Queensland Government research and development expenditure overview

2015–16 and 2016–17

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Queensland Government

Purpose of the Queensland Government R&D expenditure report

One of the roles of government is to support, participate in and enable science in the community. One of the ways it achieves this is through investment in research and development (R&D).

Since 2004–05, the Office of the Queensland Chief Scientist has collected data on the Queensland Government's expenditure on R&D, providing a valuable longitudinal study of the government's investment in R&D and associated capacity to leverage external funding.

R&D reports provide important financial information on R&D investments, trends in funding and collaborations and how this spend aligns to the Queensland Government priorities.

This report uses data to measure investments in science and research from all Queensland Government departments, government bodies and statutory authorities. These investments are used to support and address their respective priorities and develop key capabilities, talent and critical infrastructure.

For the 2015–16 and 2016–17 financial years, all R&D data for Queensland Hospital and Health Services has been included as part of Queensland Health.

What is R&D?

For the purpose of this report, we use the internationally recognised definition of R&D as determined by the Organisation for Economic Cooperation and Development (OECD). Specifically, R&D is defined 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'.[1]

The Australian Bureau of Statistics (ABS) also conducts surveys of R&D expenditure and in doing so adopts the OECD definition for R&D. However, Queensland Government R&D expenditure reported here differs from that reported by the ABS, which refers solely to Queensland Government in-house R&D (funded by the Queensland Government and external sources).

As defined in this report, R&D includes basic research, strategic and applied research, experimental development and administration support.[2]

However, R&D does not include market research, operations research, statistical analyses, policy-related studies, routine computer programming, and the extension or commercialisation of R&D. R&D also excludes science activities such as routine monitoring and data collection, quality control, testing and standardisation, or scientific and technical services.

We acknowledge that this definition of R&D does not capture the full breadth of the government's broad commitment to science-related activities, applied R&D, innovation and industry attraction and development, including support for science and innovation under the Advance Queensland initiative.

It may also not fully reflect the Queensland Government's considerable investment in applied research and development to support emerging digital technologies, particularly in the areas of data analytics and data sharing.

Similarly, several Queensland Government departments undertake various and important science-related activities that do not fall within this definition of R&D and hence are not captured in this report.

Advance Queensland

The Advance Queensland initiative was launched in July 2015 and since then the Queensland Government has committed $650 million towards programs that drive innovation, build on our natural advantages and help raise our profile as an attractive investment destination.

Major investments in R&D during 2015–16 included support for the Advance Queensland Research Fellowships, Innovation Partnerships, PhD Scholarships and Knowledge Transfer Partnerships.

While in 2016–17, the government launched a number of new Advance Queensland programs that support applied R&D, including the Small Business Innovation Research, and Testing Within Government programs and the Ignite Ideas Fund.[3]

1. Frascati Manual, 2015
2. Data from this collection and previous expenditure collections (2012–13 and 2013–14) is available on the Queensland Government open data website.
3. Some—but not all—of the activities funded under the Ignite Ideas Fund may be eligible for inclusion as R&D.

Key facts

In **2015–16** the Queensland Government spent **$314m** on R&D—this increased by 12% to **$352m** in **2016–17**

Around **50%** of R&D investment came directly from the Queensland Government

R&D expenditure leveraged from other sources was up **17%** from **2015–16**, at **$176m**

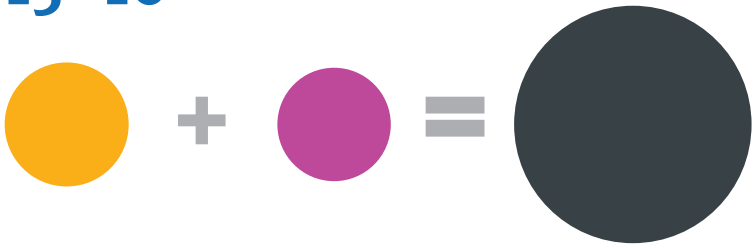
Capital investment doubled to $22m in 2015–16 and remained steady in 2016–17

The Department of Agriculture and Fisheries was the largest single funder across both years with **$57m** invested in R&D in **2015–16** and **$63m** invested in **2016–17**

Research continued to focus on:

- the translation of health and biotechnology research and
- developing enhanced production technologies in the agricultural, mining and advanced manufacturing sectors

2015–16

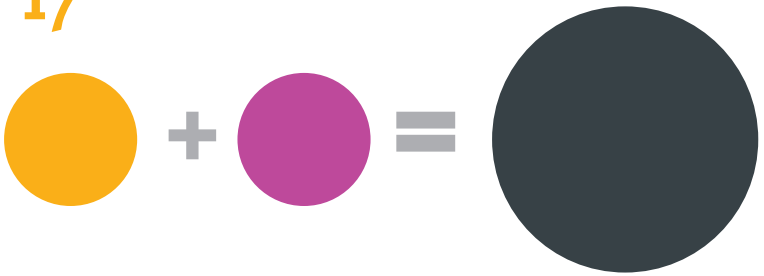


Queensland Government funding **$164m**

Leveraged funding **$150m**

Total R&D expenditure **$314m**

2016–17



Queensland Government funding **$176m**

Leveraged funding **$176m**

Total R&D expenditure **$352m**

Where does research funding come from and how is it used?

For the purpose of this report, R&D funding can be separated into two sources:

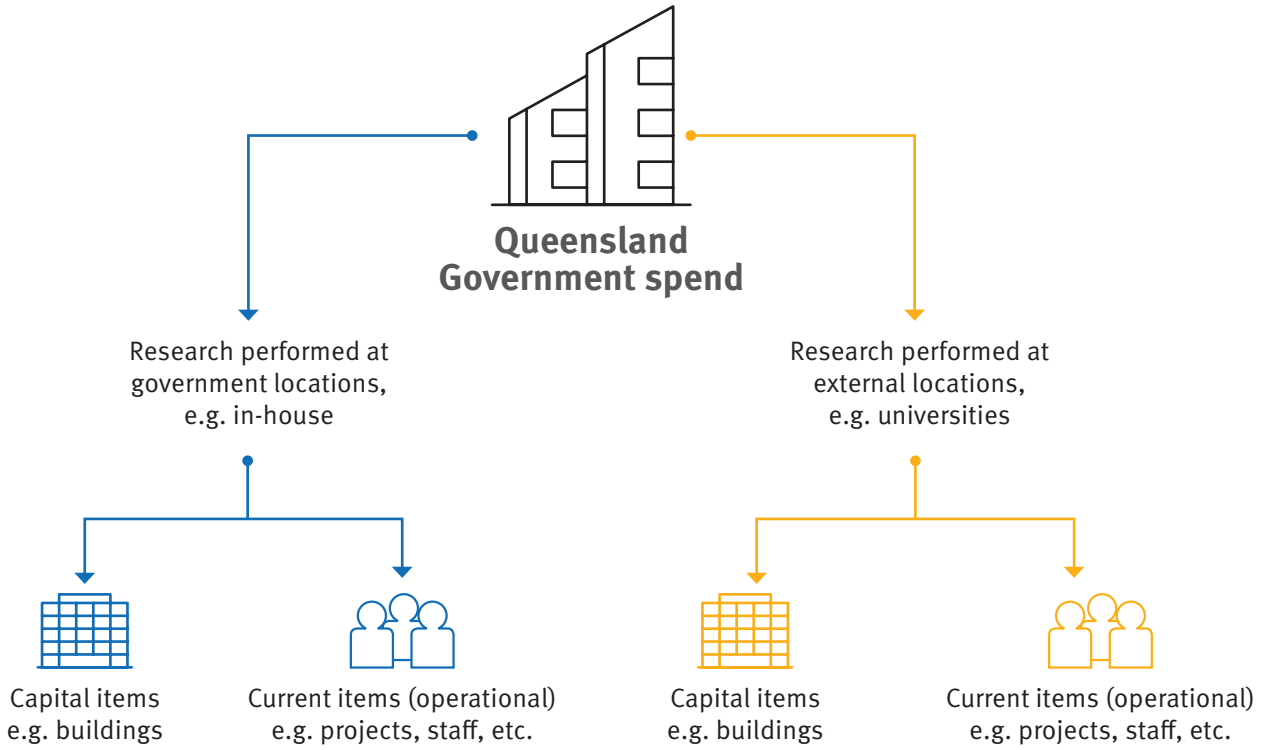
- Queensland Government money
- money from other sources, externally to the Queensland Government (leveraged funding).

Queensland Government funding includes money spent by departments and leveraged funding includes money invested by external organisations such as businesses, universities and the Australian Government.

R&D investments can also be divided into research that is performed at government sites (in-house) and at other locations sTuch as universities (external locations).

We further classify R&D investments into either capital or current items.

Capital items include investments into buildings or other physical infrastructure while current items include (among other things) investments in projects and staff.



Queensland continues to invest

While we observed a decrease in total Queensland Government R&D expenditure in 2015–16 (compared to 2014–15), expenditure experienced a 12% increase from 2015–16 to 2016–17, as Advance Queensland funding for science and innovation began to roll out. This is a reflection of the government's commitment to investing in Queensland's research capabilities and supporting opportunities to translate research into products and processes to strengthen innovation in Queensland.

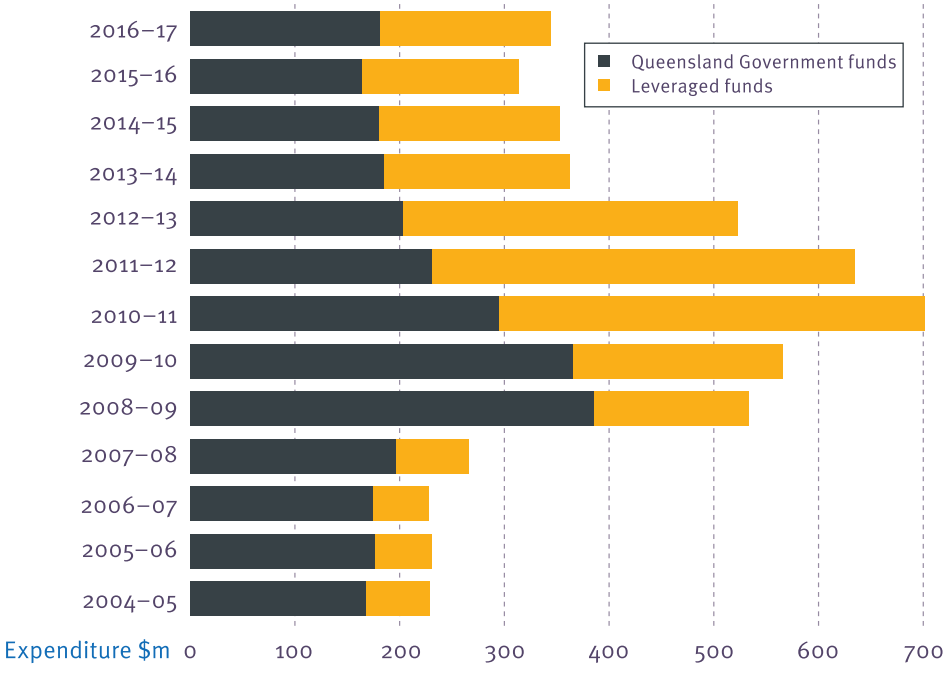
The Queensland Government was the main funding source for state government expenditure on R&D in 2015–16. However, R&D expenditure leveraged from other sources, including businesses, universities and the Australian Government increased by $26 million to $176 million in 2016–17.

In particular, in-house R&D in Queensland has seen an increase in leveraging potential following Smart State (2004–2012), despite a decrease in government funding since that time (due to the completion of major research infrastructure projects).

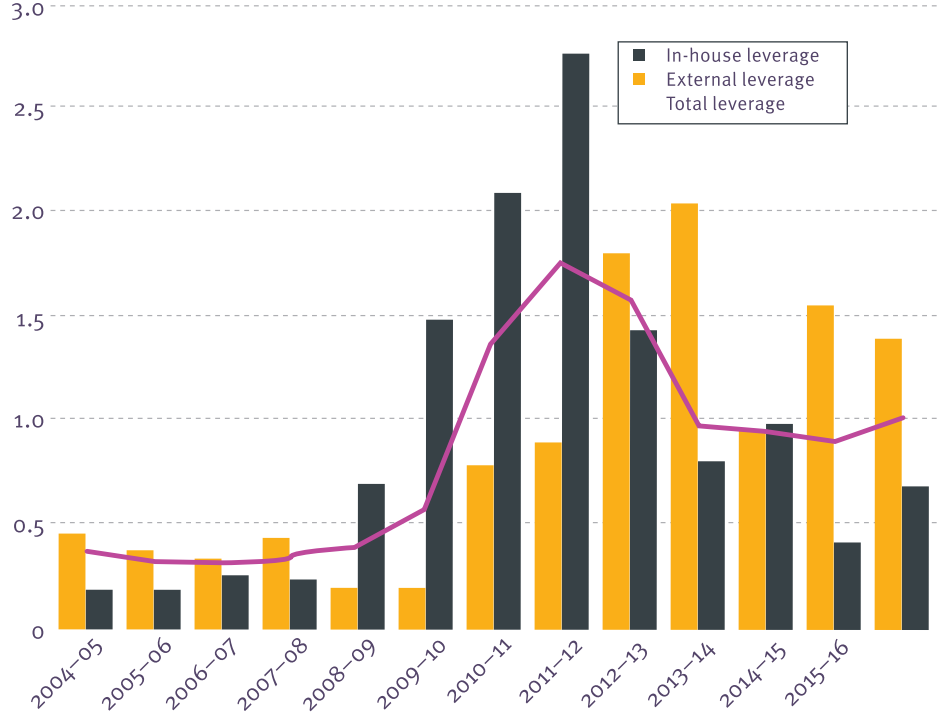
For in-house R&D, the Queensland Government leveraged $1.55 for every dollar invested in 2015–16 and $1.39 in 2016–17.

While external R&D hasn't had the same leveraging capacity since the large capital investments of Smart State, there has been a substantial increase in leveraged funds reported for external R&D from 2015–16 to 2016–17.

Total Queensland Government R&D expenditure



Leverage rates (per $1 spent by Queensland Government)



Building research capacity through collaboration

Historically, significant investments were made to establish world-class science and research infrastructure across the state. These building projects have since been completed.

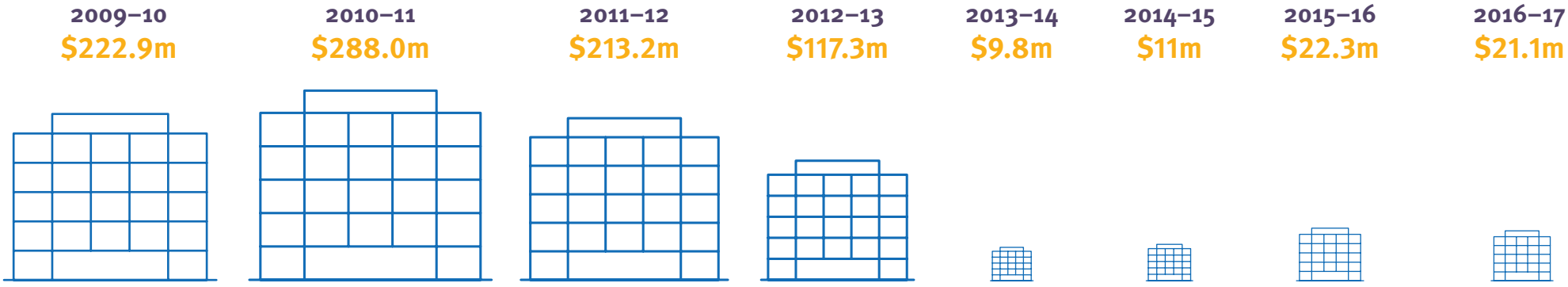
The Queensland Government is now focusing on full utilisation of this infrastructure and building a culture of collaboration between research bodies and businesses to translate ideas and research into products, processes, service outcomes and jobs.

The Queensland Government spent $22.3 million on capital investments (infrastructure) in 2015–16 and $21.1 million in 2016–17. This is double the investment in 2014–15.

This increase was largely due to funding the establishment of the Australian Institute of Tropical Health and Medicine at James Cook University—officially opened on 7 October 2016—and the Sunshine Coast Health Institute.

Other capital investments included the establishment of the CQUniversity Engineering Laboratories at the university's Cairns campus, the purchasing of equipment for Gamma Knife® technology and a MAGNETOM Prisma MRI Scanner at Metro South Hospital and Health Service to improve disease diagnosis and treatment and to facilitate research.

Capital investment



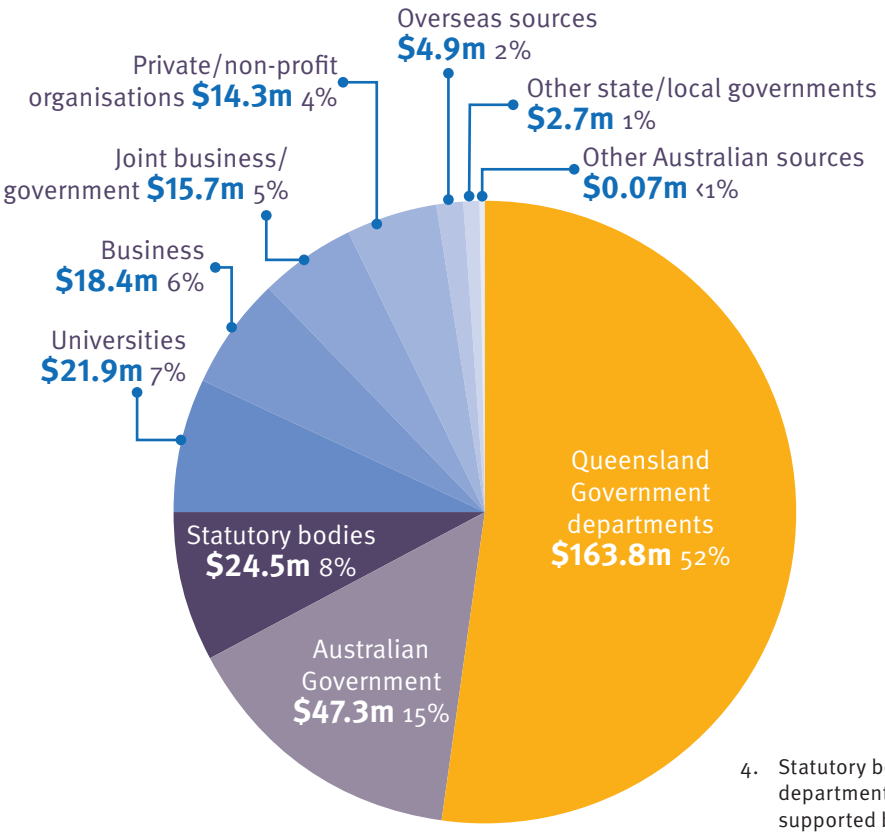
Where did the money for R&D come from?

Across both financial years, around half of R&D investment was sourced from Queensland Government departments. This investment in R&D enables new ideas to be developed, tested and commercially translated.

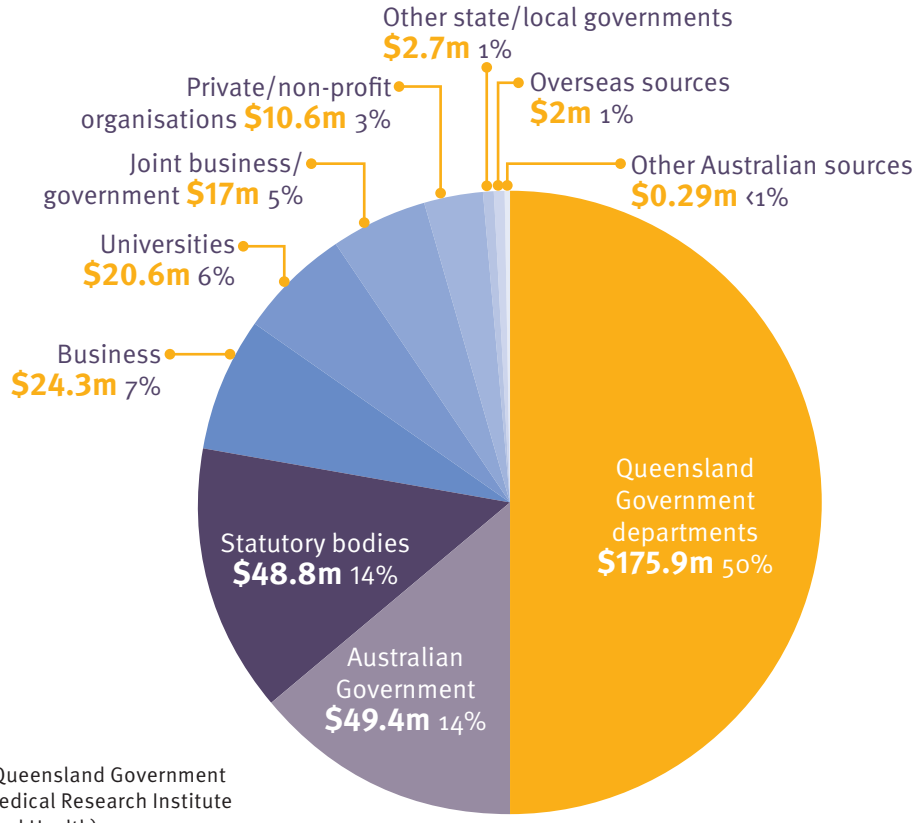
There was a $16 million decrease in 2015–16 from the previous financial year. This was offset by a $16 million increase in funding from statutory bodies.[4] There was also a small decrease in funding for R&D from the Australian Government, universities, business and overseas sources.

However, in 2016–17 we saw R&D funding from the Queensland Government increase by $12 million from 2015–16 to $175.9 million in 2016–17 and funding from statutory bodies almost double to $49 million.

Total R&D by funding source 2015–16



Total R&D by funding source 2016–17

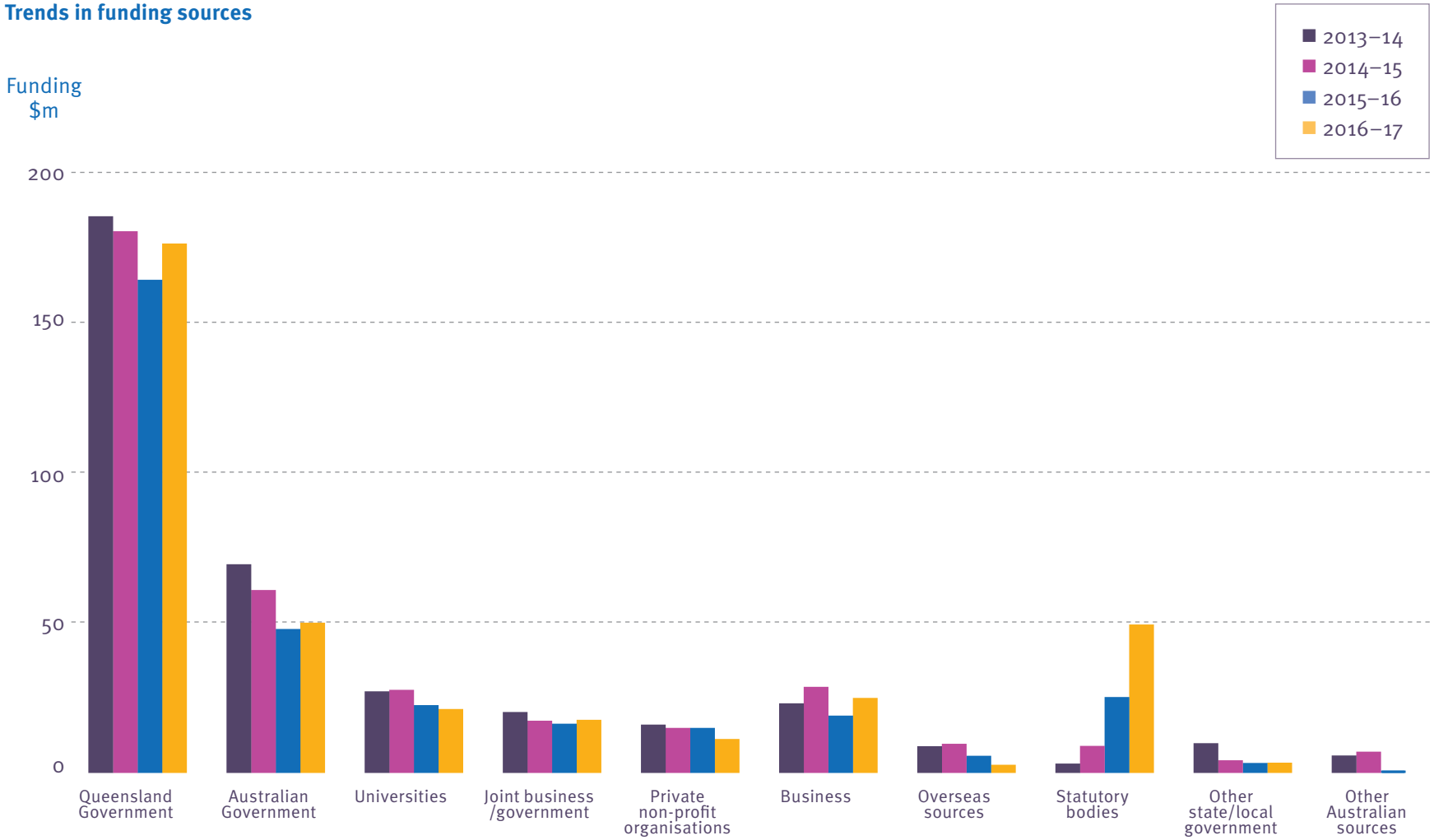


4. Statutory body funding comes from Queensland Government departments (e.g. QIMR Berghofer Medical Research Institute supported by funding from Queensland Health).

Where did the money for R&D come from?

R&D funding from the Queensland Government has remained relatively stable over the last four years.

Trends in funding sources



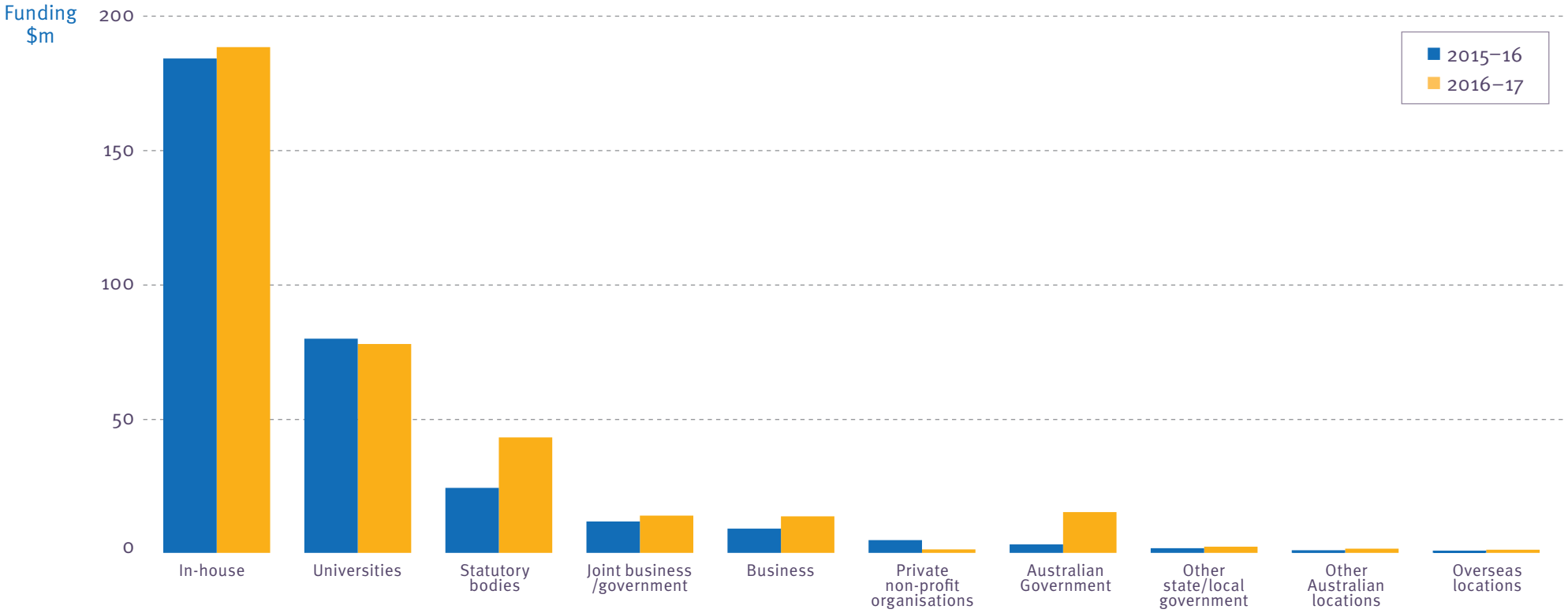
Where is R&D carried out?

Over half of the total funds invested by the Queensland Government represents R&D performed by Queensland Government departments, including $183.9 million in 2015–16 and $188.2 million in 2016–17.

This in-house investment allows projects to take advantage of past investments in infrastructure, with R&D conducted at Queensland Government facilities and field stations; for example, the Northern Fisheries Centre for aquaculture R&D activities.

This infrastructure is recognised as world-class, drawing investments from the Australian Government, businesses, private non-profit organisations, universities, government bodies and statutory authorities.

Universities continue to receive around a quarter of all Queensland Government R&D expenditure (25% in 2015–16 and 22% in 2016–17).

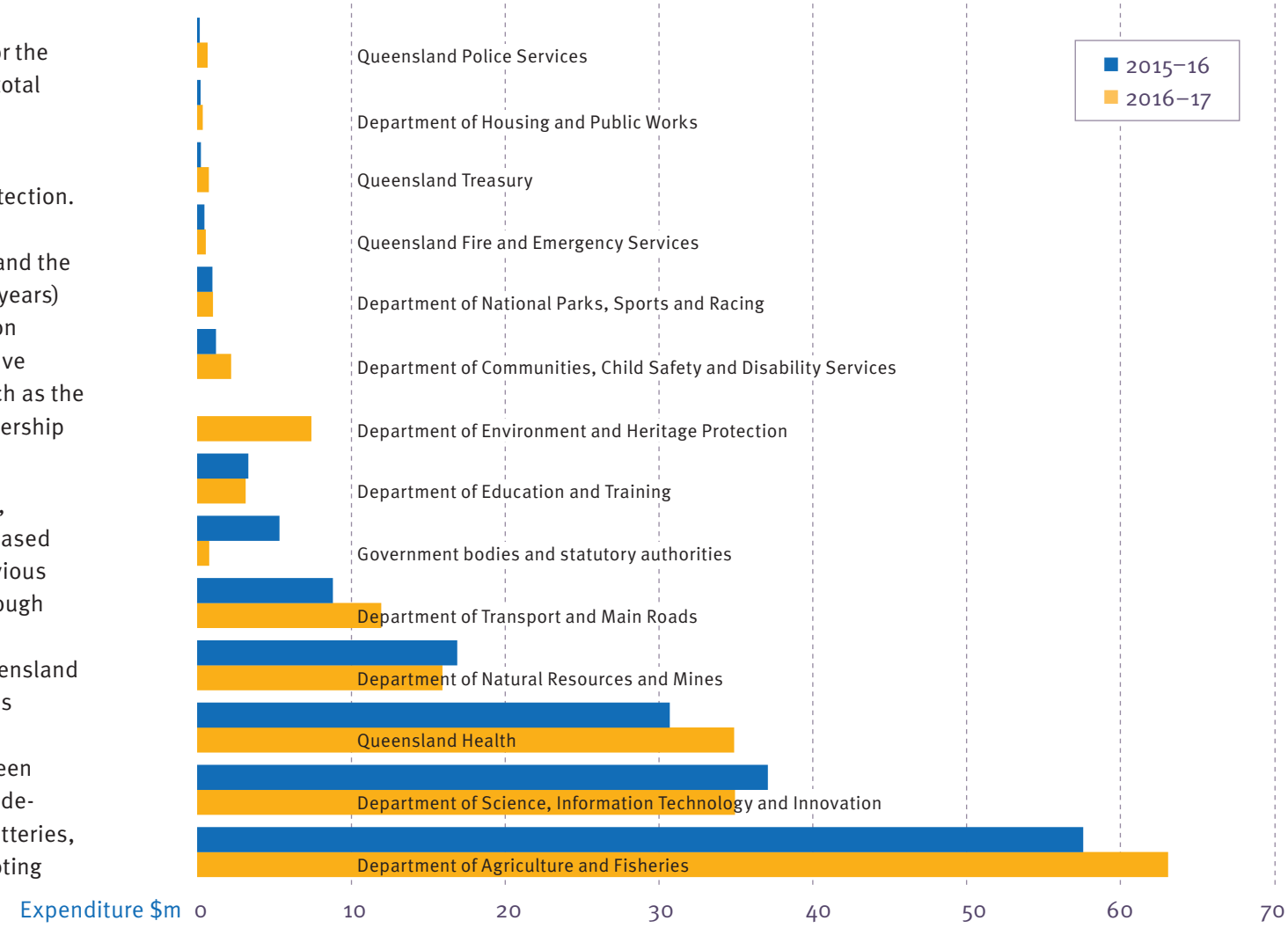


Which departments are investing in R&D?

The Department of Agriculture and Fisheries continues to be the largest provider of R&D for the Queensland Government with over a third of total investment coming from this department.

We saw increased investment from the (then) Department of Environment and Heritage Protection. This was driven through a commitment to the Climate Adaptation Strategy for Queensland and the Queensland Government's $9 million (over 4 years) investment in the Great Barrier Reef Innovation Fund to develop, trial and implement innovative approaches to improve reef water quality, such as the Innovative Gully Remediation Project in partnership with Greening Australia.

In 2015–16, the (then) Department of Science, Information Technology, and Innovation increased their investment in R&D by 50% from the previous financial year, continuing this investment through 2016–17. This increase was made possible by funding released under various Advance Queensland initiatives, including fellowships, scholarships and research partnerships. Investments in these programs supports collaboration between businesses and universities, focusing on a wide-range of topics including low-voltage solar batteries, small-scale housing opportunities and promoting native plant species.

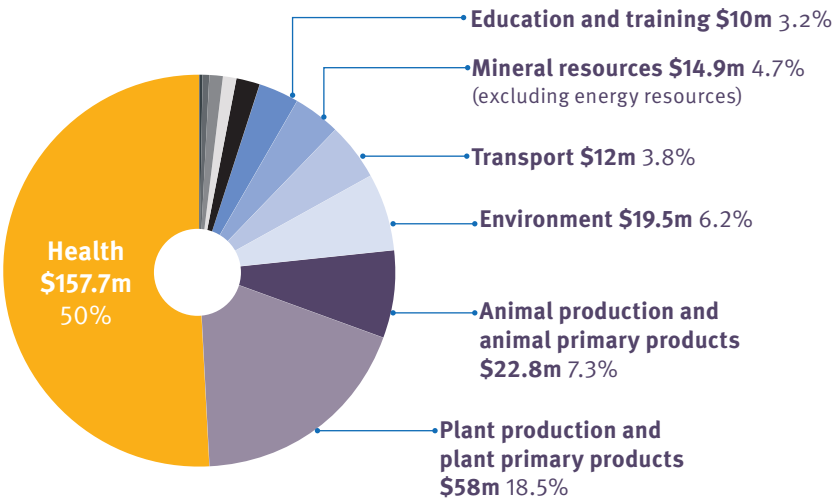


Queensland research areas

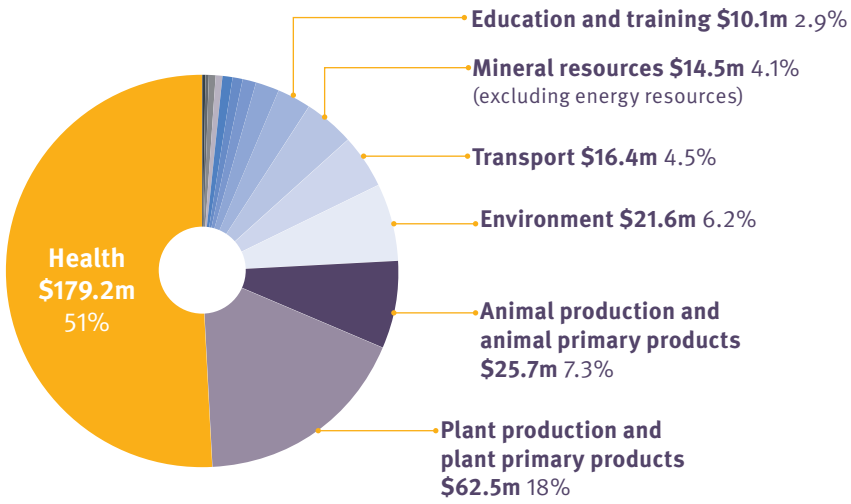
The Australian Bureau of Statistics classifications for socio-economic objectives and the fields of research have been used in this report (and our three previous reports). The socio-economic objectives of investments relate to the impact of the research. For example, a project developing a material for use in knee joint replacements would be classified as an engineering research project but the impact of the project achieves a health objective.

The proportion of investment in the field of medical and health sciences has increased in recent years, and now makes up 50% of the R&D expenditure in Queensland. Funding for this field came from Queensland Health, QIMR Berghofer Medical Research Institute and the (then) Department of Science, Information Technology and Innovation. As an important part of Queensland's economy, agriculture and veterinary sciences received 25% of R&D investment in 2015–16 and 20% in 2016–17. The Department of Agriculture and Fisheries provides most of the funding in this space.

R&D investment classified by socio-economic objectives 2015–16



R&D investment classified by socio-economic objectives 2016–17

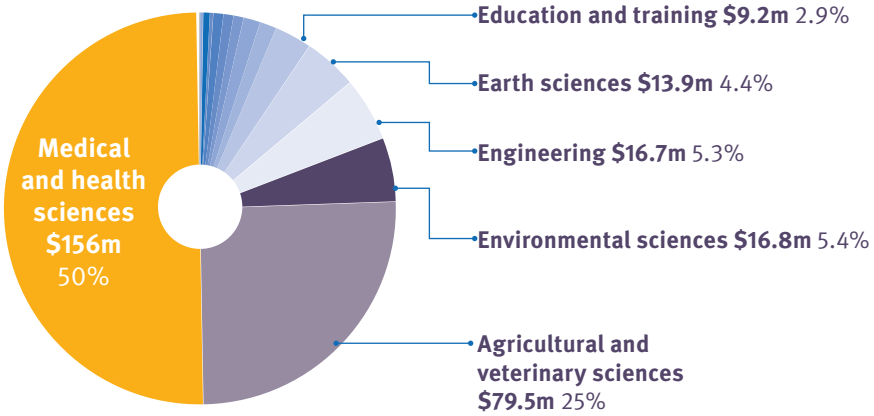


Queensland research areas

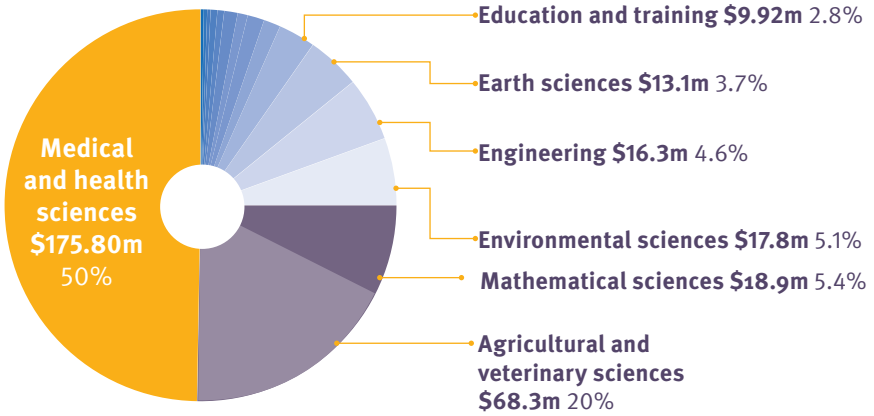
The socio-economic classification trends echo the fields of research. Health continues to attract investment for R&D activities.

Queensland Government partners with various groups within universities to achieve research outcomes including the Queensland Alliance for Agriculture and Food Innovation and the Queensland Centre for Mental Health Research.

R&D investment classified by field of research 2015–16



R&D investment classified by field of research 2016–17



Science and research priorities

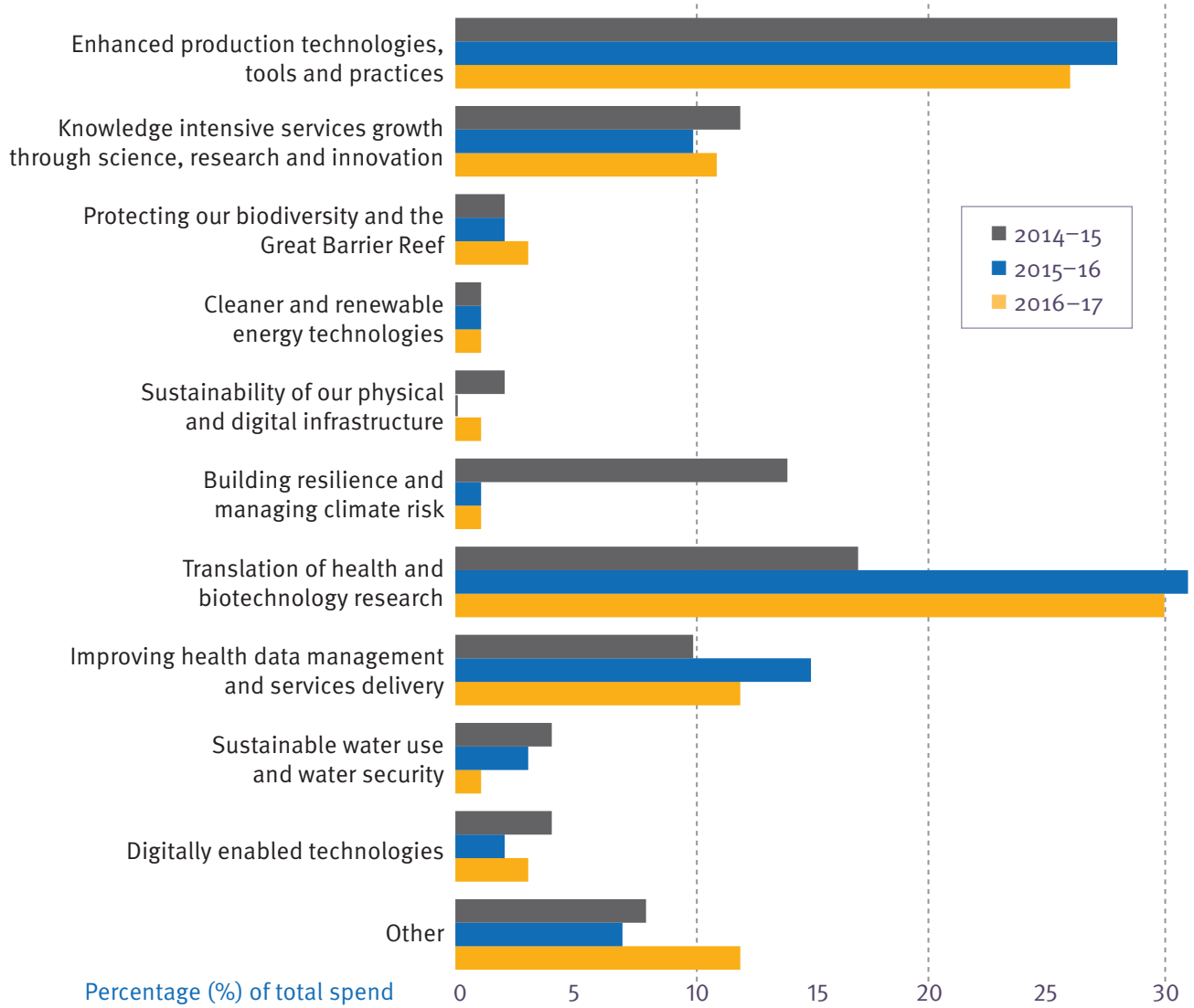
The Queensland Science and Research Priorities were developed by the Queensland Chief Scientist to guide R&D investments and support future investments to align with Queensland Government objectives* and provide value for money.

There was a fairly consistent level of funding across a number of research priorities compared to 2014–15. However, investment in protecting our biodiversity and the Great Barrier Reef increased by nearly 80% in 2016–17.

Across both years, a high proportion of our total funding went to delivering productivity growth in the primary industries through enhanced production and to the translation of health and biotechnology research, which build on Queensland's research strengths in biosciences.

Some of the funding for translating research outcomes went towards the operation of research centres, including the QIMR Berhofer Medical Research Institute, the Medical Research Commercialisation Fund and funding for establishment of the Australian Institute of Tropical Health and Medicine.

* As they stood during this reporting period—Queensland Science and Research Priorities are currently being reviewed.



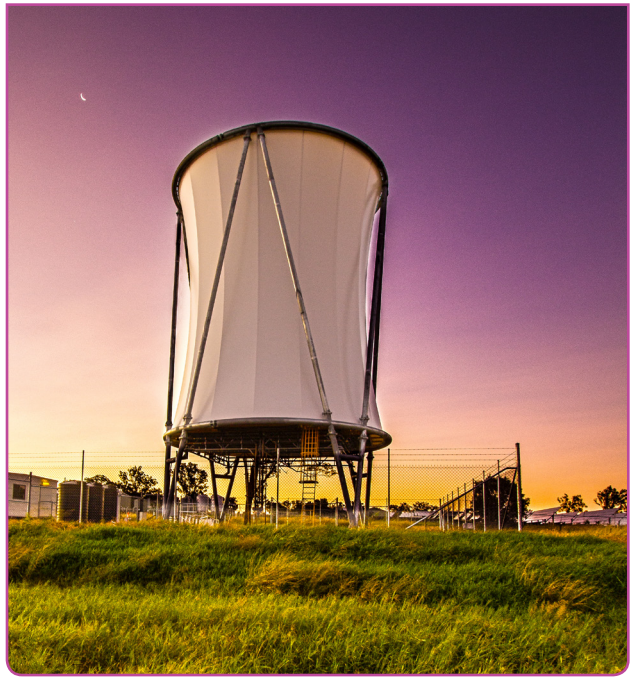
Case studies

Protecting our biodiversity and the Great Barrier Reef

Detecting oil spills on the Great Barrier Reef

Dr David Blondeau-Patissier received an early career Advance Queensland Research Fellowship to develop an oil pollution detection system for the Great Barrier Reef, based on the use of advanced optical, thermal and radar sensors from the European Space Agency's Sentinel satellite missions.

In partnership with Australian Maritime Safety Authority and CSIRO (Drs Blondeau and Thomas Schroeder), the project aims at using satellite technology to significantly improve the detection of surface oil pollution. Accurate and timely detection of such devastating events will help trigger a faster environmental response, and enhance the coastal management capabilities of the marine park.



Cleaner and renewable technologies

Energy generation in drought areas

Hybrid cooling towers research at the University of Queensland may help revolutionise energy generation in drought areas and has a goal to reduce water consumption by over 70 000 megalitres per year by 2020. The technology allows for the study and development of new methods to reduce water consumption in thermal power generation.

This technology can be applied to all kinds of power plants including traditional coal plants, biomass plants and solar thermal plants.

Digitally-enabled technologies

Harvey—capsicum harvesting robot

The Department of Agriculture and Fisheries is investing $3 million over three years into research at QUT to fast track the development of agricultural robots. A team at QUT, led by Professor Tristan Perez, has developed a new agricultural robot—nicknamed ‘Harvey’—to harvest capsicums. Harvey’s performance achieves a success rate of 75%, compared to other robotic harvests which rate at only 33%.

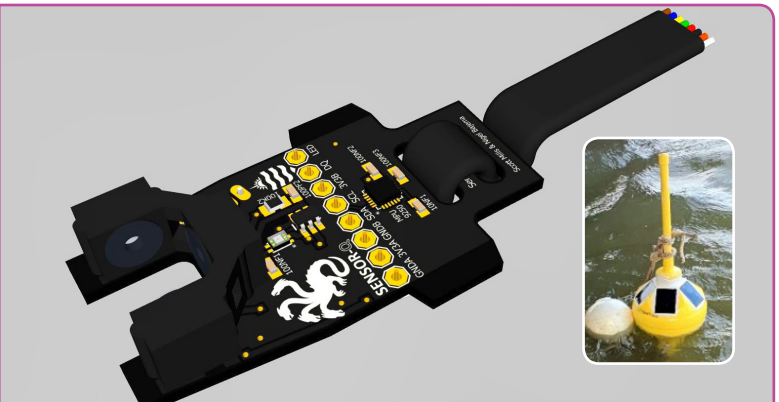
QUT is now in discussions with partners both in Australia and overseas to commercialise Harvey. In the future, the researchers also plan to investigate how automated harvesting technologies can be used for other crops, such as mangoes, strawberries and avocados.

Ensuring sustainable water use and delivering quality water and water security in a variable climate and in a resources-intensive economy

Sensor-Q

James Cook University Professor Ian Atkinson secured Queensland Government funding for his Sensor-Q research in partnership with the Townville City Council, CoastalCOM, and Taggle Inc.

SensorQ, as an integrated data collection, storage, analysis and visualisation platform, has a variety of industry applications. Sensor-Q is designed to be a low-maintenance, low-cost and simple-to-deploy system that can be used to solve important practical water problems for Townsville City Council and other local governments in the future.



Knowledge intensive services growth through science, research and innovation

Northern Farming Systems—Integrating research solutions for profitable outcomes (farm practices research)

This five-year project is done in partnership with CSIRO and the New South Wales Department of Primary Industries.

Led by Dr Lindsay Bell of CSIRO, the Northern Farming Systems Initiative examines how the performance of farming systems might be improved in the face of emerging challenges to grain farming. The project will compare various farming systems to help landowners achieve the full potential of their current farming system.

Ensuring the sustainability of our physical and especially our digital infrastructure critical for research and strategically leveraging national programs (including making use of 'big data')

High performance computing infrastructure

This high-performance computing infrastructure at the Ecosciences Precinct in Brisbane is used to store and analyse multi-petabyte (1 petabyte = 1000 terabytes) scientific data sets including an extensive archive of satellite imagery and climate data. It is an interconnected combination of multiple computer clusters, mass data storage libraries, and links into high-speed research networks and national infrastructure to enable access to 'big data' from around the world and for publishing open data for use by all Queenslanders.

The satellite imagery archive builds on the Queensland Government's continued investment in earth observation technologies. The archive contains over 80,000 Landsat satellite images for Queensland from the United States Geological Survey, and includes more than 30 years of continuous earth observation data at a 16-day (or better) interval—the longest continuous earth observation archive in history. Recently, the archive has expanded significantly through the Queensland Government's participation in a national partnership which is enabling access to the European Space Agency's range of Sentinel satellites through its Copernicus programme. Scientists analyse the data using complex algorithms to monitor and report on land-cover and land-use change. The outcomes inform and support natural resource and environmental management, climate change adaption, industry development, land-use planning and disaster response.

Improving health data management and services delivery

Improve nutrition in acute healthcare patients

Gold Coast Hospital and Health Service, in collaboration with Griffith University, has developed, implemented and evaluated an intervention to improve nutrition care, delivery and intake among acute medical patients.

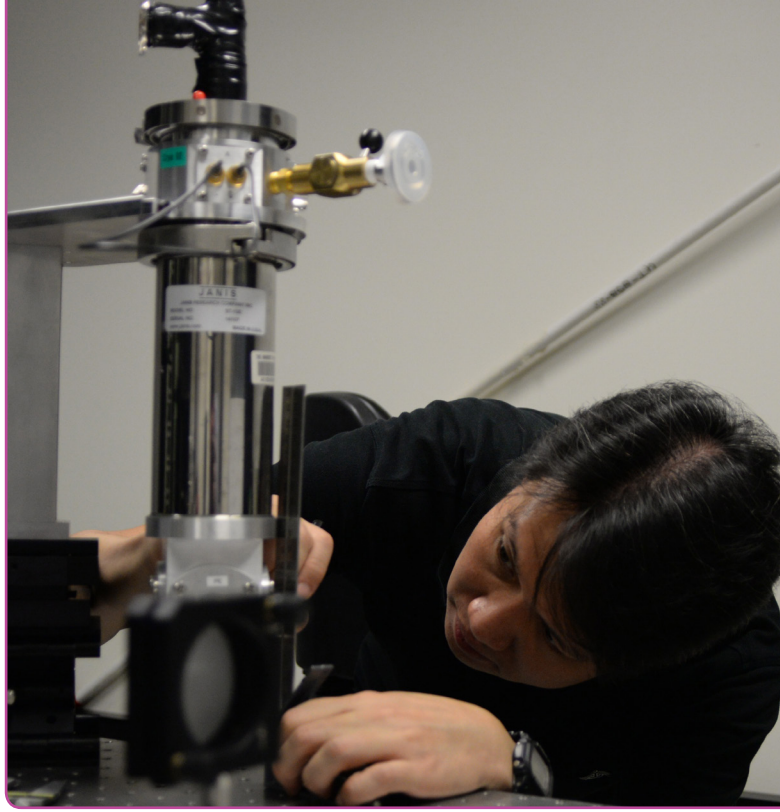
The intervention resulted in a 15–20% increase in patients' energy and protein intakes and the doubling of patients eating adequately post-intervention. The nutrition research unites research projects across the areas of intensive care, oncology, public health, food services and acute care.

Building resilience and managing climate risk through the design and development of construction technologies

Resilience against tropical cyclone winds

The Department of Agriculture and Fisheries is researching ways to improve the capacity of primary industries to withstand cyclonic winds. This research will identify techniques to mitigate the effects of cyclonic winds and develop new production practices to increase the resilience of tropical primary industries to withstand these winds in the future.

One of the techniques being trialled is using trellis systems for tree support during extreme weather events.



Translation of health and biotechnology research

Early detection of skin cancers

Dr Yah Leng Lim received an Advance Queensland Research Fellowship and has partnered with Micreo Limited (now L3 Micreo) on a project for the commercialisation of a compact terahertz laser imaging system for the early detection of skin cancer. This safe method of providing a different view of skin tissues will reduce the need for biopsies in people who present with skin cancer symptoms such as moles.

Dr Lim will work in partnership with researchers overseas to develop a more efficient cooling system for the technology and create a more compact product.

Enhanced production technologies, tools and practices

Mungbeans to money-beans

The Department of Agriculture and Fisheries' mungbean breeding efforts have continued to improve yields, grain quality and crop resilience in the face of drought and disease, with production rising from 35 000 tonnes in 2003 to more than 130 000 tonnes in 2016.

Partnerships with the University of Queensland, QUT and the University of Southern Queensland are also helping to boost the mungbean industry.

The Grains Research and Development Corporation, estimated that every $1 invested in the mungbean breeding program returned $18 of benefits to industry.

Thank you

The Office of the Queensland Chief Scientist has been working with Queensland Government departments and organisations since 2004 to identify R&D that is carried out or funded by the Queensland Government. The data is used to assess our investment in R&D and explore the partnerships and the research priorities that exist across government. Past reports are available on our website.

We would like to thank the staff, internally and externally to government, for their assistance and continued collaboration in collecting research and development data.

Collection and finalisation of data is an extensive process that requires representatives from each department to collect and finalise a whole-of-department dataset. Once sent to the Office of the Queensland Chief Scientist for inclusion, a process to confirm and finalise the dataset begins. Data from this collection and previous expenditure collections (2012–13, 2013–14 and 2014–15) is available on the Queensland Government open data website.

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