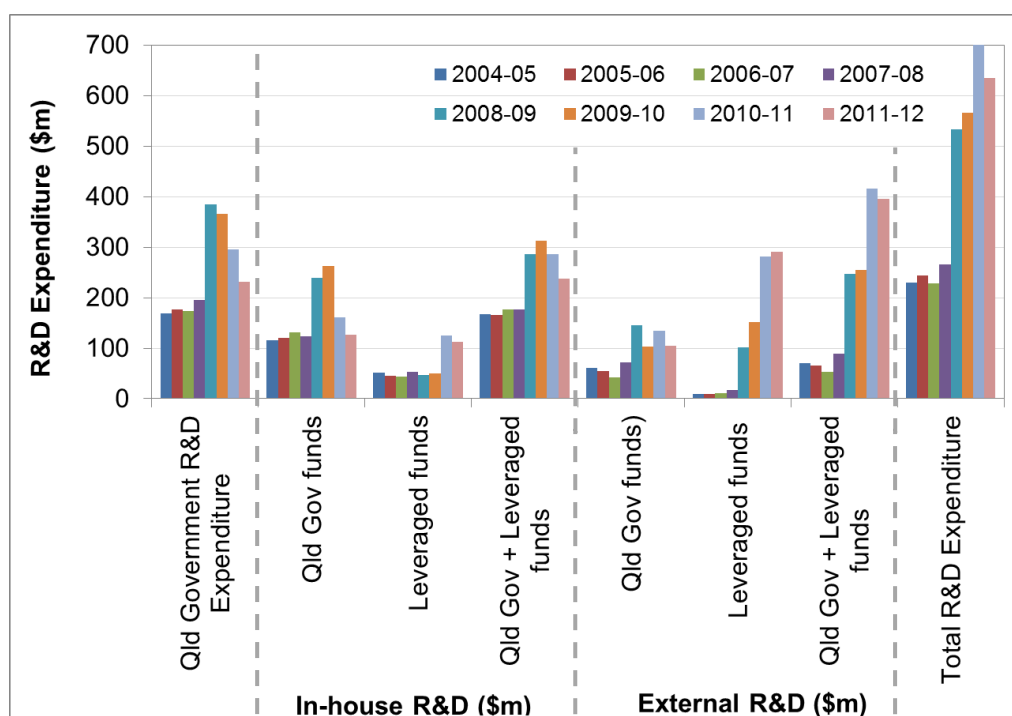
⁶ E.g. CS Energy Ltd, ENERGEX Ltd, Gladstone Ports Corporation Limited and Queensland Rail Limited.

1. R&D Expenditure from 2004-05 to 2011-12

Over the last eight years, R&D expenditure has seen major changes (Figure 3). In 2008-09, total R&D spend (including leverage) increased from \$265 million in 2007-08 to \$533 million; an increase of almost 100%. This large increase was due to financial commitments made in previous years for one-off, large R&D-related projects. Including:

- the Health and Food Sciences and Ecosciences Precincts completed in 2009-10. In 2008-09 the Queensland Government spent \$102 million and leveraged \$30 million from the Commonwealth Scientific and Research Organisation (CSIRO). (capital infrastructure)
- the National Collaborative Research Infrastructure Strategy (NCRIS) projects on which the Queensland Government spent \$7 million and leveraged (pro-rata) \$30 million (capital infrastructure)
- the Smart State Medical Research Centre on which the Queensland Government expended \$6 million (capital infrastructure)
- the ZeroGen clean coal demonstration project. The Queensland Government spent \$45 million and \$46 million in additional funding was provided by the coal industry.
- *operational support (ranging from 1-10 years) for various university and medical research institutes on which the Queensland Government expended \$23 million.*

Figure 3: Total Queensland Government R&D expenditure from 2004-05 to 2011-12



*Total R&D Expenditure – Qld Gov + Leveraged funds, In-house + External (\$m)

R&D expenditure by the Queensland Government (excluding leverage) declined by 40% between 2008-09 (\$385 million) and 2011-12 (\$231 million) (Table 2). Substantial commitment to large projects had already been expended to the Health and Food Sciences and Ecosciences Precincts in 2009-10 (\$160 million) with much smaller repayments in 2010-11 (\$19 million) and 2011-12 (\$1.6 million). In 2010-11 the last payments were made to Zerogen through DEEDI, Energy division. It is apparent that Queensland Government R&D expenditure is returning to pre-2008 levels.

Conversely, the Queensland Government's investment into R&D has generated significant returns through leveraging, particularly in 2011-12. For every \$1.00 invested in R&D by the Queensland Government, \$1.74 was leveraged from external sources, compared with \$1.37 in 2010-11. In particular, leverage has increased by 172%, from a total of \$148 million in 2008-09 (\$47 million in in-house leverage plus \$101 million external leverage) to \$403 million in 2011-12 (\$112 million in in-house leverage plus \$291 million external leverage). The increase in leverage suggests that investments made in infrastructure early on have provided a greater ability to leverage funds.

In terms of location, in-house expenditure was not as highly leveraged as external R&D. For every \$1.00 spent on in-house R&D \$0.89 was leveraged (\$0.78 in 2010-11); while each \$1.00 spent externally leveraged \$2.76 (\$2.09 in 2010-11) (Table 2). It should be noted that this is the highest level of leverage ever recorded since OQCS commenced compilation of this data in 2004-05. Funds allocated externally, as well as those spent on accessing R&D talent on collaborative projects, also allows Queensland R&D to contribute to broader topics of national significance. Queensland Government in-house expenditure is by agencies primarily performing locally relevant research.

Table 2: Total Queensland Government R&D expenditure from 2004-05 to 2011-12 across in-house and external locations funded by Queensland Government and leveraged dollars

(Note: Numbers have been rounded, resulting in individual amounts not always adding up to totals)

Qld Government R&D Expenditure (\$m)	In-house R&D Qld Gov funds (\$m)	In-house R&D Leveraged funds (\$m)	In-house R&D Qld Gov + Leveraged funds (\$m)	External R&D Qld Gov funds (\$m)	External R&D Leveraged funds (\$m)	External R&D Qld Gov + Leveraged funds (\$m)	Total R&D Expenditure (In-house + External funds) (\$m)
2011-12							
231	126 (55%)*	112 (\$0.89) ...	238	105 (45%)*	291 (\$2.76) ...	396	634
2010-11							
295	161 (54%)*	125 (\$0.78) ...	286	134 (46%)*	281 (\$2.09) ...	415	701
2009-10							
365	262 (72%)*	50 (\$0.19) ...	312	103 (28%)*	151 (\$1.48) ...	254	566
2008-09							
385	239 (62%)*	47 (\$0.19) ...	286	146 (38%)*	101 (\$0.69) ...	247	533
2007-08							
196	123 (63%)*	53 (\$0.43) ...	176	72 (37%)*	17 (\$0.23) ...	89	265
2006-07							
174	132 (76%)*	44 (\$0.33) ...	176	42 (24%)*	10 (\$0.25) ...	52	228
2005-06							
176	121 (69%)*	45 (\$0.37) ...	166	55 (31%)*	10 (\$0.18) ...	65	231
2004-05							
168	115 (68%)*	52 (\$0.45) ...	167	53 (32%)*	9 (\$0.18) ...	62	229

* Percentage of Queensland Government expenditure

† Leveraging rate

Note: In 2011-12, the total leveraged funds (\$403m) comprised capital \$155m (39%), and current (operational) of \$247m (61%). For 2010-11, the total leveraged funds (\$405m) comprised capital \$178m (44%), and current (operational) of \$227m (56%). Comparatively, in 2009-10: capital \$59m (29%) and current \$142m (71%).

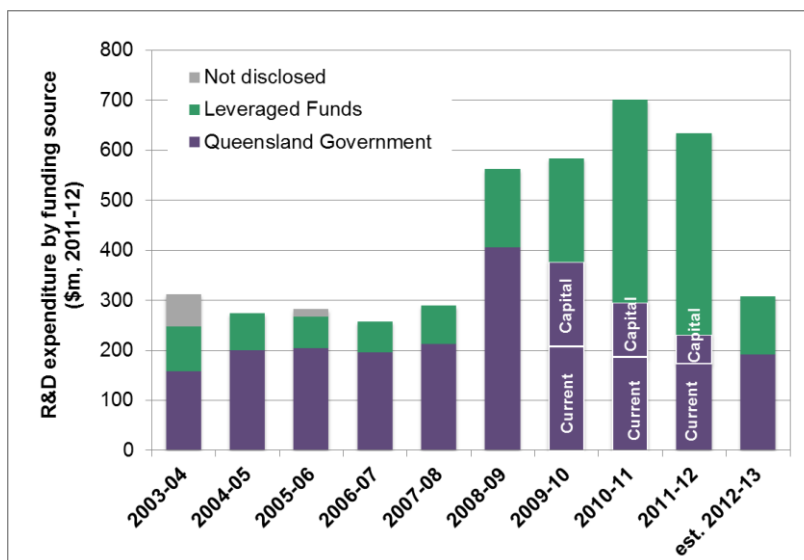
2. R&D expenditure by funding source (who provides the funding)

In order to maximise its investments in R&D, the Queensland Government leverages funds from external organisations. Many Queensland Government grants require an equal contribution from the recipient, and research infrastructure investments usually involve partner contributions. The Queensland Government also secures competitive research grants for in-house R&D from the Federal Government and other sources.

In 2011-12, the Queensland Government spent \$231 million on R&D, including \$58 million on infrastructure (capital expenditure), down from \$109million in 2010-11; and down \$173 million on current expenditure (\$186 million in 2010-11). The majority of capital expenditure was for the construction of four major research institutes: the Translational Research Institute (TRI); the Smart State Medical Research Centre (SSMRC); and the Queensland Government's Health and Food Sciences Precinct and Ecosciences Precinct.

This represents a reduction of \$64 million (22%) in Queensland Government R&D funding compared with 2010-11. There was a \$51 million (47%) reduction in capital expenditure and a \$13 million (7%) decrease in current expenditure. Figure 4 shows a consistent downward trend in Queensland Government R&D investments since 2008-09. This is primarily due to the completion of a range of major Smart State Strategy projects and programs during this period.

Figure 4: Total R&D expenditure by funding source, 2003-04 to 2011-12**



* Includes Queensland Government R&D expenditure and leveraged funds; 2006-07 to 2009-10 figures have been revised based on amended figures provided by DEEDI for the ZeroGen project.

**Categorisation of expenditure into capital and current expenditure was only implemented from 2009-10 onwards.

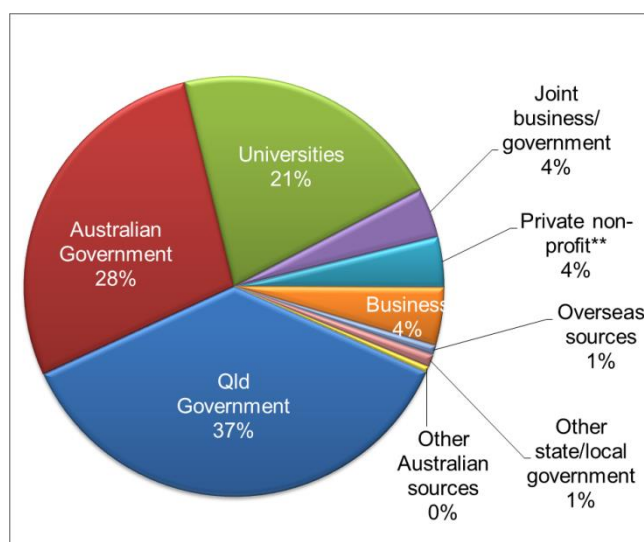
This downward trend in Queensland Government investment is in contrast to the significant increase in R&D funds leveraged from external sources in recent years. For every \$1.00 invested by the Queensland Government in R&D in 2011-12, \$1.74 was leveraged from external sources (\$1.37 in 2010-11), resulting in a total of \$403 million in leveraged funds.

This is very close to the \$405 million leveraged in 2010-11, despite a reduction in the Queensland Government's R&D funding over the same period. During this period, approximately 53% (\$213 million) of the funds were leveraged for the above three research infrastructure projects, and included operational funding of the Institute for Molecular Bioscience and the Queensland Brain Institute.

As noted previously, this is the highest leveraging rate ever reported by the Queensland Government and potentially reflects the increasingly inter-disciplinary and collaborative nature of R&D, as well as improved accuracy in reporting.

Leveraged funds were primarily sourced from the Australian Government (\$178 million, 28% of total R&D expenditure, down from 30% in 2010-11) (Figure 5). There was an increase in funds leveraged from universities (\$134 million, 20% of total R&D expenditure, up from 15% in 2010-11); and the contribution of businesses increased marginally from 3% (\$24 million) in 2010-11 to 4% (\$28 million) of total R&D expenditure.

Figure 5: Total R&D expenditure (\$634m) by funding source, 2011-12*



* Includes Queensland Government R&D expenditure and leveraged funds

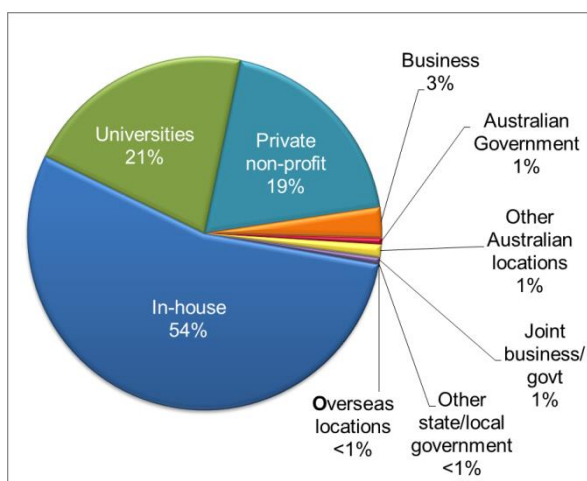
** Private non-profit organisations include: the Royal Automobile Club of Queensland, the Mater Medical Research Institute and the Translational Research Institute

3. R&D expenditure by location (the sector performing the R&D)

The Queensland Government performs R&D in-house, as well as taking part in collaborative projects with external organisations, and commissioning research to inform policy decisions. Through research grants, fellowships and infrastructure investments, the Queensland Government also supports R&D in other sectors.

In 2010-11, \$161 million (54%) of the total \$295 million spent by the Queensland Government was invested in in-house R&D, whilst 46% (\$134 million) was invested in external R&D. This was primarily due to the large (\$158 million) infrastructure expenditure in 2009-10 that was expended on the construction of the government's Health and Food Sciences and Ecosciences Precincts. In 2011-12, there was a similar proportional allocation of Queensland Government funds between in-house and external R&D. In 2011-12, 54% (\$126 million) of government funds were invested in in-house R&D and 46% (\$105 million) in external R&D (Figure 6).

Figure 6: Queensland Government R&D Expenditure (\$231m) by location i.e. sector performing the R&D 2011-12



Consistent with previous years, universities received the greatest external share of Queensland Government funds (21% in both the 2010-11 and current financial year) (Figure 6). The share of funds provided to private non-profit organisations (such as the Royal Automobile Club of Queensland, the Mater Medical Research Institute and the Translational Research Institute) increased in 2010-11 from 15% to 19% in 2011-12.

Overall, the total investment to in-house R&D by the Queensland Government was \$231 million, down \$64 million (22%) compared with 2010-11 (Figure 7). As indicated in Figure 8, universities and private non-profit organisations accounted for the largest external share of total R&D expenditure.

The share of business investment has seen a decrease from 10% in 2010-11 down to 2% in 2011-12. This is attributed to two main causes: in 2011-12 the R&D investments made through the Business and Industry Transformation Incentives (BITI) program were re-classified, and the ZeroGen Clean Coal demonstration project ceased in 2011-12.

Figure 7: Total R&D expenditure (\$634m) by location, i.e. sector performing the R&D, 2003-04 to 2011-12*

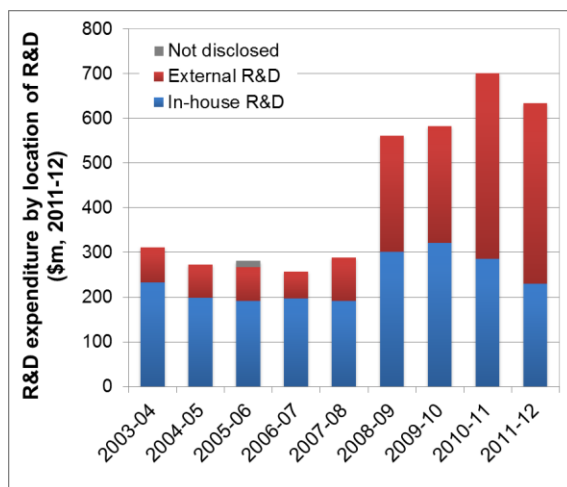
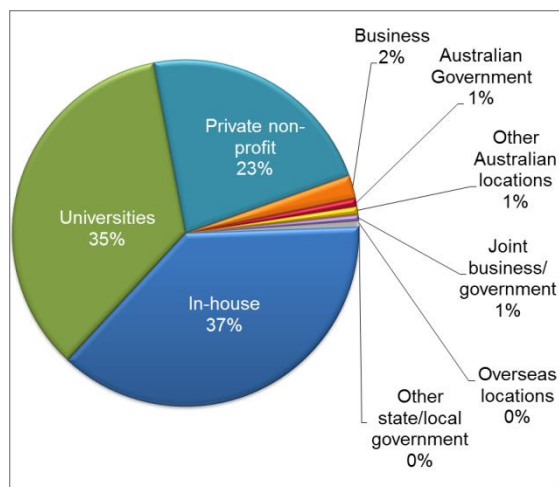


Figure 8: Total R&D expenditure (\$634m) by location, i.e. sector performing the R&D, 2011-12*



* Includes Queensland Government R&D expenditure and leveraged funds; 2006-07 to 2009-10 figures have been revised based on amended figures provided by DEEDI for the ZeroGen project.

4. R&D expenditure of Queensland Government agencies

The spread of Queensland Government R&D expenditure across Queensland Government agencies is displayed in Table 3⁷. As noted in the Scope section of this report, with three quarters of the 2011-12 financial year operating under pre-machinery of government changes (following the March 2012 election) the following R&D reporting structure is used. More detailed information on departmental R&D expenditure is provided in Appendix 1.

Table 3: R&D expenditure of Queensland Government agencies, 2009-10*, 2010-11[†] and 2011-12

Queensland Government Agency	R&D Expenditure			
	2009-10 (\$m)	2010-11 (\$m)	2011-12 (\$m)	2011-12 (%)
Dept of Employment, Economic Development & Innovation	311	233	168	73%
<i>Innovation</i>	214	136	86	37%
<i>Primary industries</i>	66	65	65	28%
<i>Energy</i>	17	19	3	1%
<i>Mining</i>	13	13	15	6%
<i>Other</i>	0	0	0	0%
Dept of Environment & Resource Management	12	14	17	7%
Queensland Health	11	10	21	9%
Queensland Treasury (incl. Motor Accident Insurance Commission)	5	6	6	2%
Dept of Education & Training	4	4	3	1%
Dept of Transport & Main Roads	11	3	2	1%
Dept of Communities	3	2	2	1%
Queensland Museum	3	2	2	1%
Dept of Community Safety	2	1	1	1%
Dept of the Premier and Cabinet	1	1	0	0%
Dept of Public Works	0	0	0	0%
Dept of Justice & Attorney-General	0	0	1	0%
Dept of Local Government & Planning	0	0	1	0%
Queensland Police Service	0	0	0	0%
Other statutory bodies and government agencies*	2	17	7	3%
Total	365	295	231	100%

* For 2009-10, 'other statutory bodies and government agencies' included Queensland Government R&D expenditure for which the department/agency was not disclosed. For 2010-11 and 2011-12, 'other statutory bodies and government agencies' included: Translink, Queensland Art Gallery, Urban Land Development Authority, Office of the Public Trustee, Office of the Public Advocate and the Queensland Institute of Medical Research (QIMR).

Note: Complete R&D investments of QIMR and some other agencies have not been collected directly from these agencies to-date. Instead QIMR expenditure was obtained from the government agencies working with QIMR (such as DEEDI and Queensland Health). This may result in under-reporting of Queensland Government R&D. Discussions are underway to capture R&D expenditure by statutory bodies in the 2012-13 report.

[†]R&D Expenditure was attributed to the Queensland Government agency **funding** the R&D. In some instances, this differed from the department **reporting** the R&D expenditure. As such, values here may differ from the values reported by individual Queensland Government agencies to OQCS.

⁷ For more detailed information on departmental R&D expenditure, see Appendix 1.

DEEDI accounted for the largest share of Queensland Government R&D expenditure over the last three financial years with 85% in 2009-10, 79% in 2010-11 and 73% in 2011-12. However, the quantum of funding has decreased each year primarily due to a reduction in capital expenditure (particularly on the Health and Food Sciences and Ecosciences Precincts).

R&D funding by other Queensland Government agencies is similar across the years, except for the Department of Transport and Main Roads, which has seen a significant drop in 2009-10 from \$10.9 million to \$3.4 million in 2010-11 (a 69% decrease). This decrease is due to:

- completion of major one-off equipment purchases through the Australian Road Research Board in 2009-10
- ad hoc projects undertaken in 2009-10 did not continue beyond that year
- more stringent application of R&D definitions in 2010-11 applied to expenditure analysis.

5. Alignment with Queensland Government Priorities

The Queensland Government has identified Agriculture, Construction, Resources and Tourism as the four pillars of the Queensland economy that will drive economic growth, job creation and prosperity. In his 'State of the State' address (Committee for Economic Development of Australia function, 19 September 2012), the Premier referred to "*the foundation on which those pillars are being built ... creativity, scientific support, R&D, technological grunt ... must be allowed and encouraged to flourish.*"⁸

Queensland needs to focus its research efforts. This does not mean 'putting all our eggs in one basket', but rather investigating in niches across a range of areas of particular benefit, or challenges, to Queensland. Therefore, we need to ensure we simultaneously have an appropriately diversified scientific portfolio, but with designated scale for optimum impact.

The state should also build and develop our strength in other targeted areas – in line with Queensland Government priorities - to ensure a diversified research portfolio.

For this report, R&D projects have been aligned to the ABS classifications for Socio-Economic Objectives (SEO) (Figure 9) and also to the Fields of Research (FOR)⁹ (Figure 10). Further explanation of these classifications can be found in Appendix 1, Table A1.4 and Table A1.5.

The SEO relates to the outcomes of the R&D while the FOR indicates the techniques and the research area used to perform the research. An explanation of the two codes is below:

⁸ The Honourable Campbell Newman's 2012 CEDA State of the State address available at <http://statements.qld.gov.au/Statement/2012/9/19/2012-ceda-state-of-the-state-address>

⁹ Australian and New Zealand Standard Industrial Classification (ANZSIC) 2006 (Revision 1.0) can be found at: <http://www.abs.gov.au/ausstats/abs@.nsf/mf/1292.0>

Socio-Economic Objective (SEO)

- The SEO classification allows R&D activity to be categorised according to the intended purpose or outcome of the research rather than the processes or techniques used in order to achieve this objective. For example, a project identifying lifestyle factors that cause kidney disease would be aligned with the Health SEO as it provides health outcomes.

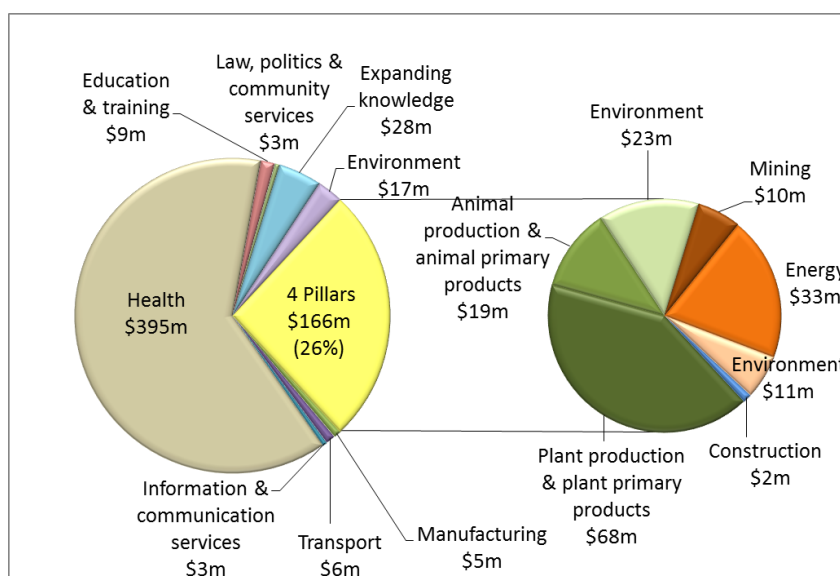
Fields of Research (FOR)

- The FOR classification allows R&D activity to be categorised according to the field of research. In this respect, it is the methodology used in the R&D that is being considered. For example, a project developing an artificial material for use in joint replacements would be aligned with Engineering as it utilises engineering-based techniques, rather than the health outcome it would provide for.

With this in mind, it is important to note that direct comparison between the classifications is not possible. Only one code has been chosen for each project.

More than 62% of expenditure was on the Health SEO, compared with 29% spent on the SEOs aligned with the four pillars (Figure 9). In terms of the four pillars, Agriculture is the second biggest SEO and is the largest of the four pillars at \$110 million (17%), with Resources next at \$54 million (9%), and Construction last at 0.3% (\$2 million).

Figure 9: Total R&D Expenditure (\$634m) for 2011-12 classified by Socio-Economic objective. The smaller pie chart refers to the alignment of SEOs to the four pillars*



*The four pillar alignment was taken to be: **Agriculture**: animal production and animal primary products, plant production and plant primary products, and 45% of the environment alignment. **Construction**: construction. **Resources**: mining; energy and 22% of the environment objective. **Tourism** did not have any SEO with expenditure.

Education is critical to realising the full potential of our investments in R&D, and if additional funding and leverage could be achieved this would be a useful investment to increase, as it currently receives only 1.5% (\$9 million) of the total investment.

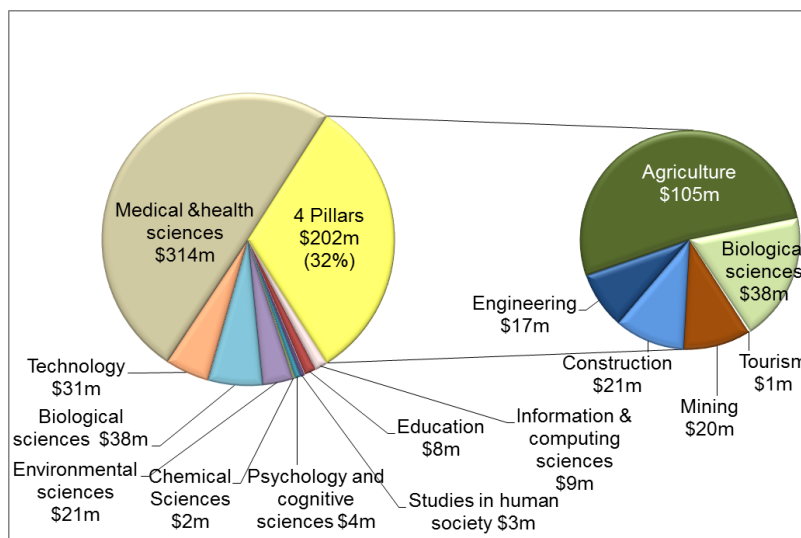
In order to better equip Queensland to respond to emerging challenges, the Expanding knowledge objective provides an investment in future capability. Expanding knowledge is defined as pure basic research or strategic basic research. This is typically an area which would be funded by universities, rather than businesses or the government and which would focus on applied research and experimental development. The Queensland Government invests \$28 million (4%) of total R&D investment in this area.

Although construction has only a small direct R&D investment, this pillar has directly benefited from R&D investment in other SEOs. In particular, infrastructure spent in the Health objective area would have created investment in Construction, but this is not visible through R&D objectives.

The alignment of investment dollars to SEOs shows a significant \$395 million investment in Health. This investment is substantial considering that Queensland Health invested only \$36.6 million (including leverage) in 2011-12. Based on the SEO alignment there has been significant spending by DEEDI, Innovation (through newly built infrastructure, projects and skills) and QIMR (a statutory body) which aligns directly to the Health SEO.

Using the FOR classification (methodology used in the R&D) shows a smaller investment in the Health classification, as defined by Medical & health sciences (49% of total expenditure), which is 13% less than the SEO alignment for Health (Figure 10). A strong focus on various sciences (Technology, Biological sciences, Environmental sciences, Chemical sciences, Psychology and cognitive sciences and Studies in human society and Information & computing sciences) at \$104 million (18% of the total) is shown. In fact, it is the further clarification of the methodologies used in the R&D program that reduce the expenditure in the Health area. For example, Technology-based R&D programs that provide a Health outcome are not aligned with the Medical & health sciences FOR, but rather with the Technology FOR.

Figure 10: Total R&D Expenditure (\$634m) for 2011-12 classified by Field of Research (FOR)*. The smaller pie chart refers to the alignment of FORs to the four pillars*



*The four pillar alignment was taken to be: **Agriculture:** agriculture and half of biological sciences; **Construction:** built environment & design and engineering. **Resources:** earth sciences. **Tourism:** tourism.

Expenditure aligned to the four pillars equates to almost 32% (\$202 million), and again the primary research field focus of the four pillars is Agriculture at \$143 million (22%), with Construction second at \$38 million (6%). The Construction pillar brings together the Engineering FOR and Built environment & design FOR. There is significant investment in these areas with expenditure on the Sir Samuel Griffith building at Griffith University (\$7 million). The Sir Samuel Griffith building is Australia's first teaching and research building powered by a combination of photovoltaics and hydrogen, a building which is the key to delivering a genuine sustainable energy options to Australian and global communities. Significant expenditure has also occurred on planning future electricity grids, coastal mapping and solar research.

6. Alignment of R&D expenditure with the current Queensland R&D objectives

Proportion of R&D expenditure aligned with each R&D objective

In July 2010, the Queensland Government released the *Queensland research and development investment strategy 2010-2020*, an overarching framework to guide Queensland Government R&D investments. It articulated 14 R&D objectives to focus the government's investment in R&D (see Table 1). While these are under review by the R&D Queensland Committee, they remain the prevailing priorities for reporting purposes.

For this report, R&D projects are aligned with the 14 Queensland R&D objectives. In cases where an R&D project is relevant to two or more R&D objectives, its expenditure is apportioned between the relevant objectives so that the proportion of Queensland Government R&D funds (and total R&D funds) invested in each objective area can be estimated (see Appendix I).

Of the 14 Queensland R&D objectives, the Health objective received the largest allocation of funds at 44% of total R&D expenditure, down from 51% in 2010-11 (Figures 11 and 12). As noted, the continued strong investment in the Health R&D objective is primarily due to investments in the TRI and the SSMRC. As before, the Health objective includes biomedical research and it is likely that the bulk of research is being undertaken in this more applied area, rather than in health per se.

The next largest investment areas were Enabling sciences and technologies (28% of total R&D) and the Energy & resources industries (5% of total R&D) (Figures 11 and 12). The Energy & resources industry objective has decreased by more than half (11% in 2010-11) due to the cessation of ZeroGen funding.

Figure 11: Queensland Government R&D expenditure (\$231m) by R&D objective, 2011-12

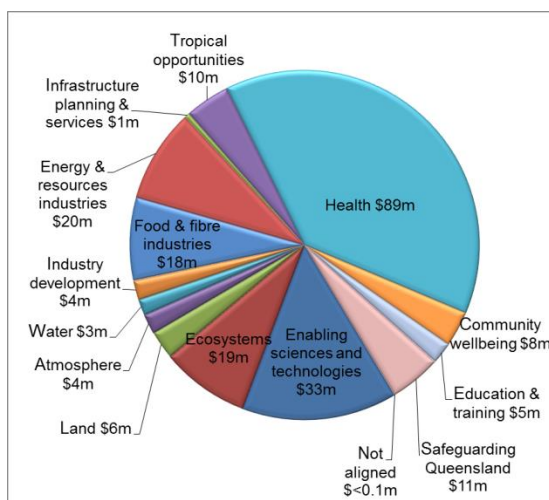
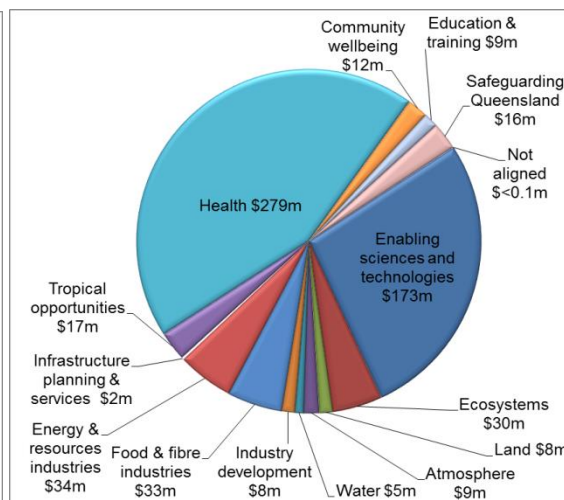


Figure 12: Total R&D expenditure (\$634m) by R&D objective, 2011-12*



* Includes Queensland Government R&D expenditure and leveraged funds.

More than 68% of total funding in the Health objective, and more than 80% of total funding in the Enabling sciences & technologies objectives, was leveraged from external sources; making these the highest leveraged areas of R&D focus for Queensland. This is due to the large investment made in infrastructure for these areas.

The Water objective and the Infrastructure, planning & services objective were two of the lowest funded R&D objectives in 2011-12. In 2010-11 Infrastructure, planning & services and Education & training were the lowest funded. Funding for Water research remained low in 2011-12 decreasing from 1.1% of total funding in 2010-11 to 0.8% in 2011-12. Funding for Education & training doubled, from a low base, during this period. There was minimal change in R&D investment for the Infrastructure, planning & services objectives (0.4% to 0.3% in 2011-12).

Total value of projects related to each R&D objective

In the analysis on previous pages (Figures 11 and 12), the expenditure on projects relevant to more than one R&D objective was divided between objectives. However, just because a project is relevant to more than one R&D objective does not mean that its contribution to achieving each of those objectives is diminished. A project relevant to more than one objective has a multiplier effect rather than a diminished impact on each objective (e.g. a solar energy R&D project does not have a lesser contribution to the energy and mining sector just because it also reduces greenhouse gases and thus contributes to the Atmosphere R&D objective).

To get a sense of the overall R&D investment by the Queensland Government towards each R&D objective, Table 4A gives the *total value* of all projects related to each R&D objective, assuming that the total value of each project can be assigned to each relevant R&D objective. Consequently, the sum of these values will be significantly greater than the Queensland Government investment in R&D. Table 4B provides the corresponding R&D spend based on the Queensland R&D Priorities (Table 1).

Table 4A: Queensland Government R&D expenditure 2011-12 – overall investment towards each R&D objective

Queensland R&D Objective	\$m
Health	136
Enabling sciences and technologies	64
Energy and resources industries	43
Ecosystems	38
Safeguarding Queensland	36
Food and fibre industries	29
Atmosphere	18
Land	18
Tropical opportunities	16
Education and training	13
Community wellbeing	11
Water	11
Industry development	7
Infrastructure, planning and services	3
Not aligned	1

Table 4B: Queensland Government R&D expenditure 2011-12 – overall investment towards each R&D priority

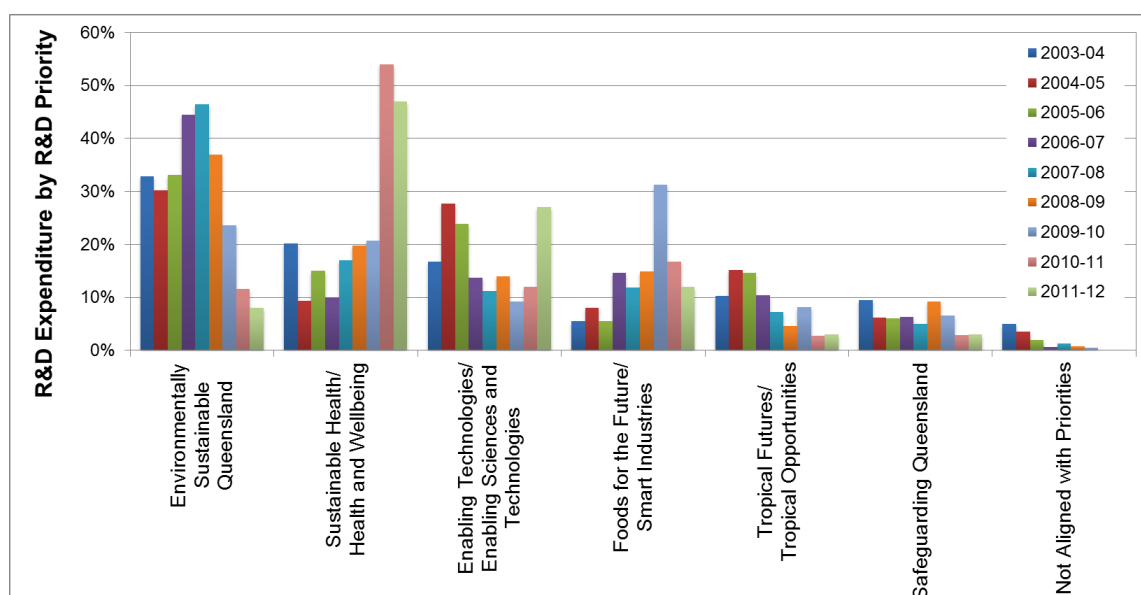
Queensland R&D Priority	\$m
Health and wellbeing	160
Environmentally sustainable Queensland	85
Smart industries	82
Enabling sciences and technologies	64
Safeguarding Queensland	36
Tropical opportunities	16
Not aligned	1

Alignment of R&D expenditure with the Queensland R&D priorities over time

Each of the 14 Queensland R&D objectives aligns with one of six Queensland R&D priorities (Tables 1 and 4B). R&D expenditure has been aligned with the Queensland R&D priorities since 2003-04, allowing for the analysis of trends over time (Figure 13).

The proportion of R&D expenditure related to Enabling technologies/ Enabling sciences & technologies more than doubled in 2011-12. Health & wellbeing maintained a high proportion of R&D expenditure, primarily due to large investments in medical research infrastructure in 2010-11 and 2011-12.

Figure 13: R&D Expenditure by Queensland R&D priority, 2003-04 to 2011-12**†



* Includes Queensland Government R&D expenditure and leveraged funds.

† Queensland Government R&D priorities were revised in 2006. Original (2003-04-2005-06) and revised (2006-07-2009-10) Queensland R&D priorities have been grouped as appropriate. Environmentally Sustainable Queensland and Safeguarding Queensland R&D priorities remained unchanged throughout.

7. Conclusions

Queensland has invested heavily in science and research over the past 15 years. Since 1998, the Queensland Government has spent \$5.1 billion on scientific infrastructure, projects and skills; leveraging an additional \$3.7 billion to provide an overall investment of \$8.8 billion (this includes the 2011-12 R&D expenditure data).

With the completion of several large R&D infrastructure projects in recent years, there has been a progressive decrease in Queensland Government funding for R&D bringing R&D expenditure in line with pre-2008 investment. This report captures expenditure in a financial year, not funds committed.

In 2011-12, Queensland Government R&D expenditure of \$231 million was matched by \$403 million of externally generated funds, giving a total of \$634 million. The total funds have decreased by 9% from the previous year's total of \$701 million. Therefore, for every dollar invested by the government, a further \$1.74 was leveraged. For every dollar of government R&D funds spent externally, a further \$2.76 was leveraged. This is the highest external leverage rate calculated to-date.

Of the Queensland Government's \$231 million expenditure in 2011-12, 25% was spent on capital (infrastructure) down from 37% in the previous year. As the TRI and SSMRC infrastructure projects come to completion, it is likely that Queensland Government funds will decrease substantially in 2012-13, and leverage components for these projects will also decrease.

Business investment has seen a decrease as a percentage of Queensland Government expenditure from 10% in 2010-11 down to 2% in 2011-12. This is partly

due to a reclassification of R&D investments made under the BITI program, and the completion of funding to the ZeroGen Clean Coal demonstration project in 2011-12.

By utilising the Queensland Government's four pillars for economic growth and the ABS definitions for SEO and FOR, the Health SEO has seen a substantial proportion of investment (\$395 million, 62%), with the Agriculture SEO second highest (\$110 million, 17%). Investment into Education R&D equates to only \$9 million (1.5%) and if further leverage could be gained there is sufficient scope to expand our investment in this area.

Using the FOR codes, R&D expenditure aligned to the four pillars equates to almost 32% (\$202 million), and again the primary research field focus of the four pillars is Agriculture at \$143 million (23%) with Construction second at \$38 million (6%).

Of the 14 Queensland R&D objectives, the Health objective remains the objective with the greatest allocation of funds at 44% of total R&D expenditure, albeit, down from 51% in 2010-11. The continued strong support of this investment is primarily due to investments in the Translational Research Institute and the Smart State Medical Research Centre.

The next largest investment areas were Enabling sciences and technologies (28% of total R&D) and the Energy and resources Industries (5% of total R&D). However, the Energy and resources objective has decreased by more than half (11% in 2010-11) due to the cessation of ZeroGen funding.

In the '2010-11 Queensland Government R&D expenditure report' it was suggested that in light of budgetary constraints it might be advantageous to consider the government's forward R&D investment planning to ensure best value and alignment with priorities for any future R&D expenditure. This work is currently underway with departments preparing three year forward looking R&D plans.

Based upon data provided to the Office of the Queensland Scientist (as at December 2012) by Queensland Government departments, it is estimated that the Queensland Government's investment in R&D in 2012-13 will be less than half that of the investments made in 2011-12. While this is an estimate only, it is likely that we can anticipate a significant reduction in expenditure on R&D for the year ending 30 June 2013 in line with cross-government budgetary pressures.

APPENDIX I

Table A1.1: Total In-house R&D expenditure by agency 2011-12*

Queensland Government Agency	2010-11 Total in-house R&D (\$m)	% of Total	2011-12 Total in-house R&D (\$m)	% of Total
Dept of Employment, Economic Development & Innovation	124.2	43.5%	109.3	46.1%
<i>Innovation</i>	22.1	7.7%	8.7	3.7%
<i>Primary industries</i>	89.7	31.4%	83.0	35.0%
<i>Energy</i>	0.1	0.0%	0.0	0.0%
<i>Mining</i>	12.0	4.2%	17.2	7.3%
<i>Other</i>	0.3	0.1%	0.4	0.1%
Dept of Environment & Resource Management	16.3	5.7%	20.2	8.5%
Queensland Health	28.1	9.9%	34.6	14.6%
Motor Accident Insurance Commission (MAIC), Queensland Treasury	-	0.0%	-	0.0%
Dept of Education & Training	2.8	1.0%	3.3	1.4%
Dept of Transport & Main Roads	1.0	0.3%	0.9	0.4%
Dept of Communities	1.2	0.4%	1.0	0.4%
Queensland Museum	4.0	1.4%	2.9	1.2%
Dept of Community Safety	1.4	0.5%	1.2	0.5%
Dept of Justice & Attorney-General	-	0.0%	-	0.0%
Dept of Local Government & Planning	-	0.0%	0.1	0.0%
Dept of Public Works	0.2	0.1%	0.1	0.0%
Dept of the Premier and Cabinet	0.1	0.0%	0.1	0.1%
Queensland Police Service	0.2	0.1%	0.2	0.1%
Other statutory bodies and government agencies[†]	106.1	37.1%	63.5	26.8%
Total	286	100.0%	237	100.0%

* Includes Queensland Government funding and leveraged funding sources. R&D expenditure was attributed to that Queensland Government agency performing the R&D. In some instances, this differed from the department reporting the R&D expenditure. As such, values here may differ from the values reported by individual Queensland Government agencies.

[†]Other Statutory bodies and government agencies for 2011-12 were Translink and QIMR and in 2010-11 additionally Queensland Art Gallery, Urban Land Development Authority, the Public Trustee QLD and the Office of the Public Advocate, JAG were included. Note, Complete R&D investments of QIMR and other agencies have not been collected to date and values for QIMR were reported by DEEDI.) In addition to the funding reported for 2011-12, Queensland Health provided \$14m to fund administrative operations and maintenance of QIMR and \$51m in grants from various sources was spent on R&D. Some of this may have been reported through DEEDI or Queensland Health. QIMR had 99.8% of expenditure for the 'Other statutory bodies and government agencies' totalling \$63.6m.

**Table A1.2: *Total* Queensland Government R&D expenditure by agency
(Queensland Government funding + leveraged funds) 2011-12**

Queensland Government Agency	Qld Gov R&D Expenditure (\$m)	% of Total	Leveraged Funds (\$m)	% of Total	Qld Gov + Leveraged Funds (\$m)	% of Total
Dept of Employment, Economic Development & Innovation	168.4	72.9%	314.0	78.0%	482.4	76.1%
<i>Innovation</i>	86.2	37.3%	272.4	67.7%	358.6	56.6%
<i>Primary industries</i>	64.6	28.0%	38.7	9.6%	103.3	16.3%
<i>Energy</i>	2.7	1.2%	0.0	0.0%	2.7	0.4%
<i>Mining</i>	14.7	6.4%	2.5	0.6%	17.2	2.7%
<i>Other</i>	0.2	0.1%	0.4	0.1%	0.5	0.1%
Dept of Environment & Resource Management	16.7	7.2%	5.0	1.2%	21.7	3.4%
Queensland Health	20.9	9.1%	15.6	3.9%	36.6	5.8%
Motor Accident Insurance Commission (MAIC), Queensland Treasury	5.6	2.4%	2.4	0.6%	8.0	1.3%
Dept of Education & Training	3.5	1.5%	4.4	1.1%	7.9	1.2%
Dept of Transport & Main Roads	2.1	0.9%	0.3	0.1%	2.4	0.4%
Dept of Communities	2.3	1.0%	1.0	0.2%	3.3	0.5%
Queensland Museum	1.6	0.7%	1.5	0.4%	3.1	0.5%
Dept of Community Safety	1.2	0.5%	0.1	0.0%	1.3	0.2%
Dept of Justice & Attorney-General	0.3	0.1%	0.0	0.0%	0.3	0.0%
Dept of Local Government & Planning	0.1	0.1%	0.0	0.0%	0.1	0.0%
Dept of Public Works	0.6	0.3%	0.1	0.0%	0.7	0.1%
Dept of the Premier and Cabinet	0.6	0.3%	0.2	0.0%	0.8	0.1%
Queensland Police Service	0.2	0.1%	1.0	0.3%	1.3	0.2%
Other statutory bodies and government agencies*	6.8	3.0%	56.9	14.1%	63.8	10.1%
Total	231	100%	403	100%	634	100%

**R&D Expenditure was attributed to the Queensland Government agency funding the R&D. In some instances, this differed from the department reporting the R&D expenditure. As such, values here may differ from the values reported by individual Queensland Government agencies. For projects funded by multiple Queensland Government agencies, leveraged funds were divided equally between the agencies. Funds leveraged for in-house R&D were attributed to the department performing the R&D.*

Table A1.3: Queensland Government and leveraged R&D expenditure *by R&D objective*, 2011-12

R&D Priorities/R&D Objectives	R&D expenditure (\$m)			R&D expenditure (%)		
	Qld Government	Leveraged funds	Total expenditure	Qld Government	Leveraged funds	Total expenditure
Enabling sciences and technologies	33.2	139.4	172.6	14.4%	34.6%	27.2%
Environmentally sustainable Qld	32.8	19.5	52.3	14.2%	4.8%	8.3%
<i>Ecosystems</i>	18.9	11.0	29.9	8.2%	2.7%	4.7%
<i>Land</i>	6.1	1.8	7.9	2.6%	0.4%	1.2%
<i>Atmosphere</i>	4.3	5.1	9.3	1.9%	1.3%	1.5%
<i>Water</i>	3.4	1.7	5.2	1.5%	0.4%	0.8%
Smart industries	43.0	32.2	75.2	18.6%	8.0%	11.9%
<i>Industry development</i>	4.1	3.6	7.7	1.8%	0.9%	1.2%
<i>Food & fibre industries</i>	17.7	14.8	32.6	7.7%	3.7%	5.1%
<i>Energy and resources industries</i>	20.0	13.3	33.3	8.7%	3.3%	5.3%
<i>Infrastructure, planning and services</i>	1.1	0.4	1.5	0.5%	0.1%	0.2%
Tropical opportunities	9.6	7.7	17.3	4.2%	1.9%	2.7%
Health and wellbeing	101.5	198.4	299.8	43.9%	49.3%	47.3%
<i>Health</i>	89.3	189.5	278.8	38.7%	47.1%	44.0%
<i>Community wellbeing</i>	7.6	4.7	12.3	3.3%	1.2%	1.9%
<i>Education and training</i>	4.6	4.1	8.7	2.0%	1.0%	1.4%
Safeguarding Queensland	11.0	5.3	16.2	4.7%	1.3%	2.6%
Not aligned	0.1	0.0	0.1	0.0%	0.0%	0.0%
Total	231	403	634	100%	100%	100%

Table A1.4: The Socio-economic objective (SEO) classification as defined by the Australian Bureau of Statistics (1297.0 - Australian and New Zealand Standard Research Classification (ANZSRC), 2008)

The ANZSRC SEO classification allows R&D activity to be categorised according to the intended purpose or outcome of the research, rather than the processes or techniques used in order to achieve this objective.

SEO SECTOR AND DIVISION CODES AND TITLES	
Sector A: Defence	
81	Defence
Sector B: Economic Development	
82	Plant Production and Plant Primary Products
83	Animal Production and Animal Primary Products
84	Mineral Resources (excl. Energy Resources)
85	Energy
86	Manufacturing
87	Construction
88	Transport
89	Information and Communication Services
90	Commercial Services and Tourism
91	Economic Framework
Sector C: Society	
92	Health
93	Education and Training
94	Law, Politics and Community Services
95	Cultural Understanding
Sector D: Environment	
96	Environment
Sector E: Expanding Knowledge*	
97	Expanding Knowledge

*Sector E Expanding Knowledge is for the categorisation of R&D which does not have an identifiable socio-economic objective. This is usually the case for pure basic research or strategic basic research, as defined in the Type of Activity classification. Applied research and experimental development, by definition, have an identified socio-economic objective and therefore should not be categorised in this sector.

<http://www.abs.gov.au/AUSSTATS/abs@.nsf/Latestproducts/1297.0Main%20Features62008?opendocument&tabname=Summary&prodno=1297.0&issue=2008&num=&view=>

Table A1.5: The Fields of research (FOR) classification as defined by the Australian Bureau of Statistics (1297.0 - Australian and New Zealand Standard Research Classification (ANZSRC), 2008)

The ANZSRC FOR allows R&D activity to be categorised according to the methodology used in the R&D, rather than the activity of the unit performing the R&D or the purpose of the R&D.

FOR DIVISION CODES AND TITLES	
01	Mathematical Sciences
02	Physical Sciences
03	Chemical Sciences
04	Earth Sciences
05	Environmental Sciences
06	Biological Sciences
07	Agricultural and Veterinary Sciences
08	Information and Computing Sciences
09	Engineering
10	Technology
11	Medical and Health Sciences
12	Built Environment and Design
13	Education
14	Economics
15	Commerce, Management, Tourism and Services
16	Studies in Human Society
17	Psychology and Cognitive Sciences
18	Law and Legal Studies
19	Studies in Creative Arts and Writing
20	Language, Communication and Culture
21	History and Archaeology
22	Philosophy and Religious Studies

In the interests of international statistical comparisons, the FOR classification, as far as is practicable, aligns at the two digit Division level with the OECD's Fields of Science 2007 classification.

<http://www.abs.gov.au/AUSSTATS/abs@.nsf/Latestproducts/1297.0Main%20Features52008?opendocument&tabname=Summary&prodno=1297.0&issue=2008&num=&view=>