



Economics and Industry Standing Committee

Growing WA through Innovation

**The Western Australian Government's role
in fostering innovation to expand and
diversify the economy**

**Report No. 7
June 2016**

Legislative Assembly
Parliament of Western Australia

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Presented by

Mr I.C. Blayney, MLA

Laid on the Table of the Legislative Assembly on 30 June 2016

Chairman's Foreword

History shows that innovation is not new—human beings have always been incredibly innovative. Talking about and reporting on innovation is also not new. For example, since 2000 there have been dozens of Commonwealth Government reports, reviews, information papers, policy reviews and policy statements. The Prime Minister's December 2015 *Innovation statement* announcing the *National innovation and science agenda*, has led to wide media coverage of the accepted need for Australia to take better advantage of its R&D and innovation. It seems everyone is talking about innovation.

This is the Economic and Industry Standing Committee's (the Committee's) report on its Inquiry into how technological and service innovation can be fostered to expand and diversify the Western Australian Economy. The aim of this report is to demonstrate to the Western Australian Government the absolute necessity for it to be much more proactive in how it goes about helping to diversify the state's economy through innovation. Innovation needs to be much more than just another buzzword.

Innovation has a very broad meaning across the economy. For clarity, innovation in this report is viewed as occurring at three clear levels:

- incremental change—the continuous improvement adopted by all successful organisations;
- step change—the market or self-imposed change pressures that require rapid adaptation; and
- disruptive change—unpredictable and breakthrough technologies and processes.

This has been a most interesting and informative Inquiry, not least because it has demonstrated just how much research and development is being done in Western Australia (WA) and how much creative talent there is in this state. The Committee has seen and heard of some amazing and innovative work being undertaken here. Unfortunately, the Inquiry has also shown that WA is at risk of not taking maximum advantage of the potential that might flow from this. If WA is to diversify its economy and become less reliant on the performance of any one sector, much more needs to be done to capitalise on the skills, knowledge and creativity that has developed through the state's major industries. We need to get better at converting the work done here into successful innovation outcomes. And government has a major role to play here.

While there are government initiatives designed to encourage innovation, and various government agencies are innovative in aspects of their service delivery, the government needs to do more. Overall, it is the government's role to help ensure the state's innovation ecosystem is strong and functioning effectively. The WA Government

needs to map the state's innovation ecosystem to determine any gaps, and then work to fill them. There are several things the government can do in this regard, including, but not limited to: doing more to encourage collaboration between government, universities and businesses; ensuring that the regulatory environment encourages rather than hampers innovation; supporting the necessary physical and intellectual innovation infrastructure; reviewing all levels of the education curriculum to ensure all students attain a certain standard in maths and science; and looking to other jurisdictions for effective initiatives that could be adapted for WA and for opportunities for WA businesses.

At a more detailed level, the government needs to amend the *Limited Partnerships Act 1909* to allow the formation of venture capital limited partnerships in WA. It also needs to review and refocus the role of Technology Park Bentley. This is an important facility for the state, but effort is required to ensure it operates as effectively as possible and remains fit for purpose. The government also needs to extend its efforts at developing collaborative relationships with interstate and overseas jurisdictions. For example, both Victoria and New South Wales have Cooperative Industrial R&D Agreements with Israel, and WA is at risk of being left behind.

Most of all, the WA Government needs to show leadership. The Premier, Hon Colin Barnett, MLA, has recently appointed a Minister for Innovation. This is a positive initiative; a good start, but more needs to be done. The WA Government needs to raise the profile of innovation and to facilitate connections between individuals and companies and universities. Importantly, government leadership needs to be long-term and take a bi-partisan approach.

I would like to take this opportunity to acknowledge the hard work of my fellow committee members—Hon Fran Logan, MLA, Mr Jan Norberger, MLA, Mr Peter Tinley AO, MLA, and Hon Terry Waldron, MLA—without whom this Inquiry and report would not have been possible. I would also like to thank the Committee's Principal Research Officer, Dr Loraine Abernethie, and Research Officer, Mr Michael Burton, for their assistance throughout this Inquiry.



MR I.C. BLAYNEY, MLA
CHAIRMAN

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Executive Summary

This inquiry is based on the uncontroversial view that innovation is both necessary and desirable as a means of growing a diversified Western Australian economy. Successful innovation drives productivity which, in turn, stimulates high-level, high value employment. As **Chapter 1** notes, the need for innovation has long been recognised by government, with many reports produced on the topic. This need still exists but, if anything, in recent times it has become more urgent. Following the Prime Minister's December 2015 *Innovation statement*, the word 'innovation' is everywhere. It is therefore essential that innovation does not become just another overused cliché. This will require a concerted effort by policy-makers over the long-term so that innovation can be embraced and converted into meaningful outcomes. It will also require bi-partisan support and continuity across governments.

It was in the context of an economy in transition that the Committee undertook this Inquiry into how to foster innovation to strengthen Western Australia's (WA's) economy, paying particular attention to the agriculture and food, mining and energy, and advanced manufacturing sectors. Details on the conduct of the Inquiry are contained in **Chapter 1**.

Given the focus on the agriculture and food, mining and energy, and advanced manufacturing sectors, **Chapter 2** provides a brief outline of the structure of the WA economy. A snapshot of the three sectors on which the Inquiry focussed is also provided, showing that these are sectors in which WA is already strong and has particular comparative advantage.

For WA to become a state of innovation, it is important that it develops and maintains a strong, healthy innovation ecosystem, in which all the public and private agents and entities, and their structures, processes and interrelationships function together as a unit. The complexity of an innovation ecosystem is described and illustrated in **Chapter 3**, with the Australian Marine Complex in Henderson discussed as an example of a successful innovation ecosystem. There are a number of drivers of innovation, and these are also outlined in Chapter 3.

A healthy innovation ecosystem both requires and generates a culture of innovation throughout the system. As Chapter 3 also shows, a culture of innovation embraces creative thinking, collaboration, dialogue, initiative, research, openness, a willingness to be more open to risk and an acceptance that not every innovative idea will succeed.

An innovation ecosystem cannot be effective unless it is founded on effective collaboration between all of its elements. WA has a strong history of successful scientific research and there is a wide range of areas across which industry, universities

and government collaborate. However, as **Chapter 4** demonstrates, while Australia ranks highly in global indexes for levels of knowledge, research and creativity, our track record in turning research into commercial or practical outcomes is relatively poor.

There are a number of factors that hamper collaboration, particularly between industry and universities, and these are discussed in Chapter 4. Key amongst these is the misalignment of incentives and core functions, with academics being largely rewarded for publications in academic journals—an outcome that is largely irrelevant to industry. There is also a general lack of awareness on the part of businesses and universities in relation to their respective needs and capabilities. This, in part, has been generated by a lack of effective communication and plain language. Small to medium enterprises (SMEs) face particular challenges in engaging with universities, mainly because these businesses are relatively small in size and often lack the resources necessary to negotiate university administrative policies. A further challenge to increased collaboration in WA in particular is the conservative nature of the resources sector. Chapter 4 also notes that competition between potential partners is a barrier to improved collaboration, including competition for market share and for government research grants.

While most of the funding for university R&D is provided by the Commonwealth Government, there are a number of measures the Western Australian Government could implement to increase the levels of collaboration, and these are also outlined in Chapter 4. However, the state government alone cannot meet the challenge of improving collaboration—a concerted effort is required by government at all levels, and by universities, businesses, industry associations, labour organisations, entrepreneurs, venture capitalists and all other agents in the innovation ecosystem.

Chapter 4 also outlines a number of efforts being made to increase collaboration, and highlights the Western Australian Energy Research Alliance (WA:ERA) as an effective collaboration in the petroleum resources sector. Government and other sectors of the economy could look to WA:ERA as a model to enhance their own collaborative efforts.

Developing a new or improved product, process or service and bringing it to market requires investment, from the R&D stage through to the start-up and commercialisation stages. As **Chapter 5** notes, WA's total expenditure on R&D is approximately 1.8 per cent of gross state product, which is well below the proportional R&D spend of the top 10 OECD nations, which each invest between 3 and 4.2 per cent of their economic production back into R&D. WA businesses, government and research institutions need to invest more in R&D, and would do well to aim for expenditure equal to at least 3 per cent of gross state product.

Chapter 5 also provides information on the level of investment in R&D by businesses, the Commonwealth and state governments, and universities, noting that expenditure

by the Western Australian Government has shown almost no growth over the past 25 years and has certainly not kept pace with the growth of the state's economy in that time. While R&D investment in Australia is primarily supported by the Commonwealth Government, there are a number of ways in which the state government could positively impact R&D investment in WA, and these are outlined in Chapter 5.

With investment in R&D just one piece of the innovation funding puzzle, Chapter 5 also outlines the types of capital used for the commercialisation of innovative technologies—angel investment, venture capital and private equity—making the important point that venture capital is more than providing money. Venture capitalists provide both money and mentoring to target businesses to help grow these businesses and ensure that their investments are successful.

While some perceive a lack of available investment capital in WA, the situation is more complex. While local investors understand the resources sector and the associated risks, they are less familiar with investing in other sectors of the economy. A further structural problem is the risk averse nature of the corporate finance sector in Australia. Attracting capital for the commercialisation stage of innovation is particularly challenging, largely due to the speculative, generally unsecured nature of commercialisation investment.

Incubators and accelerators are two ways in which businesses can obtain effective financial assistance and business guidance in the early stages of their development, and these are outlined in Chapter 5. University-led commercialisation activities and issues relating to intellectual property are also discussed, as is the role of government in helping to address the structural barriers to investment and commercialisation. One particular way the Western Australian Government could enhance the commercial potential of innovative local ideas would be to ensure that the business environment is attractive to private investors. The state government must, as a matter of priority, update the *Limited Partnerships Act 1909* (WA) to allow the registration of incorporated limited partnerships in WA under the *Venture Capital Act 2002* (Cth).

Another essential element in an innovation ecosystem is efficient physical and intellectual infrastructure. **Chapter 6** discusses infrastructure that is particularly geared towards stimulating innovation outcomes such as collaboration, learning, research and invention. The state's physical infrastructure includes innovation precincts like Technology Park Bentley, research facilities like the Pawsey Supercomputing Centre, and cultural institutions like Scitech. It is through this strategic designation, use and investment in land by government that business clusters can be stimulated, with business clusters being a well-recognised means of improving business productivity and innovation capacity. In WA, one of the most widely-recognised successes in strategic land use is the Queen Elizabeth II Medical Centre, and this is described in detail in Chapter 6.

Noting that governments around the world seek to emulate the success of ‘science parks’ or ‘technology parks’ in places such as San Diego, Cambridge and Oxford, Chapter 6 discusses the development of Technology Park Bentley as a catalyst for science and technology development in WA. The importance of this precinct is also highlighted, particularly in relation to the opportunities it provides to businesses to network and obtain advice from the Innovation Centre of Western Australia (ICWA). Yet while there is enormous potential in Technology Park Bentley, it has never been fully realised. There is a need for the precinct to be revitalised, for its purpose to be reviewed and its focus to be clarified. The government would also be able to use its own research capabilities as a catalyst for innovation clusters through locating government research departments close to each other, as the Queensland Government did when it established the EcoSciences Precinct in Brisbane. There would also be benefit in helping SMEs to better access government research facilities, thus maximising their benefit to the Western Australian economy.

The role of the Technology and Industry Advisory Council (TIAC) as a key piece of the state’s intellectual infrastructure is also discussed in Chapter 6. TIAC was first established in the 1980s to provide independent strategic advice to the state government on industry, science and technology matters. Noting TIAC’s recent work on the development of STEM skills in WA, Chapter 6 also provides an outline of areas on which TIAC could provide timely and strategic advice to government.

Chapter 6 also describes two further pieces of intellectual infrastructure, namely the capability mapping being undertaken by the Chamber of Commerce and Industry of Western Australia (Inc) and the innovation networking events generated and hosted by Innovate Australia. Government must support and help facilitate these types of initiatives to ensure that the intellectual infrastructure generated is freely available to those who need it.

The introduction of new technologies in the workplace can cause significant disruption in the labour market, with employees at all levels of an organisation suddenly requiring new skills, or a different mix of skills. There is also a growing demand for employees to have higher qualifications than previously, and employers report difficulties in recruiting suitably qualified people. As a result, there is considerable current emphasis on the need for science, technology, engineering and mathematics (STEM) skills, with 75 per cent of the fastest growing occupations now requiring STEM skills. As **Chapter 7** shows, there is widespread concern over the capacity of the Australian education system to equip students with the level of STEM knowledge and skills that future employment will require.

The state government has a major role in workforce planning and development, from primary school through to high school and Vocational Education and Training (VET). While a concerted effort is required by government to address the current status of

STEM education in WA schools, as Chapter 7 explains, improved STEM education in WA is not the government's responsibility alone. A collaborative effort from all stakeholders—including primary, secondary and tertiary education providers, government agencies, professional teacher organisations, school principals and employers and industry associations—is required.

Chapter 7 also highlights concerns over the perception that university graduates are not job ready, and suggests possible reasons for this. There are a number of initiatives in place that aim to increase STEM skills and student interest in those subjects, as well as various programs at universities designed to provide university students with work-integrated learning. As Chapter 7 demonstrates, the Industry and PhD Research Engagement Program (iPREPWA) is a relatively new program working to address the problem of universities and businesses not collaborating in research projects, while also providing PhD students with industry placements. iPREPWA has received positive feedback from industry partners and students.

As well as supporting R&D and promoting and providing STEM education, state government agencies can encourage innovation through their own practices. Agencies that are innovative in the way they deliver services to the public set a good example for others, and **Chapter 8** provides some examples of where this is happening in WA. Agencies can also foster innovation through strategic procurement policies, which should be designed to assist local fledgling companies at critical stages of their development by providing opportunities that may not arise through normal market operations. There are, of course, risks with any such approach. It would require not only careful policy development, but also a shift in government and public service culture, and informing the public of the new approach and its associated risks and benefits would be essential.

Chapter 8 also makes it clear that the state government can encourage innovation by ensuring that its policies, legislation and programs all work to foster innovation, rather than presenting barriers to business growth. The state has developed several initiatives aimed at encouraging science and innovation in WA and some of these are outlined in Chapter 8. The two main agencies charged with assisting innovators develop their ideas and grow their businesses are the Small Business Development Corporation (SBDC) and the Department of Commerce, and Chapter 8 provides an outline of the services they provide. The Innovation Centre of Western Australia (ICWA), which is located at Technology Park Bentley, is run by the Department of Commerce. ICWA provides important services to innovators to take their ideas from a concept through to a viable business, and is well regarded by those it has assisted. ICWA's future is, however, uncertain as the Department of Commerce is currently reviewing its service delivery model.

Chapter 8 notes that the continuing perception that there is too much red tape for businesses in WA, and that managing the regulatory burden is a particular problem for SMEs. There is also concern that the state's regulatory regime is not flexible enough to cope with rapidly developing technologies and, in fact, may stifle better solutions to problems before they can reach their full potential. The proposed amendments to the *Limited Partnerships Act 1909 (WA)* is discussed as one example of legislation that has been slow to change. Chapter 8 also makes the point that government efforts to foster innovation should not duplicate what is being done in the private sector. The role of government within the innovation ecosystem must be to find gaps due to market failure and work to fill those gaps. LandCorp's solar PC and battery trial at the Gen Y Demonstration Housing Project is an example of how this can work.

Chapters 4 to 8 of this report describe key elements of WA's innovation ecosystem, pointing out challenges in relation to each and making suggestions as to how government can address them. Throughout the Inquiry it became increasingly clear that without one key ingredient, many of the considerable efforts being made by government, universities, businesses and representative bodies would not reach their full potential—and that key ingredient is government leadership. If WA is to become a state of innovation, it is essential that the Western Australian Government lead the way. It falls to government to raise the public profile of the importance of innovation, and to create a culture of innovation with an enhanced level of excitement about the possibilities this creates. **Chapter 9** acknowledges the signals sent by the Western Australian Government in publishing its *Science statement* and in the recent appointment of a Minister for Innovation. These initiatives alone, though, do not go far enough, and Chapter 9 sets out the key areas in which the Government of Western Australia must take the lead if WA is to become the home of clusters of innovative industries, employing highly-skilled workers in high-wage roles.

Ministerial Response

In accordance with Standing Order 277(1) of the Standing Orders of the Legislative Assembly, the Economics and Industry Standing Committee directs that the Minister for Science, Minister for Innovation, Minister representing the Minister for Commerce, Minister for Small Business, Minister for Agriculture and Minister for Mines and Petroleum report to the Assembly as to the action, if any, proposed to be taken by the Government with respect to the recommendations of the Committee.

Findings and Recommendations

Finding 1

Page 24

Obtaining accurate and comprehensive statistics on employment in the various sectors of the Western Australian economy is currently very difficult.

Recommendation 1

Page 24

The Western Australian Government improves its data collection by drawing on the various available sources to better inform decision-making for industry support and investment.

Finding 2

Page 51

It is particularly difficult for SMEs to collaborate with universities and major companies.

Finding 3

Page 54

There is a considerable need for increased levels of effective collaboration between universities and industry.

Finding 4

Page 58

WA:ERA is a collaborative model that could possibly be utilised in other sectors of the economy.

Recommendation 2

Page 58

The Western Australian Government explores the WA:ERA model, as well as those in other jurisdictions, as the basis for collaborative frameworks across the economy.

Finding 5

Page 61

The estimated R&D expenditure across the Western Australian economy is approximately 1.8 per cent of gross state product, which is low relative to the world's top ten nations.

Recommendation 3

Page 61

The Western Australian Government sets an aspirational target for R&D investment across the economy of three per cent of gross state product, and monitor and report on progress in reaching this goal.

Finding 6

Page 62

Data on Western Australian Government R&D investment is incomplete and not easily accessible.

Finding 7 **Page 65**

The Western Australian Government has limited capacity to encourage R&D investment through taxation measures.

Recommendation 4 **Page 67**

The Western Australian Government ensures that it is not investing in R&D that could be or is being conducted by industry or other institutions

Recommendation 5 **Page 68**

The Western Australian Government develops an R&D funding strategy to better direct funding to where it will have most impact and function as a catalyst for further investment by business and/or the federal government.

Finding 8 **Page 69**

Venture capital is not just money—it consists of both money and mentoring.

Finding 9 **Page 71**

There is possibly only one venture capital firm based in Western Australia.

Finding 10 **Page 76**

Western Australian investors generally understand investment in the resources sector, but need to be better informed as to how to invest in other sectors of the economy.

Finding 11 **Page 77**

As banks will generally not provide loans secured solely against business assets, SMEs in particular experience significant difficulty in obtaining debt financing.

Finding 12 **Page 79**

Funding for the expansion stage of a business is limited, which means that many good businesses miss the opportunity to grow.

Recommendation 6 **Page 79**

The Western Australian Government promotes the presence of venture capital companies in Western Australia through the encouragement of local companies or the attraction of national and international venture capital funds.

Recommendation 7 **Page 79**

The Western Australian Government considers sponsoring a venture capital conference in Perth.

Finding 13 **Page 82**

While obtaining a patent over a new idea is often critical in the early stages of commercialisation, the process of protecting intellectual property is relatively underutilised in Australia.

Finding 14 **Page 86**

Human capital is just as necessary to the commercialisation process as funding.

Finding 15 **Page 87**

Western Australia is the only Australian state where venture capital limited partnerships cannot be formed.

Recommendation 8 **Page 87**

The Western Australia Government, as a priority, completes the review of the *Limited Partnerships Act 1909* and introduces legislation to amend the Act to allow the formation of venture capital limited partnerships in Western Australia.

Finding 16 **Page 98**

While the CSIRO is a major tenant of Technology Park Bentley, there is a need for a major commercial anchor tenant to help attract others to the park.

Recommendation 9 **Page 98**

The Western Australian Government encourage a major commercial anchor tenant(s) to relocate to Technology Park Bentley.

Finding 17 **Page 102**

In the context of a modern innovation ecosystem, Scitech's future role needs to be reviewed.

Recommendation 10 **Page 103**

The Western Australian Government undertakes a review of Scitech's future role in the innovation ecosystem to ensure it can meet the challenges presented by the recent and continuing rapid developments in science and technology.

Finding 18 **Page 105**

For WA to become a state of innovation, Government Ministers should take advantage of the Technical and Industry Advisory Council as a resource and direct it to take on more of a leadership role to ensure that government decisions are made with a clear understanding of what future technology may bring.

Recommendation 11 **Page 105**

The Western Australian Government appoints the Chief Scientist of Western Australia to the Technical and Industry Advisory Council's board.

Finding 19 **Page 107**

A detailed and well-maintained capability map, which is universally accessible, will significantly benefit the WA economy.

Finding 20 **Page 107**

The Chamber of Commerce and Industry of Western Australia (Inc) is producing a capability map of Western Australia. The Committee is supportive of this initiative.

Finding 21 **Page 109**

Speaking and networking events that are freely accessible by the business, university and student communities are a critical component of the intellectual infrastructure for Western Australia's innovation ecosystem.

Recommendation 12 **Page 109**

The Western Australian Government supports future speaking and networking events that are freely accessible by the business, university and student communities as an important component of its role in supporting innovation in Western Australia.

Finding 22 **Page 116**

There was strong consensus throughout the evidence to this Inquiry on the need for improving the mathematics and science skills of Western Australian students.

Finding 23 **Page 127**

iPREPWA is an innovative and successful program with enormous potential to grow through targeting different industries. To deliver a successful program at scale iPREPWA will need to be better resourced.

Recommendation 13 **Page 127**

The Western Australian Government supports iPREPWA by providing the funding necessary to make it available to more PhD students in Western Australia, in its current format of three rounds per year.

Finding 24 **Page 127**

Any improvements in the level of government funding of iPREPWA should be on a co-funded basis with industry in order to meet agreed targets.

Finding 25 **Page 137**

There is a role for the Western Australian Government through the procurement process in fostering local innovation.

Finding 26 **Page 138**

Fostering innovation through the Western Australian Government's procurement process may involve a degree of risk. While this will require careful management by the government it should not be a deterrent.

Recommendation 14 **Page 138**

The Western Australian Government develops an innovation-specific local procurement policy.

Finding 27 **Page 139**

Western Australia's Science Statement is a positive development but the government needs to develop an implementation strategy and a process to review and update this strategy.

Finding 28 **Page 144**

While ICWA is well regarded by the innovation community its future is unclear.

Recommendation 15 **Page 144**

The Western Australian Government ensures that any model developed for the delivery of innovation-related services does not result in a duplication of services.

Finding 29 **Page 149**

There are several portfolios and appointments with various responsibilities for encouraging and supporting innovation in Western Australia. It is not clear at this time which agency has the lead responsibility.

Finding 30 **Page 155**

The appointment of a Western Australian Minister for Innovation is a positive development.

Recommendation 16 **Page 155**

The Western Australian Government combine the science and innovation portfolios to form a department and Minister for Science and innovation.

Recommendation 17 **Page 161**

The Western Australian Government forms an Industrial R&D Cooperation agreement with Israel.

Finding 31**Page 170**

Governments in other jurisdictions provide leadership through developing various programs and initiatives that:

- address contemporary problems through creating an environment that encourages and facilitates the development of high-technology potential future industries;
- Leverage existing intellectual and physical infrastructure;
- Recognise and proactively seek collaborative opportunities beyond their own borders; and
- Recognise the imperative to invest in human capital.

Recommendation 18**Page 170**

That the Western Australian Government:

- identifies the state's existing intellectual and physical infrastructure, and the potential opportunities these present, given the state's geographic location and resources;
- develops programs and initiatives that facilitate bringing that infrastructure and potential opportunities together to generate future comparative advantage through developing new technologies; and
- ensures that its policies and initiatives emphasise the need to collaborate with other Australian states and Territories as well as overseas jurisdictions.

Finding 32**Page 173**

Successful innovation requires strong, sustained leadership from current and future Western Australian Governments.

Chapter 1

Introduction

- 1.1 This report is the result of the Economic and Industry Standing Committee's (the Committee's) Inquiry into ways in which technological and service innovation can be fostered to expand and diversify the Western Australian economy.¹ It follows the Committee's work on the economic impact of floating LNG (FLNG) on Western Australia (WA), the safety of FLNG facilities operating off the WA coast and the potential opportunities that these operations might bring to the state's industries.
- 1.2 These earlier inquiries made it clear that, first, the state needs to diversify its economy in a way that provides highly skilled, well paid employment for Western Australians and second, that a sensible way to do this is to leverage off the existing industries and skills that are already important to the state.

Fostering innovation is desirable

- 1.3 The Committee approached the Inquiry from the clearly uncontroversial position that innovation and an expanded and diversified Western Australian economy are desirable.²
- 1.4 This view is reinforced by the enormous number of reports produced in recent years on the need for innovation. As Professor Roy Green's 2015 report for the Senate Economics References Committee notes, from 2000 to 2015 there have been at least '60 Commonwealth Government ministerial policy statements, government commissioned reports, reviews, and information papers that address innovation system issues. There has also been a stream of policy reviews and position papers'.³ This does not include the large number of 'consultants' reports and advocacy documents issued by industry organisations, professional services businesses, academic associations, and learned academies'.⁴ Generally speaking, these documents accept the need for fostering innovation.

1 The Terms of Reference for the Inquiry are contained in Appendix One.

2 The Committee acknowledges that not all innovation is necessarily positive and that innovation can have unintended economic and social consequences.

3 *Australia's innovation future: A report on the structure and performance of Australia's national innovation system*, report prepared by Professor Roy Green, for Senate Economics References Committee, *Australia's innovation system*, Commonwealth of Australia, Canberra, 3 December 2015, p 14. These documents are listed in Attachment 2 to Professor Green's report.

4 *Australia's innovation future: A report on the structure and performance of Australia's national innovation system*, report prepared by Professor Roy Green, for Senate Economics References

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- 1.5 The view that innovation and a diversified economy are desirable is also supported by the Prime Minister's December 2015 *Innovation statement* in which he announced the *National innovation and science agenda* (NIS Agenda).⁵ The Prime Minister's statement says that the NIS Agenda 'is part of the Government's commitment to establishing Australia as a leading innovation system' and 'will help to create a modern, dynamic, 21st century economy for Australia'.⁶ Since that statement, innovation has been a hot topic of discussion.
- 1.6 Many submissions to this Inquiry also noted the importance of innovation. For example, Edith Cowan University (ECU) submitted that 'technological and service innovations are essential to drive forward the Western Australian economy'.⁷ Similarly, the Technology and Industry Advisory Council (TIAC) referred to the work of American economist Robert Solow, who demonstrated that about 80 per cent of all economic growth is driven by technological development.⁸
- 1.7 Given the above, this report does not provide further argument on the need for innovation and economic diversity except to say that for a state such as Western Australia (WA), with a heavy reliance on its resources sector, innovation and the resulting growth and diversity should help to smooth out the highs and lows associated with fluctuating commodity prices.

Focus on Western Australia

- 1.8 This is an Inquiry of a Western Australian parliamentary committee. The Committee's report is to the Legislative Assembly and contains recommendations to the Government of Western Australia in relation to what it, the state government, can do to foster innovation in WA. Given this, the Committee's report does not discuss in detail the initiatives of the Commonwealth Government except where they are relevant to particular Western Australian initiatives.
- 1.9 This, of course, does not mean that the Commonwealth's initiatives have not been, or will not continue to be, essential to innovation in WA. In fact, State-run initiatives should be most effective when they complement Commonwealth efforts in the same

Committee, *Australia's innovation system*, Commonwealth of Australia, Canberra, 3 December 2015, p 14.

5 Hon Malcolm Turnbull, (Prime Minister), *National innovation and science agenda*, Media Statement, Prime Minister of Australia, Canberra, 7 December 2015. Available at <https://www.pm.gov.au/media/2015-12-07/national-innovation-and-science-agenda>. Accessed on 24 March 2016.

6 *ibid.*

7 Submission No. 10 from Edith Cowan University, 26 August 2015, p 1. See also, for example, Submission No. 7 from Engineers Australia, Western Australia; Submission No. 12 from WA:ERA; Submission No. 13 from Department of Training and Workforce Development; Submission No. 15 from Minerals Research Institute of Western Australia; and No. 17 from UnionsWA.

8 Submission No. 21 from the Technology and Industry Advisory Council, 1 September 2015, p 1. This work earned Robert Solow the 1987 Nobel Prize for Economics.

area. Therefore, the state government should always seek to harness maximum advantage from the various Commonwealth initiatives in formulating its own innovation policies and programs.

Policy-makers must follow through

- 1.10 It is essential that WA policy-makers accept that innovation is more than just a buzzword or simply the subject of yet another report. This point was illustrated by WA's Chief Scientist, Professor Peter Klinken, in discussing the 1994 *Final report* of the WA Select Committee on Science and Technology.⁹ According to Professor Klinken:

*had we implemented half of the recommendations that were in here [the 1994 Report], we would not be meeting today. ... 21 years ago there was a committee that reported on precisely the topics that we are discussing today. I think it was actually a visionary document, looking back on it now.*¹⁰

- 1.11 While there is widespread consensus on the importance of innovation, programs that aim to foster innovation require prospective and long-term commitment. It is time for the state government to redouble its efforts in fostering technological and service innovation in WA, and it was in recognition of this that the Committee undertook this Inquiry.

Innovation must be converted to meaningful outcomes

- 1.12 While Australia has a strong research and development (R&D) history, its innovation performance does not rank highly when compared with other jurisdictions. In the 2015 *Global innovation index* (GII) Australia ranked 17th out of 141 countries, achieving a total score of 55.2 out of 100. Table 1.1 provides key information about Australia's ranking in the 2015 GII.

9 Select Committee on Science and Technology, *Final report*, Legislative Assembly, Parliament of Western Australia, Perth, November 1994.

10 Professor Peter Klinken, Chief Scientist of Western Australia, Office of Science, Department of Premier and Cabinet, *Transcript of Evidence*, 11 February 2106, p 2.

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Table 1.1: Australia's rankings in the 2015 Global Innovation Index¹¹

Innovation Index	Rank (out of 141)
Global Innovation Index (average of Input and Output Sub-Index Scores)	17
Input Sub-Index (Institutions, human capital and research, infrastructure, market sophistication, and business sophistication)	10
Output Sub-Index (Knowledge and technology outputs, and creative output).	24
Innovation Efficiency Ratio (ratio of the Output Sub-Index score over the Input Sub-Index score)	72

1.13 Australia maintained its 2014 rankings of 17th and 10th place in the overall GII and the Input Sub-Index respectively. While Australia improved in its creative outputs component of the Output Sub-Index by five places, it experienced falls in 'Human capital and research (down two places) and Knowledge and technology outputs (down eight places)'.¹²

1.14 It is clear that Australia directs considerable resources to the elements making up the Input Sub-Index. As our rankings in the Output Sub-Index and Innovation Efficiency Ratio show, however, Australia is not optimising its return on this investment. Similarly, while there is a considerable amount of R&D and innovation happening in WA, it is not being consistently converted into successful innovation outcomes. This makes the Committee's Inquiry all the more important.

Continuity of policy is essential

1.15 One of the key themes raised in this Inquiry is a lack of continuity or long term commitment for government initiatives. The Chief Scientist of Queensland, Dr Geoff Garrett AO, advised that when governments are devising initiatives to foster innovation, rather than responding to a present set of circumstances they should work towards a desired future outcome. Working towards achieving a future goal means it is essential that efforts to nurture technological and service innovation receive ongoing support from all governments regardless of political party. While this is discussed further in the report, it is important to note here that the Committee calls for bi-partisan support for innovation in WA.

11 Cornell University, INSEAD, and WIPO, *The global innovation index 2015: Effective innovation policies for development*, Fontainebleau, Ithaca, and Geneva, 2015, p 167.

12 *ibid*, p 24.

What is innovation?

1.16 As Engineers Australia noted, ‘innovation often begins with invention’, but innovation involves more than the invention of a new product.¹³ There are many definitions of innovation, some more complex than others. BHP Billiton sees innovation as being about ‘developing and applying new ideas and technologies to create value and stimulate growth’.¹⁴ Murdoch University submitted that innovation occurs in two broad forms, ‘the development of novel products, services and systems’ and the ‘development of incremental improvements to existing products, services and systems’.¹⁵

1.17 The Committee has adopted a broad view of what is meant by innovation for this Inquiry, using the concept as it is defined by the Organisation for Economic Co-operation and Development (OECD):

*the implementation of a new or significantly improved product (that is, a physical good or service), process, a new marketing method, or a new organisational method in business practices, workplace organisation, or external relations.*¹⁶

1.18 According to the OECD, innovations in products and processes are ‘often based on new knowledge and/or new technologies, [and] are strongly linked with research and development (R&D activities)’.¹⁷ Innovations in organisational methods and marketing usually come from ‘the adoption of new methods, concepts and/or strategies’.¹⁸

1.19 It is important to recognise that because innovation occurs in different ways it can have different impacts. It can be incremental in that it occurs as businesses gradually refine their technology, products and services. Innovation can also result in a step change such as a significant change in public policy or the way a company conducts its business.¹⁹ Where innovation leads to a new and unexpected technology, one that replaces existing technologies, it can be disruptive and create new markets.

13 Submission No. 7 from Engineers Australia, 28 August 2015, p 6.

14 Submission No. 16 from BHP Billiton Iron Ore Pty Ltd, 28 August 2015, p 2.

15 Submission No. 18 from Murdoch University, 28 August 2015, p 1.

16 Green, Roy, Marsh, Ian and Pitelis, Christos, ‘Future skills, industry policy and a new social contract’, pp 213–224 in *Australia’s future workforce?* Committee for Economic Development of Australia, Melbourne, June 2015, p 216.

17 Reillon, Vincent, *Understanding innovation*, Briefing, European Parliamentary Research Service, European Parliament, February 2016, p 2.

18 *ibid.*

19 McGagh, John, Head of Innovation, *Rio Tinto and step-change innovation*, presentation at ASEG Conference, Sydney, 23 August 2010. Available at: http://www.riotinto.com/investors/presentations-91_2427.aspx. Accessed on 12 May 2016. Rio Tinto Iron Ore stated that it has ‘many areas in which step change technology can be applied in order to create the mine-of-the-future™’, and that company investments in innovation aim to

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1.20 Whether it is incremental, step change or disruptive, successful innovation is innovation that drives productivity.²⁰ In WA, successful innovation will achieve this through stimulating high-level, high-value employment that leverages off areas in which the state has a comparative advantage. The state's economic growth depends upon the ability to develop and embrace changes in technology and service provision to add value to our existing industries and resources.

The importance of this Inquiry

1.21 While Australia is recognised as having a strong history of research and technological advancement, our track record in innovation does not compare favourably to our economic peers. In terms of 'innovation efficiency', Australia's global ranking of 72nd was well below that of countries such as Switzerland, the Netherlands, Ireland, Sweden and the United Kingdom. Again, despite the level of resources allocated in pursuit of innovation, Australia does relatively poorly at turning those allocated resources into outcomes.²¹

1.22 When successful, innovation can produce economic growth and prosperity. The pursuit of innovation, however, carries a level of inherent risk. It requires a prospective investment in R&D with no guarantee of success. Furthermore, innovation fundamentally involves questioning an accepted method. This can be difficult in WA where, for example, the success of projects like the North West Shelf gas export plant or the various iron ore mines in the Hamersley Range reflects the ability of mine operators to achieve significant economies of scale in production. While economies of scale are an important element of competitive advantage in many industries, their achievement can also remove the incentive to look for a new way of doing things.²²

1.23 Nevertheless, WA is home to many innovative firms and has been the birthplace of numerous innovations, with recent examples including the fleet of driverless trucks on

capture shareholder value 'through the introduction of the step change technologies; this is the driving rationale behind our mine-of-the-futureTM'.

20 Green, Roy, Marsh, Ian and Pitelis, Christos, 'Future skills, industry policy and a new social contract', pp 213–224 in *Australia's future workforce?* Committee for Economic Development of Australia, Melbourne, June 2015, p 216. As Green, Marsh and Pitelis note, innovation does not always drive productivity. For example, financial innovations such as derivatives were unproductive.

21 Cornell University, INSEAD, and WIPO, *The global innovation index 2015: Effective innovation policies for development*, Fontainebleau, Ithaca, and Geneva, 2015, p 24.

22 Porter, Michael E, *The comparative advantage of nations*, Macmillan, London, 1990, pp 48–49.

Rio Tinto's Hope Downs 4 mine site,²³ and Woodside's remote-controlled *Angel* production platform within the North West Shelf LNG project.²⁴

1.24 With all the above points in mind, on 24 June 2015 the Committee resolved to undertake this Inquiry with the broad aim of identifying mechanisms by which innovation might successfully be encouraged in this state. This Inquiry focuses on the agriculture and food, mining and energy and advanced manufacturing sectors of the state economy, and considers:

- what drives innovation;
- collaboration between government, universities and business;
- how research can lead to the development of new products, services and jobs;
- the challenges associated with financing and commercialising new technologies, products and services; and
- models of development by which technological and service innovation could be encouraged in Western Australia.

The Committee

1.25 The Economics and Industry Standing Committee (the Committee) is a portfolio-related Committee of the Legislative Assembly of the Parliament of Western Australia. The Committee was appointed on 9 May 2013.

1.26 Pursuant to the Legislative Assembly's Standing Order 287(3) the Speaker determined that the Committee would have the portfolio responsibilities of: State Development, Mines and Petroleum, Fisheries, Regional Development, Lands, Tourism, Transport, Commerce, Science, Housing, Racing and Gaming, Planning, Energy, Water, Heritage, Agriculture and Food, Forestry and Small Business.²⁵

Conduct of this Inquiry

1.27 After resolving to conduct this Inquiry and informing the Speaker of the Legislative Assembly accordingly, the Committee began by placing advertisements outlining the Inquiry and calling for public submissions. Advertisements were placed in:

- *The West Australian* on 4 July 2015;
- *WA Business News* on 13 July 2015; and
- *Farm Weekly* on 9 July 2015.

23 Ker, Peter, 'Rio Tinto pushes ahead with driverless trains in Pilbara', *The Sydney Morning Herald*, 10 March 2015. Available at: <http://www.smh.com.au/business/mining-and-resources/rio-tinto-pushes-ahead-with-driverless-trains-in-pilbara-20150309-13z28v.html>. Accessed on 4 August 2015.

24 Woodside, *Angel delivers on promise and plan*, November 2009. Available at: <http://www.woodside.com.au/Working-Sustainably/Documents/FACT%20SHEET%20-%20Angel.pdf>. Accessed on 4 September 2015.

25 Hon Michael Sutherland, MLA, Speaker of the Legislative Assembly, Western Australia, Western Australia, *Parliamentary Debates* (Hansard), 16 April 2013, p 36.

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- 1.28 To ensure that the Inquiry attracted the attention of a broad range of interested parties, a media release was issued on 25 June 2015. The Committee also invited submissions from specific state government agencies, professional associations (including trade unions and industry groups), universities and major corporations with business interests in WA. A total of 46 submissions was received.²⁶
- 1.29 The Committee also conducted documentary research, received 58 briefings and held 30 formal evidence public hearings.²⁷ The Committee issued media releases for the public hearings and notice of these was placed on the Parliament's web site. Subsequent transcripts of the hearings were made available by the same means.
- 1.30 The Committee also undertook investigative travel to Adelaide, Melbourne, Sydney and Brisbane in October/November 2015, where it received briefings from a total of fifty-nine relevant persons, representing a total of nineteen separate entities.²⁸ The Chairman of the Committee also travelled to the United Kingdom and Israel where he received briefings from a number of universities, government agencies and businesses. The Committee also drew upon its travel to the United Kingdom, the Netherlands and Norway, which was undertaken for its work on the impact of floating LNG on the Western Australian economy and the safety of floating LNG facilities operating off the Western Australian coast.
- 1.31 In addition to its interstate travel, the Committee undertook a number of site visits in and around Perth.²⁹ The purpose of the Committee's travel and site visits was to allow members to better understand the work that is being done in research and development, in the commercialisation of that work and the different approaches taken by research organisations, industry and governments in WA and in other jurisdictions. These provided the Committee with an insight into the main challenges faced in achieving successful innovation outcomes and some of the ways in which others are meeting those challenges.

Report structure

- 1.32 As the Committee focused on the agriculture and food, mining and energy, and advanced manufacturing sectors, Chapter Two provides a brief overview of the Western Australian economy and provides information on each of these three sectors. Following that, the concept of an innovation ecosystem is introduced. The balance of the report is then structured around various key elements of a WA innovation ecosystem such as research institutions, leadership, commercialisation, collaboration, and government as an agent of innovation.

26 Submissions to the Inquiry are listed in Appendix Three.

27 A list of hearings and witnesses is provided in Appendix Four.

28 A list of these briefings is contained in Appendix Five. These 19 briefings are included in the total of 58 for the whole Inquiry.

29 These site visits are also included in Appendix Five.

1.33 The evidence to this Inquiry revealed a common purpose among stakeholders—the desire to find ways to encourage technological and service innovation in WA and, in turn, diversify the state’s economy and provide high-level employment. There was little disagreement in the evidence presented; rather, there was considerable commonality in ideas and proposed solutions. The evidence also revealed the enormous amount of collaborative projects being undertaken in WA. In light of this, the Committee decided to quote only a small sample of the evidence in relation to each issue. This in no way diminishes the importance of the evidence not directly referred to as it was an important factor in the Committee’s consideration of the issues, and provided much of the foundation on which the report’s findings and recommendations are made. The Committee appreciates the assistance of those who contributed to this Inquiry.

Chapter 2

The Western Australian Economy

Introduction

- 2.1 Over the past decade, Western Australia's (WA's) economy has grown substantially, largely as a result of activity within the resources sector. As a result, WA—which is home to about 11 per cent of the national population—contributed about 15.5 per cent of Australia's 2014–2015 Gross Domestic Product, compared to 11 per cent in 2004–2005.³⁰ This reliance upon mining and petroleum production has, however, seen the performance of the state's economy largely become a function of global demand for mineral and energy commodities. As these commodities are often subject to significant fluctuations in demand and price, so too is the WA economy.
- 2.2 Together, these facts have provided the impetus for this Inquiry into ways in which technological and service innovation can be fostered to diversify the state's economy. They are also the reason why the Committee has focused on the agriculture and food, mining and energy, and advanced manufacturing sectors.
- 2.3 Given this, it is useful to provide some context for the discussion contained in this report. This chapter presents a brief overview of the Western Australian economy in general, and the three sectors focussed on in this report in particular.

The structure of the Western Australian economy

- 2.4 WA has an export-oriented economy, dominated by the mining and petroleum sector.³¹ The WA resources sector accounted for 90 per cent of the state's and 48 per cent of Australia's merchandise exports for 2013–2014.³² Consequently, the structure of the state's economy is, in large part, dominated by the resources sector.
- 2.5 On the back of the resources sector's strong contribution, WA's gross state product grew at an annual average rate of 4.9 per cent for a decade, to a record \$265 billion in

30 Department of State Development, *Economic profile*, July 2015. Available at: <http://www.dsd.wa.gov.au/about-the-state/quality-of-life/economic-profile>. Accessed on 26 August 2015.

31 *ibid*; Department of Mines and Petroleum, *Western Australia's resources industry fact sheet*, p 1. Available at: http://www.dmp.wa.gov.au/documents/Factsheets/143390_Resource_Industry_Fact_Sheet_2014_proof3.pdf. Accessed on 26 August 2015.

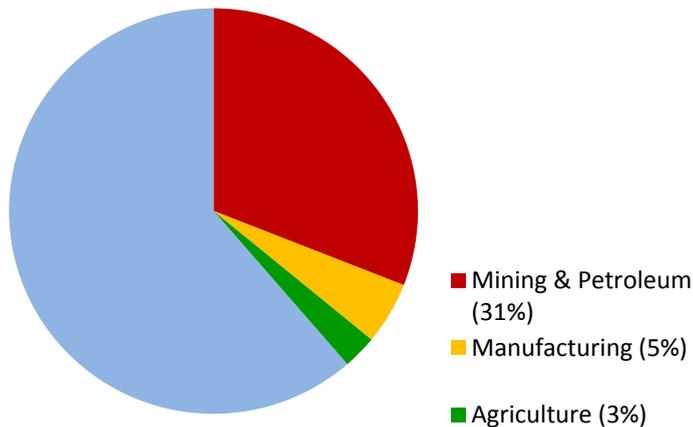
32 Department of Mines and Petroleum, *Western Australia's resources industry fact sheet*.

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2013–2014.³³ One consequence of this strong growth was that it tended to overshadow the extent to which the state had come to rely upon that one sector as ‘the backbone of our economy’.³⁴

2.6 Mining and petroleum generated \$79 billion worth of production in 2013–2014, accounting for some 31 per cent of WA’s total economic output.³⁵ It is by far the state’s largest single industry sector, with the second largest sector, the construction industry, contributing 13 per cent. The construction industry, though, was largely driven by mining and petroleum industry activity.³⁶ The importance of the resources sector in Western Australian is underscored by Figure 1.1 below, which illustrates the proportion of economic output contributed by that sector.

Figure 1.1: Western Australia’s economic output by industry, 2013–2014³⁷



33 Department of State Development, *Western Australia economic profile*, July 2015, p 1. Available at: <http://www.dsd.wa.gov.au/docs/default-source/default-document-library/wa-economic-profile-july-2015?sfvrsn=4>. Accessed on 25 August 2015.

34 Department of Mines and Petroleum, *Why should I care about the mining industry?* 23 October 2014. Available at: <http://www.dmp.wa.gov.au/9771.aspx>. Accessed on 26 August 2015.

35 The Australian Bureau of Statistics, *Australian national accounts: State accounts. Table 6. Expenditure, income and industry components of Gross State Product, Western Australia, chain volume measures and current prices* (Cat. No. 5220.0), 21 November 2014; and Department of Treasury, *The structure of the Western Australian economy*, May 2014, p 4. Available at: http://www.treasury.wa.gov.au/uploadedFiles/_Treasury/Publications/2014_Structure_of_the_Economy.pdf. Accessed on 25 August 2015.

36 *ibid*, p 4.

37 Data obtained from the Australian Bureau of Statistics, *Australian national accounts: State accounts. Table 6. Expenditure, income and industry components of Gross State Product, Western Australia, chain volume measures and current prices* (Cat. No. 5220.0). 21 November 2014. Data represented is industry gross value added at current prices.

- 2.7 Manufacturing accounted for about 5 per cent of the state's economic output and agriculture about 2.6 per cent. While both sectors contribute a relatively small proportion of the state's total economic output, their importance is greater than their contribution to gross state product.
- 2.8 WA's current economic circumstances reinforce the need to add value through innovation. Innovation provides an important opportunity to take advantage of the knowledge and skills gained through the development of the state's existing economic resources to diversify the economy and, thus, become less reliant on the performance of any individual sector.

Comparative advantage is key

- 2.9 Post World War Two, the significant growth in international trade has both allowed and required nations around the world to specialise in producing the goods and services best derived from their natural resources. In this context, innovation that increases productivity and adds further value to areas of existing strength is increasingly important. Given this, programs aimed at stimulating innovation in WA should target the state's areas of economic and strategic strength. This Inquiry has focussed on the mining and energy, agriculture and food, and advanced manufacturing sectors. In addition to being sectors in which WA is already strong, these align with WA's *Science statement*³⁸ and with the federal government's *Industry Growth Centre* initiative.³⁹ In short, these sectors are important today—and they are each recognised as having significant strategic value to the state well into the future. It is therefore useful to begin by considering the present status of each sector, both to demonstrate WA's strength in these areas and to appreciate their importance.

Mining and energy

- 2.10 WA's economic success is directly linked to the performance of the resources sector. In 2013–2014, WA's mining industry represented 31 per cent of the state's \$265 billion Gross State Product, and about 5 per cent of the Australian Gross Domestic Product.⁴⁰
- 2.11 This productivity is a direct function of the global demand for commodities. Chinese demand for Western Australian resources (especially iron ore) has been a key driver of

38 Department of Premier and Cabinet, *Science statement*, 21 April 2015. Available at: <https://www.dpc.wa.gov.au/science/ScienceStatement/Pages/default.aspx>. Accessed on 7 July 2015.

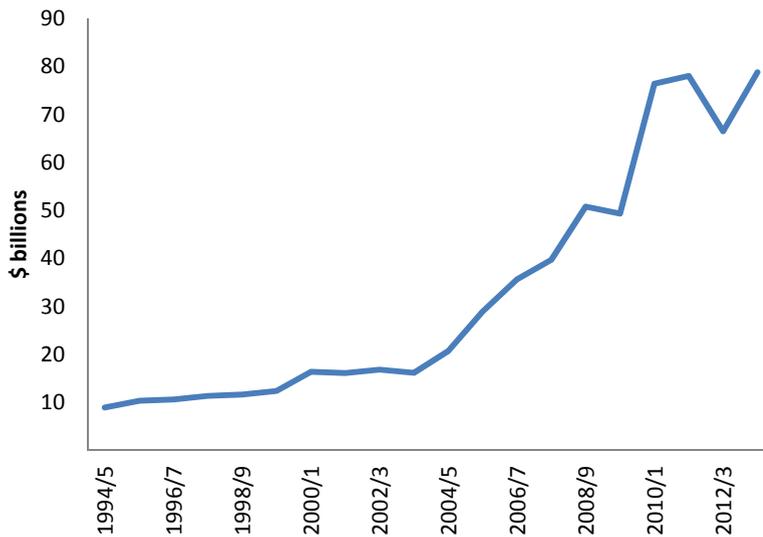
39 Department of Industry and Science, *Industry growth centres*. Available at: <http://www.business.gov.au/advice-and-support/IndustryGrowthCentres/Pages/default.aspx>. Accessed on 7 July 2015.

40 The Australian Bureau of Statistics, *Australian national accounts: State accounts. Table 6. Expenditure, income and industry components of Gross State Product, Western Australia, chain volume measures and current prices* (Cat. No. 5220.0).

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the state's economy for the past decade.⁴¹ Growth in resource sector production has been even more significant, as the value of resources produced in WA has grown by an average 14 per cent annually since 2004–2005, reaching a record \$121.6 billion for 2013–2014.⁴² The growth in gross value added to the state economy by the mining industry is illustrated in Figure 2.3 below:

Figure 2.3: Western Australian mining industry gross value added (current prices) 1994/5–2013/4⁴³



2.12 WA is one of the world's leading producers of minerals and petroleum, with the state's production of iron ore leading the way. In 2013–2014, iron ore accounted for more than 60 per cent of Western Australian resource production, with mines around the state producing a total of 630 million tonnes—or \$73.6 billion worth—of the commodity.⁴⁴ Petroleum production was also significant, with some \$26.5 billion of petroleum products being sold in 2013–2014.⁴⁵ Substantial and valuable quantities of gold (\$8.8 billion), alumina (\$4.3 billion) and nickel (\$3.5 billion) were also produced in WA.⁴⁶

2.13 In addition to iron ore, the WA mining industry produces significant volumes of many other commodities. Figure 2.4 shows the value of production of the state's major

41 Department of State Development, *Western Australia economic profile—December 2014*, December 2014, p 1. Available at: http://www.dsd.wa.gov.au/docs/default-source/default-document-library/wa_economic_profile_1214.pdf?sfvrsn=14. Accessed on 10 July 2015.

42 Department of Mines and Petroleum, *Quantity and value of minerals and petroleum 2013–2014*. Available at: <http://www.dmp.wa.gov.au/1521.aspx>. Accessed on 8 July 2015.

43 The Australian Bureau of Statistics, *Australian national accounts: State accounts. Table 6. Expenditure, income and industry components of Gross State Product, Western Australia, chain volume measures and current prices* (Cat. No. 5220.0).

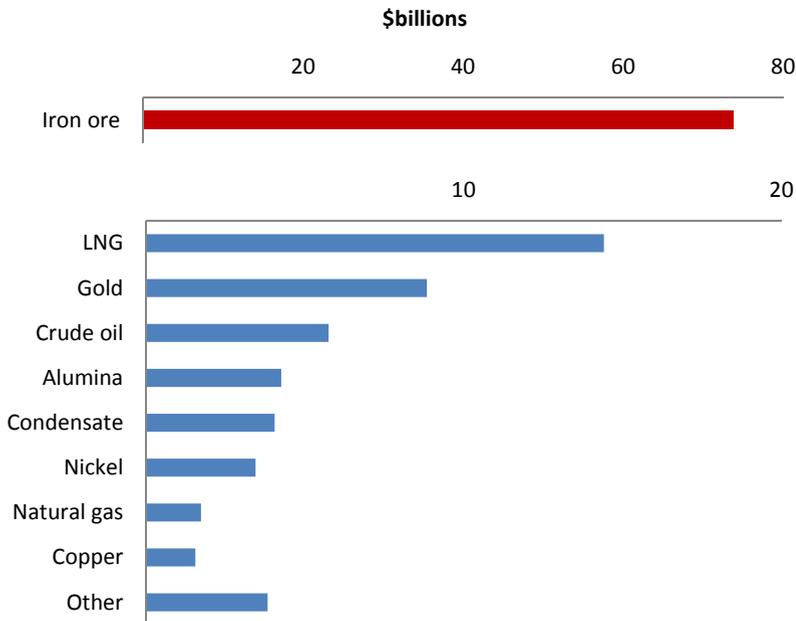
44 Department of Mines and Petroleum, *Quantity and value of minerals and petroleum 2013–2014*.

45 *ibid.*

46 *ibid.*

resources. In addition to those commodities, WA also produces LPG, salt, diamonds, coal, aggregate, lead metal, cobalt, tin, zinc, zircon, silver, sand plus other minerals.

Figure 2.4: Value of production of major resource commodities in Western Australia, 2013–2014⁴⁷



2.14 The sale of resources produced in WA provides a significant injection of capital into the Western Australian economy. The state's resources sector is also a major source of direct employment. A total of 108,975 workers were directly employed in mining operations in WA in 2013–2014,⁴⁸ receiving wages and salaries of some \$13.6 billion.⁴⁹ This figure, however, does not include the large number of workers employed for the past several years in constructing the various resources projects that are nearing completion (including the Gorgon and Wheatstone LNG plants, and the Roy Hill and Sino Iron Ore mines), or the large number of manufacturing workers whose output has long been a critical element of the state's mining success.

2.15 Table 2.1 provides data on employment in the state's mining industry by subsector.

47 *ibid.*

48 Department of Mines and Petroleum, *Western Australia's resources industry*, p 1. Available at: http://www.dmp.wa.gov.au/documents/Factsheets/143390_Resource_Industry_Fact_Sheet_2014_proof3.pdf. Accessed on 14 July 2015.

49 The Australian Bureau of Statistics, *Australian national accounts: State accounts. Table 6. Expenditure, income and industry components of Gross State Product, Western Australia, chain volume measures and current prices* (Cat. No. 5220.0).

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Table 2.1: WA mining employment by subsector⁵⁰

Mining	Total employment		% change
	2014–2015	2009–2010	
Coal mining	1,012	1,066	-5.07%
Oil & gas extraction	12,409	9,163	35.43%
Metal ore mining	54,472	38,723	40.67%
Non-metallic mining & quarrying	3,962	3,219	23.08%
Exploration & mining support services	21,361	17,337	23.21%
Mining sector total	93,216	69,507	34.11%

- 2.16 At its peak during the August 2012 quarter, WA's mining sector directly employed a total of 122,800 people. Although mining sector employment has declined, mining remains the largest single source of direct employment in WA, employing 102,200 people in the February 2016 quarter.⁵¹
- 2.17 Though it is difficult to precisely quantify, the economic activity associated with mining and petroleum industry production also generates significant indirect employment in WA.
- 2.18 The Committee acknowledges that it has not examined renewable energy in this report and considers that this important issue warrants a stand-alone Inquiry.

Agriculture and food

- 2.19 WA is and has long been a major agricultural producer and exporter. In 2013–2014 the gross value of the state's agricultural production was in the order of \$6.9 billion⁵²—a figure that represented almost 18.5 per cent of Australia's total \$37.3 billion of value added through agricultural production,⁵³ and about 2.6 per cent of WA's \$265 billion

50 Developed from an industry sector analysis data from the City of Gosnells web site. Available at: <http://economy.id.com.au/gosnells/industry-sector-analysis?IndkeyNieir=23001>. Accessed on 16 June 2016.

51 The Australian Bureau of Statistics, *Labour force, Australia, detailed, quarterly. Table 5. Employed persons by state, Territory and industry division of main job (ANZSIC)* (Cat. No. 6291.0.55.003).

52 The Australian Bureau of Statistics, *Australian national accounts: State accounts. Table 6. Expenditure, income and industry components of Gross State Product, Western Australia, chain volume measures and current prices* (Cat. No. 5220.0).

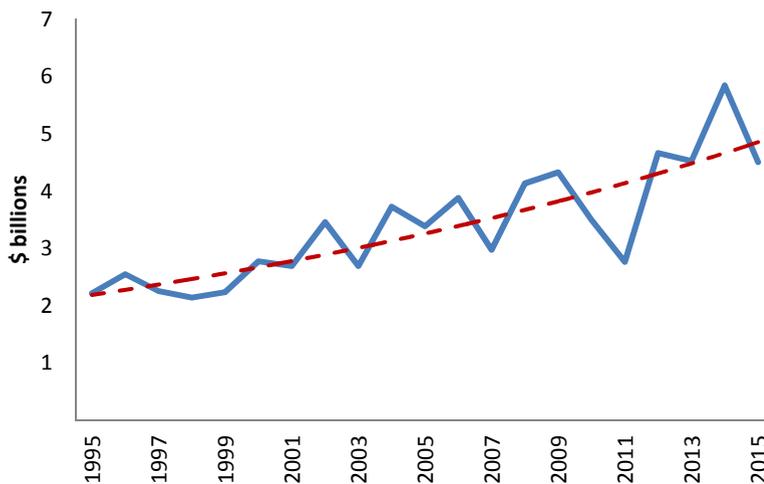
53 The Australian Bureau of Statistics, *Australian system of national accounts: gross value added (GVA) by industry* (Cat. No. 5204.0).

Gross State Product.⁵⁴ Significantly, this \$6.9 billion represented a 64 per cent increase from the \$4.2 billion generated in 2012–2013.⁵⁵

2.20

While agricultural production has been a fundamental component of the Western Australian economy for some time, it has become increasingly important in the twenty-first century as exports to key trading partners have grown. This is underscored by the steady growth in the gross value added to the economy by Western Australian agricultural production over the past two decades, which is illustrated in Figure 2.6 below.

Figure 2.6: Gross value added through agriculture, forestry and fishing, 1995–2015⁵⁶



2.21

With an abundance of available land, and as a reliable supplier of safe, high-quality products, WA's agricultural sector 'is well placed to offer premium products that are sustainably and ethically produced, of known provenance and exceptional quality'.⁵⁷ Indeed, WA is known globally to be 'one of the most pest-free and disease-free agricultural production areas in the world'.⁵⁸ This reputation—maintained through strict quarantine and regulatory requirements—provides the state's agricultural sector with numerous export opportunities, and as a consequence agriculture is the state's second

54 Department of State Development, *Western Australia economic profile—December 2014*, December 2014, p 1. Available at: http://www.dsd.wa.gov.au/docs/default-source/default-document-library/wa_economic_profile_1214.pdf?sfvrsn=14. Accessed on 10 July 2015.

55 The Australian Bureau of Statistics, *Australian national accounts: State accounts. Table 6. Expenditure, income and industry components of Gross State Product, Western Australia, chain volume measures and current prices* (Cat. No. 5220.0).

56 *ibid.*

57 Department of Agriculture and Food, *Western Australia's agriculture and food sector*, 5 May 2015. Available at: <https://www.agric.wa.gov.au/western-australias-agriculture-and-food-sector>. Accessed on 15 July 2015.

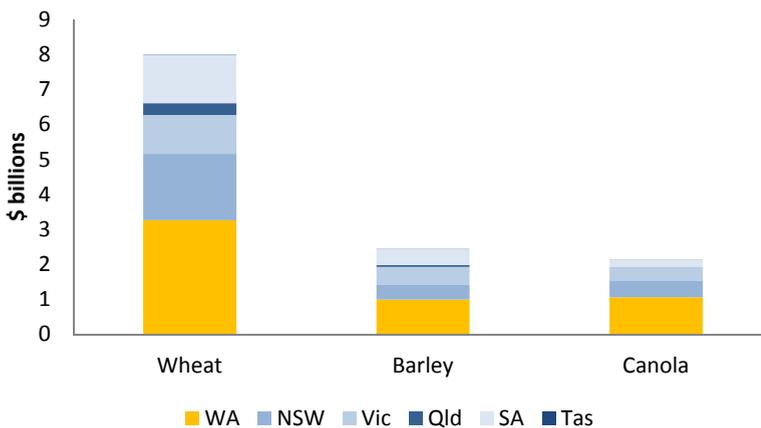
58 *ibid.*

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major export industry.⁵⁹ Indeed, up to 80 per cent of Western Australian agricultural production is exported, 'including 92 per cent of total crop production and 73 per cent of livestock production'.⁶⁰ For the past ten years, about 70 per cent of these exports have been destined for Asia, with China, Indonesia and Vietnam the largest markets. As WA's Department of Agriculture and Food (DAFWA) suggests, the state is thus well-placed to benefit from growing demand for premium products in this region.⁶¹

2.22 WA is by some distance the nation's leading producer of the principle export crops of wheat, barley and canola. This is illustrated in Figure 2.7 below:

Figure 2.7: Value of wheat, barley and canola production in Australia, 2013–2014 (by state)⁶²



2.23 While these three crops dominate agricultural production in WA, production by the sector as a whole is quite diverse. Ordered by value, wheat (\$3.2 billion), canola (\$1,061 million) and barley (\$998 million) are the state's top commodities, with significant quantities of wool (\$582 million), cattle (\$579 million) and lamb (\$410 million) are also produced, along with a wide range of other products.⁶³ The value of key agricultural commodity production is illustrated in Figure 2.8 below:

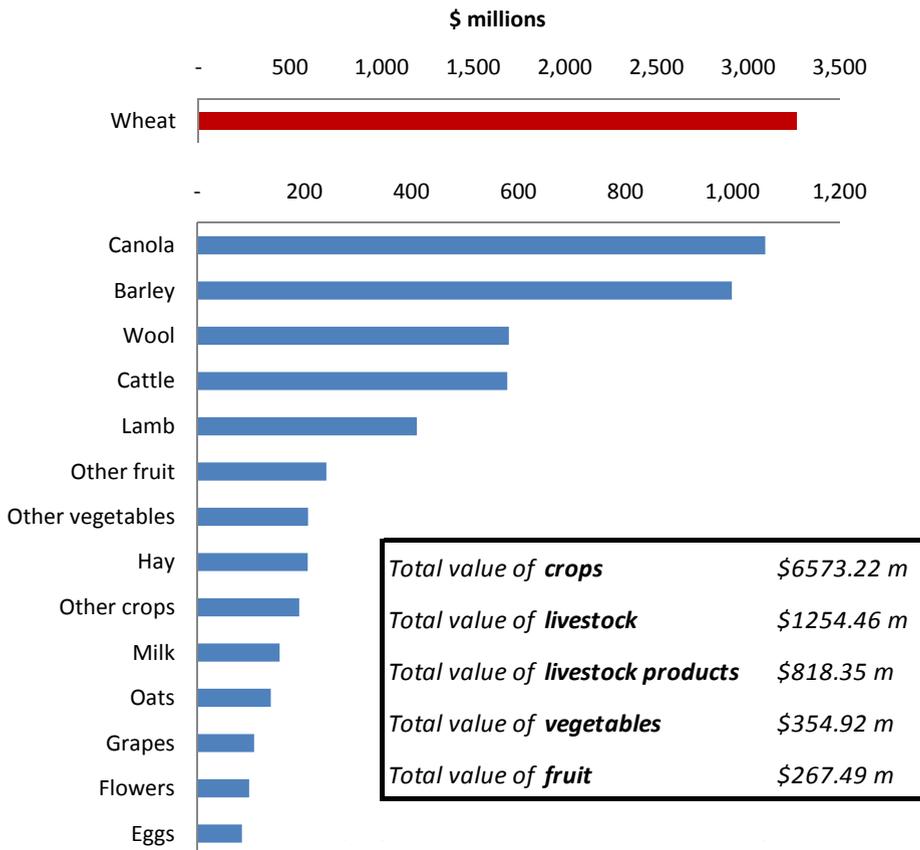
59 *ibid.*

60 *ibid.*

61 Department of Agriculture and Food, *Western Australia's agriculture and food sector*, 5 May 2015.

62 The Australian Bureau of Statistics, *Value of agricultural commodities produced, Australia, states and territories 2013–14* (Cat. No. 75030DO001_201314).

63 *ibid.*

Figure 2.8: Value of key agricultural commodities produced in Western Australia, 2013–2014⁶⁴

2.24 The strengths of WA's key areas of agricultural production is also reflected in the Grains Industry National Research, Development and Extension Strategy. Under this strategy, WA 'was to take the lead in grains and wool'.⁶⁵ According to DAFWA:

*Western Australia was chosen to co-lead the strategy with GRDC because grains is our biggest and most important economic sector. We as a state had the biggest stake in making sure that our strategy performed very well.*⁶⁶

2.25 Agriculture is also a significant source of employment in WA, providing jobs for 28,325 of the state's 1.39 million workers⁶⁷ (predominantly in regional areas) and generating

64 The Australian Bureau of Statistics, *Value of agricultural commodities produced, Australia, states and territories 2013–14* (Cat. No. 75030DO001_201314).

65 Dr Mark Sweetingham, Executive Director, Grains Research and Development, Department of Agriculture and Food, *Transcript of Evidence*, 24 February 2016, p 2.

66 *ibid.*

67 Department of State Development, *Western Australia economic profile—December 2014*, December 2014, pp 2–3. Available at: http://www.dsd.wa.gov.au/docs/default-source/default-document-library/wa_economic_profile_1214.pdf?sfvrsn=14. Accessed on 10 July 2015.

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total worker compensation of some \$641 million.⁶⁸ As such, agriculture ‘continues to be the lifeblood of rural and regional communities’.⁶⁹

2.26 Employment data for the agriculture, forestry and fishing sector by subsector, as provided in Table 2.2, shows an increase in employment in agriculture from 2009–2010 to 2014–2015 of around seven per cent.

Table 2.2: Western Australian agriculture, forestry and fishing employment by subsector⁷⁰

Agriculture, Forestry and Fishing	Total Employment		% change
	2014–2015	2009–2010	
Agriculture	28,534	26,604	7.25%
Aquaculture	238	270	-11.85%
Forestry & logging	807	744	8.47%
Fishing, hunting & trapping	972	1,047	-7.16%
Support services	1,904	1,967	-3.20%
Agricultural sector total	32454	30632	5.95%

Manufacturing

2.27 Manufacturing is defined by the Commonwealth Government as ‘the physical or chemical transformation of materials into new products’.⁷¹ WA’s manufacturing sector produces a vast array of different goods, from fabricated metal products and petroleum, to fertilizer and milk. Like mining and agriculture, manufacturing is a significant component of WA’s economy. In 2014–2015 manufacturers in WA added a total of almost \$12.5 billion to the state economy, accounting for 5 per cent of Gross State Product.⁷² This was the fifth largest contribution of any sector, behind mining (\$63.5 billion), construction (\$32.9 billion), real estate (\$19.1 billion) and health care

68 The Australian Bureau of Statistics, *Australian national accounts: State accounts. Table 6. Expenditure, income and industry components of Gross State Product, Western Australia, chain volume measures and current prices* (Cat. No. 5220.0).

69 Department of Agriculture and Food, *Western Australia’s agriculture and food sector*, 5 May 2015. Available at: <https://www.agric.wa.gov.au/western-australias-agriculture-and-food-sector>. Accessed on 15 July 2015.

70 Developed from industry sector analysis data generated by the City of Gosnells. Available at: <http://economy.id.com.au/gosnells/industry-sector-analysis?IndkeyNieir=23001>. Accessed on 16 June 2016.

71 Department of Industry, Innovation and Science, *Manufacturing definition*. Available at: <http://www.business.gov.au/grants-and-assistance/closed-programs/CleanTechnology/CleanTechnologyInvestment/CTIPEligibility/Pages/ManufacturingDefinitionFactSheet.aspx>. Accessed on 14 April 2016.

72 The Australian Bureau of Statistics, *Australian national accounts: State accounts. Table 6. Expenditure, income and industry components of Gross State Product, Western Australia, chain volume measures and current prices* (Cat. No. 5220.0).

(\$12.7 billion).⁷³ It also represented 12.3 per cent of Australia's total \$103 billion in manufacturing production.⁷⁴

2.28 Though the sector as a whole continues to make an important contribution to the nation's economy, Australian manufacturers have faced numerous challenges over the past 50 years as the economy has transformed. While the manufacturing industry was able to produce almost \$103 billion worth of goods in 2014–2015 and rank as Australia's sixth-largest sector,⁷⁵ manufacturing has not kept pace with growth in the remainder of the economy. This has resulted in its share of GDP dropping from about 25 per cent during the 1960s to the current contribution of about 6.4 per cent—the lowest level in recorded history.⁷⁶

2.29 Western Australian manufacturers have, however, largely bucked the recent national trend. Based on Productivity Commission data, WA's manufacturing sector has grown at an average rate of 4.8 per cent per year over the past decade, against the national sector's average of 0.4 per cent per year.⁷⁷ Furthermore, Australian Bureau of Statistics (ABS) data shows that after five consecutive years of positive growth in the value of their output, Western Australian manufacturers have almost reached the record levels of output achieved immediately prior to the Global Financial Crisis of 2008.⁷⁸ The contrasting performances of the state and national manufacturing sectors over the past decade are illustrated in Figure 2.9 below:

73 *ibid.*

74 The Australian Bureau of Statistics, *Australian system of national accounts: Gross value added (GVA) by industry* (Cat. No. 5204.0).

75 *ibid.*

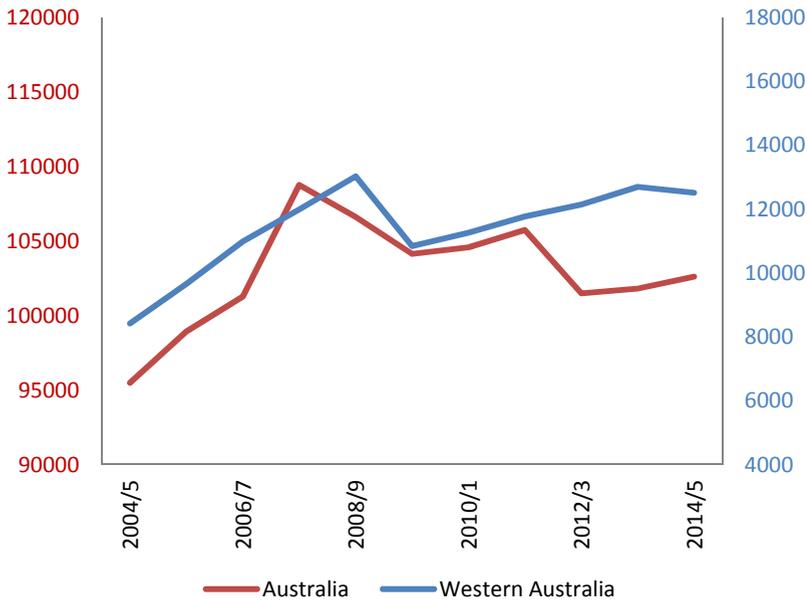
76 Productivity Commission, *Trends in Australian manufacturing*, 28 August 2003. Available at: <http://www.pc.gov.au/research/completed/manufacturing/tiam.pdf>. Accessed on 19 July 2015.

77 Chamber of Commerce and Industry of Western Australia (Inc), *WA's manufacturing industry at a glance*. Available at: <http://cciwa.com/docs/default-source/membership/membership-manufacturing-flyer-april-2015.pdf?sfvrsn=2>. Accessed on 24 July 2015.

78 The Australian Bureau of Statistics, *Australian national accounts: State accounts. Table 6. Expenditure, income and industry components of Gross State Product, Western Australia, chain volume measures and current prices* (Cat. No. 5220.0).

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Figure 2.9: Gross value added by the manufacturing sector, 2004–2005—2014–2015 (current prices)⁷⁹



2.30 In 2013–2014, WA’s manufacturing sector employed a total of 91,150 people, making it the state’s seventh largest source of direct employment. These workers received total earnings of \$7.7 billion. More recently, employment in the manufacturing sector appears to have fallen away significantly, with figures for the February 2016 quarter indicating that 71,100 workers were employed in the manufacturing sector—down from 78,300 in the November 2015 quarter and by some 21 per cent in the twelve months from February 2015.⁸⁰

2.31 The employment data for each of the mining and energy, agriculture and food, and manufacturing sectors would be much more useful if it were more specific and more robust. While knowing that 71,100 people were employed in the manufacturing sector in the February 2016 quarter, for example, is useful, it is important to recognise that the manufacturing sector is made up of a broad array of industry sub-divisions, such as food production, chemical processing, metal fabrication and shipbuilding. The currently available data makes it effectively impossible to identify which areas within the manufacturing sector in WA are areas of strength in terms of employment and productivity per worker. Data of this nature would allow government to emphasise and promote the strengths of the WA economy supported by hard evidence.

79 The Australian Bureau of Statistics, *Australian national accounts: State accounts. Table 6. Expenditure, income and industry components of Gross State Product, Western Australia, chain volume measures and current prices* (Cat. No. 5220.0); and The Australian Bureau of Statistics, *Australian system of national accounts: Gross value added (GVA) by industry* (Cat. No. 5204.0).

80 The Australian Bureau of Statistics, *Labour Force, Australia, Detailed, Quarterly. Table 5. Employed persons by state, Territory and industry division of main job (ANZSIC)* (Cat. No. 6291.0.55.003).

- 2.32 In addition, industry representatives have expressed frustration at some of the methodologies used by the ABS to collect data, arguing that the survey methodology results in published statistics that can be misrepresentative. While compiling statistical data is challenging, more sources of data, particularly for business operations as compiled by the Australian Taxation Office, could be drawn together with survey responses to offer more reliable industry statistics.
- 2.33 The WA Government could obtain more robust and specific data through the analysis of sources such as the Australian Business Register. This would better highlight specific strengths within the WA economy, aid policy formation and enable better future planning. In WA, impressive efforts are being made by some local governments in the realm of data collection and forecasting—the state government would do well to follow this lead. For example, see industry sector data generation and analysis conducted by the City of Gosnells.⁸¹
- 2.34 Data compiled by the City of Gosnells from the manufacturing sector, by subsector, is provided in Table 2.3.

Table 2.3: WA manufacturing sector employment by subsector⁸²

Manufacturing	Total Employment		% change
	2014–2015	2009–2010	
Food products	14,325	13,229	8.28%
Beverage & tobacco products	4,414	3,805	16.01%
Textiles, leather, clothing & footwear	3,105	3,628	-14.42%
Wood products	5,135	4,892	4.97%
Pulp & paper products	995	1,145	-13.10%
Printing	3,359	3,518	-4.52%
Petroleum & coal products	1,271	1,169	8.73%
Basic chemicals & chemical products	6,023	6,239	-3.46%
Polymer products & rubber products	3,925	3,841	2.19%
Non-metallic mineral products	7,127	6,439	10.68%
Primary metal & metal products	18,485	17,565	5.24%
Fabricated metal products	11,100	10,797	2.81%
Transport equipment	8,882	7,856	13.06%
Machinery & equipment	16,422	13,849	18.58%
Furniture & other manufacturing	5,392	5,747	-6.18%
Manufacturing sector total	109,958	103,720	6.01%

81 City of Gosnells, *Industry sector analysis*, nd, np. Available at: <http://economy.id.com.au/gosnells/industry-sector-analysis?IndkeyNieir=23001>. Accessed on 16 June 2016.

82 Developed from an industry sector analysis data from the City of Gosnells web site.

Chapter 2

Finding 1

Obtaining accurate and comprehensive statistics on employment in the various sectors of the Western Australian economy is currently very difficult.

Recommendation 1

The Western Australian Government improves its data collection by drawing on the various available sources to better inform decision-making for industry support and investment.

- 2.35 UnionsWA expressed concern about the future of manufacturing sector works, but also recognised opportunities that might be generated through innovation. As Mr Owen Whittle, UnionsWA’s Assistant Secretary, stated:

*in particular, manufacturing in Western Australia has suffered at some time at the hand of a strong Australian dollar and other elements like rising electricity costs and many other things, but as some of those adverse factors I suppose are receding in those industries, they really are ripe for significant innovation, which really could provide many jobs into the future in those industries.*⁸³

- 2.36 Furthermore, UnionsWA ‘are really keen to ensure that our local manufacturing industry can innovate to ensure it can enter the supply chains of local industries, such as oil and gas, agriculture and mining, but also hopefully into the future break into those global supply chains in those industries’.⁸⁴

83 Mr Owen Whittle, Assistant Secretary, UnionsWA, *Transcript of Evidence*, 24 February 2016, p 2.

84 *ibid.*

Chapter 3

A Strong, Healthy Innovation Ecosystem is Essential

3.1 In thinking about how to foster technological and service innovation in Western Australia (WA), it is useful to think in terms of an innovation ecosystem and how a strong and healthy innovation ecosystem might be developed and maintained to expand and diversify the state's economy.

What is an innovation ecosystem?

3.2 In this report the term *innovation ecosystem* is used to describe the public and private agents and entities, and their structures, processes and interrelationships as they function together as an economic unit.

3.3 In an innovation ecosystem:

- **agents** include government agencies, universities, businesses, industry–university research institutions, investors, industry and labour representative bodies, economic development and business assistance organisations and other related entities, and their policies, regulations and standards;
- **resources** include funding, infrastructure, facilities and equipment; and
- **human capital** includes university, industry and government researchers, university students and staff, business employees, consultants and others who contribute their knowledge, ideas, skills and expertise.⁸⁵

3.4 An innovation ecosystem is made up of 'two distinct, but largely separated economies, the knowledge economy, which is driven by fundamental research, and the commercial economy, which is driven by the marketplace'.⁸⁶ The knowledge and commercial economies, though, are not entirely separate as the resources that drive the knowledge economy come from the commercial sector, including government funding and tax incentives.⁸⁷

85 Jackson, Deborah J, 'What is an innovation Ecosystem?', National Science Foundation, Arlington, VA, nd, p 2; and Reillon, Vincent, *Understanding innovation*, Briefing, European Parliamentary Research Service, European Parliament, February 2016, p 4.

86 Jackson, Deborah J, 'What is an innovation Ecosystem?', National Science Foundation, Arlington, VA, nd, p 2.

87 *ibid.*

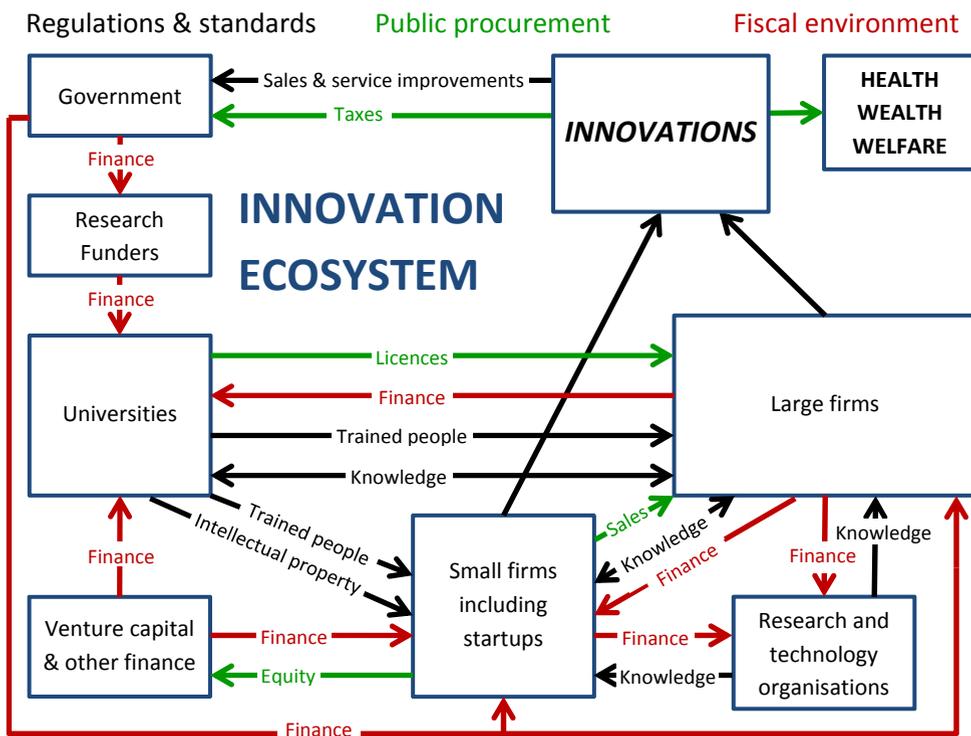
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3.5 Clearly, innovation ecosystems are not simple arrangements or systems. Rather, as the Chamber of Commerce and Industry of Western Australia (Inc) (CCIWA) submitted

*recent economic analyses have unambiguously demonstrated that innovation systems are complex, agile, evolving, and generally involve robust (but flexible) network linkages that allow corporations and institutions to leverage enhanced capacity, efficiency, and profitability from innovation.*⁸⁸

3.6 This complexity is demonstrated in Figure 3.1.

Figure 3.1: An Innovation Ecosystem⁸⁹



3.7 In WA, a good example of an innovation ecosystem is the Australian Marine Complex (AMC) in Henderson. While the AMC is part of the larger Western Australian and national innovation ecosystems, it is also an ecosystem in its own right.

88 Submission No. 34 from Chamber of Commerce and Industry of Western Australia (Inc), 18 September 2015, Cover Letter.

89 Georgiou, Luke, *Improving the framework conditions for R&D*, June 2015, as cited in Reillon, Vincent, *Understanding innovation*, Briefing, European Parliamentary Research Service, European Parliament, February 2016, p 5.

The AMC as an innovation ecosystem⁹⁰

The AMC has been developed to facilitate and enhance the opportunities created by the clustering of industries and is arranged into four adjoining precincts, each with a particular service focus.

- **Fabrication Precinct**—incorporating the Common User Facility (CUF) provides world-class, multi-purpose facilities for the fabrication, assembly and load-out of pre-assembled units up to 15,000 tonnes for local, national and international projects. [...]
- **Technology Precinct**—dedicated to strategic innovation and enterprise within the marine, defence, oil and gas technology and research sectors. The Technology Precinct includes the new Central Services Facility, Raytheon Australia's Naval System Division and Challenger TAFE's Australian Centre for Energy Process Training (ACEPT) Facility.
- **Maritime Precinct**—this is now Australia's largest commercial Shipbuilding Precinct and home to local shipbuilders such as Austal Ships, Evolution Commercial, Echo Yachts, Hanseatic Marine, and BAE Systems. [...] The Shipbuilding Precinct includes the Marine Support Facility with an 8,000 tonne shiplift owned by BAE Systems Australia, plus access to a 13,000 tonne lift floating dock within the CUF.
- **Support Industry Precinct**—comprised of leading manufacturing and service companies, dedicated to providing support to the shipbuilding, defence and resource industries and worldwide export markets.

In July 2003, funding for the AMC was provided by the Commonwealth and Western Australian governments—\$80 million through the Commonwealth Federation Funding, with \$80 million in matching state funding. The Western Australian Government also provided a further \$120 million for the CUF.

Since then funding has been provided for two major upgrades:

2006: \$170m infrastructure upgrade, mostly for the construction of the floating dock, and primarily for support to Defence. This was completed in 2010.

2009: Chevron \$35m service and supply wharf infrastructure to support the Gorgon project at Barrow Island.

The CUF provides infrastructure that complements rather than replicates existing private industry infrastructure. It provides industry with means to grow their capability [through] a virtual capacity expansion. All costs involved in using it are project costs, access is on a project by project basis and it is available for multiple users.

⁹⁰ Based on Submission No. 28c from Department of Commerce, 20 May 2016, p 1.

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The AMC Business Directory shows there are currently 116 organisations at the site, employing approximately 4,550 people. These organisations include fabricators, ship builders, suppliers and service providers, including, for example, education and training providers, storage facilities, engineering contractors, facility management, specialised cleaning services, painting, catering and commercial diving. The number of organisations in each sector and the number of people employed are shown in Table 3.1.

Table 3.1: AMC organisations and employment⁹¹

Sector	No of organisations	No employed (approx.)
Services	63	1794
Fabrication	35	2016
Ship Building	5	436
Suppliers	13	304
Total	116	4550

Although this is the most current available employment data, it was published in 2010 and therefore does not reflect the significant movement in employment numbers at the AMC in recent times. It also does not include the large numbers of subcontractors that are employed on projects at the AMC. More current and regularly updated data would be invaluable.

The cumulative growth of economic benefit to Western Australia from the AMC-CUF is outlined in Table 3.2.

AMC-CUF has delivered more than 399 major projects worth in excess of \$2.25 billion and generated more than 33,792 jobs.

Table 3.2: Cumulative Economic Benefit to Western Australia from the AMC-CUF

	Year	Economic Benefit (\$m)	No. of Jobs Created	No. of Projects
Early Years	2003–2005	45.6	1150	86
Concept to Reality	2006–2008	240	3639	195
Building on Success	2009–2010	532	7811	277
Sustainable Growth	2011–2013	1745	26700	373
Maturation	2014–2016	2250	33792	399

91 Compiled from information provided by the AMC and in the AMC Business Directory. Available from: <http://www.australianmarinecomplex.com.au/Business-Directory/#>. Accessed on 24 May 2016.

The value and success of the AMC is exemplified by the innovative use of and skill with aluminium by shipbuilding companies at the centre. The vessels fabricated by these organisations are world-class and world-renowned, having developed from the construction of small boats to the manufacture of commercial and recreational boats, including superyachts.

The success of AMC is also demonstrated by potential further development of the CUF's Floating Dock.

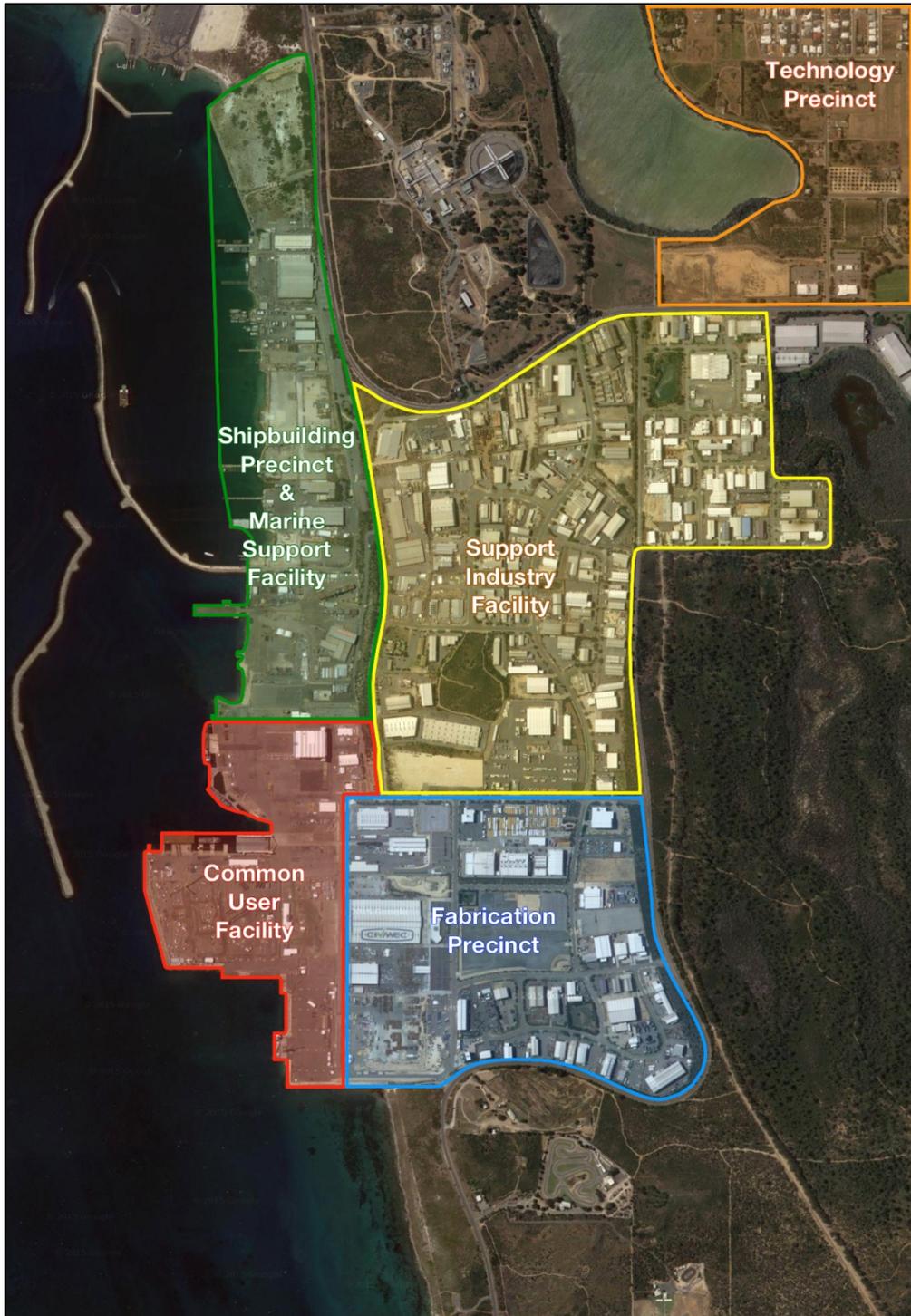
Since commissioning in February 2010, the floating dock Stage 1 has lifted over 100 vessels for the defence, marine, oil and gas, and mining sectors.

Measuring 99 metres by 53 metres (Stage 1), the AMC Floating Dock can lift vessels up to 13,000 tonnes out of the water for service and maintenance and transfer vessels up to 4,000 tonnes onto a hard-stand.

Stage 2 will see the Floating Dock's lifting capacity increased to 28,000 tonnes with a total length of 232 metres.

Stage 1 and Stage 2 will be able to operate independently or as an integrated unit.

Figure 3.2: The Australian Marine Centre in Henderson



3.8 The growth of the AMC and its cumulative economic benefit for WA demonstrates its significance as an innovation ecosystem in its own right and as an important part of the state's overall ecosystem. Nevertheless, there is room to improve the capacity and performance of the AMC. For example, there is no interrelationship between the AMC and the university sector, and no university facilities at the AMC site. The establishment of such a connection, and the associated resulting collaboration between university researchers and SMEs within the AMC, would be of enormous benefit—particularly to those SMEs, but also to WA as a whole.

3.9 It is important to recognise that while the success of the AMC has largely been driven by industry, it was ultimately initiated by government and has enjoyed bi-partisan support by successive governments. Governmental commitment to the ongoing development of the AMC must remain forthright, to ensure that the AMC continues to grow as a strong contributor to the WA economy, and an important facility for skilled employment within the state.

Culture of innovation

3.10 Strongly aligned with the concept of an innovation ecosystem is that of a culture of innovation. Many submissions to this Inquiry called on the need for a culture of innovation, without explaining what this meant or what it might look like. While the concept can sound empty or clichéd, it is useful to think about what a culture of innovation might mean and what it might consist of.

3.11 A culture of innovation can be defined as 'a particular set of values, norms and patterns of behaviour that stimulate the innovation process'.⁹² A healthy, strong culture of innovation is:

- *an environment that supports creative thinking and advances efforts to extract economic and social value from knowledge, and, in doing so, generates new or improved products, services or processes;*
- *has a shared set of values and mutually reinforcing beliefs about the importance of innovation as well as an integrated pattern of behaviour that supports research and innovation; and*
- *can leverage the existing strengths of a given research and innovation ecosystem.*⁹³

3.12 This would necessarily include 'creative thinking, collaboration, initiative, openness, a positive approach to failure and high trust',⁹⁴ and may challenge long-established

92 Reillon, Vincent, *Understanding innovation*, Briefing, European Parliamentary Research Service, European Parliament, February 2016, p 6.

93 Hepburn, Nicola, *What is a culture of innovation*, 17 May 2013, np. Available at: <https://www.marsdd.com/news-and-insights/what-is-a-culture-of-innovation/>. Accessed on 16 June 2016.

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practices, 'collective assumptions, mindsets, silos and outdated ways of doing business'.⁹⁵ A culture of innovation is important for all elements in the ecosystem.

- 3.13 To be effective, an overall culture of innovation needs to exist at a government level, a company level, a university level, an education system level and an individual level. Achieving this outcome will turn largely upon the leadership of the state government. As Mr Andrew Harding, Rio Tinto's Product Group Executive, Iron Ore, advised, government 'cannot pick the winners, technologically, but you can provide the ecosystem for it to work, and that is a big one for government'.⁹⁶ Government leadership is discussed further in Chapter 9.
- 3.14 As will be demonstrated throughout this report, the Committee received considerable evidence showing that WA must improve its culture of innovation to encourage the innovation process itself. For example, Engineers Australia submitted that 'Australia needs to do more to build an innovation culture. All too often policies put forward as innovation policies are little more than quasi business assistance and eloquent bureaucratic solutions. A more substantive foundation is essential'.⁹⁷ The Technology and Industry Advisory Council (TIAC) argued that there is a need for 'important cultural change within the research community', that WA is hampered 'by a weak venture capital culture' and that 'Australia has changed from a country of risk takers to a culture of risk avoidance'.⁹⁸
- 3.15 A strong and healthy WA ecosystem needs a dynamic culture of innovation in which to flourish. As Edith Cowan University (ECU) submitted, WA 'has the potential to create new world leading innovative companies that enhance or disrupt current practices if an innovative environment and culture are developed'.⁹⁹ Importantly, the development and maintenance of this culture requires strong and committed leadership, particularly from government.
- 3.16 This report deals with key elements of the Western Australian innovation ecosystem, including the major challenges faced, and what might be done by the Western Australian Government to nurture a culture of innovation and an innovation ecosystem. Rather than covering every element of the Western Australian innovation ecosystem, the focus is on the significant areas raised in evidence to the Inquiry.

94 Reillon, Vincent, *Understanding innovation*, Briefing, European Parliamentary Research Service, European Parliament, February 2016, p 6.

95 Idea Champions, *Culture of innovation*, nd, np. Available at: http://www.ideachampions.com/creating_coi.shtml. Accessed on 16 June 2016.

96 Mr Andrew Harding, Product Group Executive, Iron Ore, Rio Tinto Iron Ore, *Transcript of Evidence*, 23 March 2016, p 8.

97 Submission No. 7 from Engineers Australia, 28 August 2015, p 7.

98 Submission No. 21 from Technology and Industry Advisory Council, 28 August 2015, p 14 and p 17.

99 Submission No. 10 from Edith Cowan University, 22 August 2015, pp 1–2. Emphasis added.

3.17 It is useful, though, to begin by outlining some of the general drivers of innovation.

Drivers of innovation

3.18 Submissions to this Inquiry suggested a number of main drivers of innovation. These include:

- the need for efficiencies, improving productivity, increasing shareholder value, greater profits, and the challenge of competition;¹⁰⁰
- ensuring the safety and sustainability of operations;¹⁰¹
- the availability of new technologies;¹⁰²
- the motives of individuals (professional or otherwise), including altruism, self-expression, advocacy, demonstration of expertise, dreams or the desire to solve a problem;¹⁰³ and
- consumer, market and industry demand.¹⁰⁴

3.19 Australian Bureau of Statistics (ABS) data on what motivates Australian businesses to pursue innovation provides further insight into the drivers of innovation. Table 3.1 contains a summary of the range of answers given in the most recently published data.

100 See, for example, Submissions No. 2 from Department of Fisheries; No. 10 from Edith Cowan University; No. 16 from BHP Billiton Iron Ore Pty Ltd; No. 24 from Mark J Pivac; No. 26 from Rio Tinto Iron Ore; No. 28 from Department of Commerce; No. 34 from Chamber of Commerce and Industry of Western Australia (Inc); and No 39 from Australian Dairy Industry.

101 See, for example, Submissions No. 16 from BHP Billiton Iron Ore Pty Ltd; No. 26 from Rio Tinto Iron Ore and No. 28 from Department of Commerce.

102 See, for example, Submissions No. 16 from BHP Billiton Iron Ore Pty Ltd; and No. 34 from Chamber of Commerce and Industry of Western Australia (Inc).

103 See, for example, Submissions No. 17 from UnionsWA; and No. 24 from Mark J Pivac.

104 See, for example, Submissions No. 18 from Murdoch University; and No. 28 from Department of Commerce.

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Table 3.3: Drivers of Innovation in Australian Business¹⁰⁵

Competition, demand and marketing related drivers		%
Any competition, demand and/or market related drivers		75.2
Profit related reasons		72.0
Increase responsiveness to customer needs		51.2
Increase or maintain market share		43.4
Establish new markets		35.5
Be at the cutting edge of the industry		31.3
Ensure the business' products are competitively priced		29.9
Increase export opportunities		6.6
Production and delivery drivers		%
Any production and delivery reasons		55.4
Improve quality of goods and services		37.7
Increase efficiency of supplying/delivery goods or services		34.4
Improve IT capabilities or better utilise IT capacity		22.5
Increase capacity of production or service provision		18.2
Other drivers		%
Improve safety or working conditions		21.8
Adherence to standards		17.8
Reduce environmental impacts		11.7
In response to government regulations		10.1

3.20 As well as drivers relating to market competition, productivity and safety, TIAC includes the following as drivers of innovation:

- *Need for a solution to a wicked problem*
- *The human desire to do things better*
- *Entrepreneurs wanting to succeed, create wealth or make an impact [...]*
- *The quest to remove or reduce barriers, obstacles or impediments [... and]*
- *A need for better social outcomes.*¹⁰⁶

3.21 All of these drivers have one common feature—they are all problems in need of a solution. Indeed, the fact that innovation occurs in response to a problem was

105 Australian Bureau of Statistics, *Innovation in Australian business*, 81580Do007_201213, August 2014. Available at: <http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/8158.0Main+Features12012-13?OpenDocument>. Accessed on 31 March 2016. The *Innovation in Australian business* data is based on information provided through the Business Characteristics Survey of Australian businesses, and includes a series of questions adapted from recommendations of the OECD.

106 Submission No. 21 from Technology and Industry Advisory Council, 28 August 2015, p 8.

impressed upon the Committee, with industry representatives especially emphatic in making this point.¹⁰⁷

3.22 It is largely for this reason that collaboration between various agents within an innovation ecosystem is so important: while research bodies have the skills and capacity to solve problems, it is generally industry-driven by the needs of the market—that is most acutely aware of the solutions that are most urgent. For this reason, stimulating and enhancing collaboration between agents within an innovation ecosystem is critical in helping that ecosystem to thrive.

107 This was emphasised in briefings by Mr Stuart Elliot, Managing Director of Planet Innovation, and Dr Matthew Lamont, Managing Director of DownUnder GeoSolutions, as well as in several hearings. See Woodside Energy, *Transcript of Evidence*, 16 March 2016; Shell Australia, *Transcript of Evidence*, 16 March 2016; BHP Billiton Iron Ore Pty Ltd, *Transcript of Evidence*, 23 March 2016; Rio Tinto, *Transcript of Evidence*, 23 March 2016; Chevron Australia, *Transcript of Evidence*, 6 April 2016; and Chamber of Minerals and Energy of Western Australia and Australian Petroleum Production and Exploration Association, *Transcript of Evidence*, 19 April 2016.

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Collaboration

4.1 Collaboration is essential for the development and growth of a healthy ecosystem. Within an ecosystem, collaboration between and across sectors can lead to new knowledge and product development, increased workforce education and skill levels, diversified income sources and improved commercialisation outcomes. By global standards, though, Australia is relatively poor at embracing collaboration. This chapter provides information on the need for, and benefits of, collaboration, and explains some of the barriers to improved levels of collaboration in Australia. It also outlines some examples of collaboration in Western Australia (WA) that may provide a framework for other sectors of the economy.

Collaboration is essential in an innovation ecosystem

4.2 One of the founding elements of a healthy innovation ecosystem is the network of collaborative linkages between different elements and agents within the system, and with other innovation ecosystems.

4.3 Collaboration, put simply, refers to a situation where people and/or organisations work together toward a common objective. It can take many forms such as information sharing, communicating, networking or working together on a particular project. Collaboration can occur through a formalised arrangement, such as when there are express agreements between universities, companies and/or governments to conduct research on a specific problem; it can also happen informally, such as when people are drawn to work together organically because of a shared interest or a common purpose.

4.4 The essential nature of collaboration was recognised by universities, government agencies and business alike. For example, the Department of Mines and Petroleum's submission recognised the power of collaboration:

One of the keys to delivering major resources innovation in Western Australia has been effective collaboration between governments, universities, technical institutions and industry [...].

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*Encouraging scientific research and technological innovation through collaboration will be crucial to addressing the challenges facing the State's resources sector.*¹⁰⁸

4.5 For StartupWA, 'increasing collaboration and support between Corporates, Government, Not for Profits, Universities, Entrepreneurs and Startups will be vital to ensuring ongoing funding, customers and pathways to scaling up local ventures'.¹⁰⁹

4.6 Rio Tinto advised that it:

*seeks to actively engage with governments, universities and our business partners to realise our innovation agenda. [...]. [A] commitment to collaboration is fundamental in driving the complex technology and innovation initiatives that are essential to moving the resources industry forward.*¹¹⁰

4.7 Murdoch University argued that 'policies that focus on the interrelationships between the elements of the innovation system—education, training and research & development in institutions and enterprises—are crucial for stimulating individual and organisational innovation'.¹¹¹

4.8 According to the Minerals Research Institute of Western Australia (MRIWA), 'innovation is most generally the result of productive collaboration by and among the various parties involved across the entirety of the activities of the system, eg research, financial, marketing, commercial, design, and end-user'.¹¹²

There's lots of research happening in Western Australia...

4.9 WA's Chief Scientist, Professor Peter Klinken, argued that WA is a 'world leader in mining, petroleum and agricultural industries, all strongly based on science', and in 'the application of science in processing methods'.¹¹³ The state is also home to 'highly innovative' agricultural and fisheries sectors 'by world standards, especially in dry-land

108 Submission No. 6 from Department of Mines and Petroleum, 26 August 2015, p 5. See also: Submission No. 14 from Chief Scientist of Western Australia, Office of Science, p 3.

109 Submission No. 11 from StartupWA, 28 August 2015, p 7. See also: Submission No. 3 from Interspatial Systems, p 3.

110 Submission No. 26 from Rio Tinto Iron Ore, 7 September 2015, p 6.

111 Submission No. 18 from Murdoch University, 28 August 2015, p 2. See also: Submission No. 22 from University of Western Australia, p 10; and Professor Graeme Wright, Deputy Vice-Chancellor, Research, Curtin University, *Transcript of Evidence*, 12 February 2015, p 6.

112 Submission No. 15 from Minerals Research Institute of Western Australia, 28 August 2015, p 4.

113 Submission No. 14 from Professor Peter Klinken, Chief Scientist of Western Australia, Office of Science, 28 August 2015, p 2. See also: Mr Stedman Ellis, Chief Operating Officer, Australian Petroleum Production and Exploration Association, *Transcript of Evidence*, 19 April 2016, p 3.

farming and sustainable seafood production'.¹¹⁴ Professor Klinken noted that Perth is also 'an internationally-recognised centre for radio astronomy', and has 'a strong base and proud history of medical research and translation, underpinned by extensive collaboration between government, universities, medical research institutes and the private sector'.¹¹⁵

- 4.10 Many submissions to this Inquiry provided details of collaboration between government agencies, universities and businesses in WA across a wide range of areas, including agriculture and food, and mining and energy. While the full range of collaborative efforts brought to the Committee's attention are too numerous to detail within this report, the following examples give some insight into the breadth of work being undertaken in WA in these sectors.
- 4.11 The Department of Fisheries has developed new molecular approaches for species identification, in collaboration with Edith Cowan University (ECU). That project aimed to 'establish whether the presence of pest fish can be detected in a water body through the use of eDNA tools'.¹¹⁶
- 4.12 The Western Australian Energy Research Alliance (WA:ERA) is a joint venture between the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Curtin University, the University of Western Australia (UWA), Woodside Energy Ltd, Chevron Australia Pty Ltd and Shell Australia Pty Ltd.¹¹⁷ WA:ERA's focus is 'on meeting the research and development needs of the oil and gas industry in the areas of offshore infrastructure on the seabed (subsea and pipelines), through the water column (risers) and on the surface (floaters)'.¹¹⁸ A case study on WA:ERA is provided below.
- 4.13 The Department of Agriculture and Food (DAFWA) 'collaborates extensively with both WA and other Australian universities on a wide range of projects', including projects with UWA, Murdoch University, University of Adelaide and the University of Melbourne.¹¹⁹ DAFWA also works with InterGrain Pty Ltd, a cereal breeding company

114 Submission No. 14 from Professor Peter Klinken, Chief Scientist of Western Australia, Office of Science, 28 August 2015, p 2.

115 *ibid.*

116 Submission No. 2 from Department of Fisheries, 14 August 2015, p 2.

117 Submission No. 6 from Department of Mines and Petroleum, 26 August 2015, p 10; and Submission No. 12 from Western Australian Energy Research Alliance, 27 August 2015, p 1. Chevron and Shell were not original members of the joint venture. Chevron became a member in 2005 and Shell in 2014. See also, for example: Submission No. 28 from Department of Commerce; No. 31 from Shell Australia; No. 32 from Woodside Energy; and No. 38 from Chevron Australia; and *Transcripts of Evidence* from Shell Australia, Woodside Energy and Chevron Australia.

118 Western Australian Energy Research Alliance, *Facilities and innovative technologies*, nd, np. Available at: <http://www.waera.com.au/Facilities-and-Innovative-Technologies>. Accessed on 13 April 2016.

119 Submission No. 33b from Department of Agriculture and Food, 11 November 2015, p 6. The submission provides a list of some of the Department's existing collaborative work.

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established in 2007 as a ‘partnership with the Grains Research and Development Corporation (GRDC) and the WA State Government as DAFWA transitioned out of wheat, and later, barley breeding’.¹²⁰ InterGrain’s wheat and barley breeding programs ‘service the major cereal growing areas across Australia’, with InterGrain varieties being sown ‘on a significant proportion of the area sown to cereals in Australia’.¹²¹

4.14 Rio Tinto Iron Ore submitted that it:

*work(s) closely with many of [its] large and small suppliers to develop systems and technologies that significantly improve productivity are better for the environment and safer for our people. [...] We also have partnerships with a range of tertiary education and research institutions, including UWA, Massachusetts Institute of Technology, University of Sydney and Duke University, as well as the US defence, aerospace and space sectors.*¹²²

4.15 One example provided by Rio Tinto Iron Ore is its work with UWA to ‘pool[ing] our knowledge of orebody geology and advanced physics, in the development of an Airborne Gravity Gradiometer [...] an advanced piece of exploration technology designed to detect otherwise invisible, buried ore bodies’.¹²³

...but it’s not being translated into innovation

4.16 Evidence from ‘various reviews, reports, and global indexes’ shows that ‘Australia (and WA) is good at research, performing well given the size of the nation’.¹²⁴ A generally recognised annual global index is the *Global innovation index* (GII), which analyses innovation drivers and outcomes, and is published annually.¹²⁵ The drivers or inputs considered in the GII are institutions, human capital and research, infrastructure, market sophistication and business sophistication. The innovation outcomes considered are knowledge and technology outputs, and creative outputs.¹²⁶

120 Submission No. 33b from Department of Agriculture and Food, 11 November 2015, p 6.

121 *ibid.* Monsanto became an InterGrain shareholder in 2010, providing an ‘injection of capital and bringing a large network of scientists and breeders’ to the partnership.

122 Submission No. 26 from Rio Tinto Iron Ore, 7 September 2015, p 6.

123 *ibid.*

124 Submission No. 28 from Department of Commerce, 9 September 2015, p 6. See also: Submission No. 14 from Professor Peter Klinken, p 5; No. 21 from Technology and Industry Advisory Council, p 6; and No. 34 from the Chamber of Commerce and Industry of Western Australia (Inc), Cover Letter.

125 Over its eight years of publication, the *Global innovation index* has become a leading reference point for those interested in innovation.

126 *Global innovation index 2015 conceptual framework*, Cornell University, INSEAD, and the World Intellectual Property Organization. Available at: <https://www.globalinnovationindex.org/content/page/framework/>. Accessed on 15 April 2016.

4.17 Table 4.1 provides GII data for Australia for the past five years. This data demonstrates that Australia’s overall GII ranking—the simple average of inputs and outputs—has moved from 21st (out of 125 countries) in 2011 to 17th (out of 141 countries) in 2015.

4.18 Australia achieves high rankings in knowledge, research and creativity; that is, ‘Australia and Western Australia are great at developing ideas’.¹²⁷ The GII recognises Australia’s human capital and research, and creative outputs as strengths.

Table 4.1: Australia’s rankings on the Global Innovation Index¹²⁸

Index Pillar (Number of countries considered)	2011 (125)	2012 (141)	2013 (142)	2014 (143)	2015 (141)
Overall Global Innovation Index Rank	21	23	19	17	17
Overall Global Innovation Index Score	(49.9%)	(51.9%)	(53.1%)	(55%)	(55.2%)
Human Capital and Research	9	24	11	7•	9
Creative Outputs	36	23	17	12	7•
University—Industry Collaboration	12	13	12	14	20
Venture Capital Deals/tr PPP\$ GDP	25	21	26	23	29
Domestic Resident Patent Applications	37	46	47	40	34
High- and Medium- High-Technology Manufactures output	n/a	n/a	48 ^o	54 ^o	56
Knowledge Diffusion	70	83 ^o	63	78 ^o	99 ^o
Graduates in Science and Engineering	22 Science 68 Engineering	64 ^o	65 ^o	73 ^o	77 ^o
Innovation Efficiency Ratio Rank	97	107 ^o	116 ^o	81 ^o	72
Innovation Efficiency Ratio Rank	(0.6%)	(0.6%)	(0.7%)	(0.7%)	(0.7%)

^o represents a weakness

• represents a strength

4.19 While the GII ranked Australia’s university—industry collaboration at between 12th and 14th (out of between 125 to 143 countries) for the years 2011 to 2014, this ranking fell to 20th out of 141 countries in 2015.

4.20 Australia also ranks very poorly for the High- and Medium- High-Technology Manufactures output index, the Knowledge Diffusion index, and the Graduates in Science and Engineering index, with knowledge diffusion and the percentage of graduates in science and engineering noted as a weakness for Australia.

4.21 Furthermore, while Australia’s ranking in the overall Innovation Efficiency Ratio—the ratio of innovation inputs to outputs—in 2015 was an improvement over the preceding

127 Submission No. 21 from Technology and Industry Advisory Council, 2 September 2015, p 6.

128 Sourced from *Global innovation index* reports for 2011, 2012, 2013, 2014 and 2015, Cornell University, INSEAD, and the World Intellectual Property Organization. Available at: <https://www.globalinnovationindex.org/content/page/GII-Home>. Accessed on 13 April 2015.
Note: PPP\$ GDP refers to purchasing power parity gross domestic product.

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three years, a ranking of 72 and a fairly stable Innovation Efficiency Score of 0.7 per cent is not a strong position for Australia to be in.

4.22 As Professor Peter Klinken submitted, ‘Australia’s ability to translate research into commercial or practical outcomes is weak’.¹²⁹ Australia ‘falls well short at turning [...] ideas into local business opportunities’.¹³⁰

4.23 UWA also acknowledged the immense ‘potential to lift our performance and deliver greater economic and social benefit’, and argued that this will require ‘greater collaboration, coordination and the development of a coherent plan that universities, research institutions, business and industry, venture capitalists, entrepreneurs and innovators and the general public can all work towards’.¹³¹

University—industry—government collaboration must increase

4.24 OECD data on businesses engaging in collaboration illustrates part of the reason why Australia performs poorly in relation to knowledge diffusion and innovation efficiency. As Table 4.2 shows, Australia ranked 25 out of 29 countries in the 2015 *Scoreboard of businesses engaging in collaboration on innovation*. Just 32.1 per cent of Australian businesses that actively pursue R&D also engaged in collaboration; by contrast, this figure was 77.2 per cent in the United Kingdom. Just 23.3 per cent of non-R&D active firms in Australia engage in collaboration.

Table 4.2: Businesses engaging in collaboration on innovation, by R&D status¹³²

	2013	2015
Australia’s overall position (number of countries)	29 (out of 30)	25 (out of 29)
R&D active firms engaging in collaboration	27.4%	32.1%
Non-R&D active firms engaging in collaboration	23.4%	23.3%

4.25 If, as the MRIWA suggested, ‘innovation is most generally the result of productive collaboration by and among the various parties involved across the entirety of the activities of the system, eg research, financial, marketing, commercial, design, and end-user’,¹³³ Table 4.2 provides some insight into Australia’s poor GII innovation efficiency ranking.

129 Submission No. 14 from Professor Peter Klinken, Chief Scientist of Western Australia, Office of Science, 28 August 2015, p 5.

130 Submission No. 21 from Technology and Industry Advisory Council, 2 September 2015, p 6.

131 Submission No. 22 from University of Western Australia, 28 August 2015, p 10.

132 OECD, Science, Technology and Industry Scoreboard 2015 and 2013. Available at: <http://www.oecd.org/sti/scoreboard.htm>. Accessed on 14 April 2016. Country data is not for the same years, therefore some caution is needed in making comparisons. The Australian data in the 2015 Scorecard is for 2012–2013 and in the 2013 Scorecard is for 2011.

133 Submission No. 15 from Minerals Research Institute of Western Australia, 28 August 2015, p 5.

4.26 There are clearly a number of benefits to collaboration between universities and industry, and government has an important role in this process. The state government's role is the subject of Chapter 9. While the 'benefits of collaboration are multi-faceted and different types of collaboration provide correspondingly differing benefits to stakeholders',¹³⁴ evidence to this Inquiry reports that overall improved collaboration can:

- 'lead to new knowledge and product development';¹³⁵
- 'streamline the commercialisation of a range of products and services';¹³⁶
- ensure appropriately educated, experienced and skilled personnel are available in Australia;¹³⁷
- provide industry with the opportunity to develop curriculum to meet future requirements and to gain early access to 'the best and brightest students';¹³⁸
- enhance the academic environment, particularly through exposing academics to industry and the application of research, which, in turn, feeds back into their research and teaching;¹³⁹
- help young entrepreneurs gain experience and credibility, and thus engage with major corporations;¹⁴⁰
- deliver 'outcomes with real impact';¹⁴¹
- 'provide the interdisciplinary skills and infrastructure required to address the State's scientific challenges, as well as create exciting new opportunities';¹⁴²
- facilitate the diversification of income through improving awareness of other opportunities;¹⁴³ and
- drive innovation initiatives and create an innovation culture that is a 'significant departure from "business as usual" processes'.¹⁴⁴

134 Australian Technology Network of Universities and the Ai Group, *Innovate and prosper. Ensuring Australia's future competitiveness through university-industry collaboration*, PwC, Sydney, 2015, p 11.

135 *ibid.*

136 Submission No. 10 from Edith Cowan University, 28 August 2015, p 2; and Submission No. 11 from StartupWA, 28 August 2015, p 7.

137 Dr Darren Gibson, Manager, Collaboration and Innovation, Edith Cowan University, *Transcript of Evidence*, 12 February 2015, p 3 and pp 3–4; Submission No. 32 from Woodside Energy, 11 September 2015, p 2; and Australian Technology Network of Universities, *Innovate and prosper. Ensuring Australia's future competitiveness through university-industry collaboration*, PwC, Sydney, 2015, p 11.

138 Australian Technology Network of Universities, *Innovate and prosper. Ensuring Australia's future competitiveness through university-industry collaboration*, PwC, Sydney, 2015, p 11.

139 *ibid.*; and Dr Darren Gibson, Manager, Collaboration and Innovation, Edith Cowan University, *Transcript of Evidence*, 12 February 2015, p 5.

140 Ms Sheryl Frame, Director, StartupWA, *Transcript of Evidence*, 11 February 2016, p 4.

141 Submission No. 12 from Western Australian Energy Research Alliance, 27 August 2015, p 1.

142 Submission No. 14 from Professor Peter Klinken, Chief Scientist of Western Australia, Office of Science, 28 August 2015, p 3.

143 Submission No. 22 from University of Western Australia, 28 August 2015, p 6.

144 Submission No. 26 from Rio Tinto Iron Ore, 7 September 2015, p 6.

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4.27 While, ideally, collaboration would occur amongst all elements of an innovation ecosystem, the balance of this chapter explores collaboration between universities, businesses and government. It outlines the reasons why more collaboration does not occur, highlights some examples of successful collaboration, and outlines some programs and incentives that foster effective collaboration in WA.

Factors hampering effective collaboration

4.28 There are a number of factors, both cultural and systemic, that help to explain Australia's poor performance in collaboration. This lack of collaboration impedes innovation in Australia by exacerbating the problems of misaligned incentives and core functions, a lack of awareness and understanding of sector needs and capabilities, differences in size and scale of entities, and a culture of competition rather than cooperation. These are not discrete issues; rather, they overlap and impact on one another. It is useful, though, to consider each separately.

Misaligned incentives and core functions

4.29 Evidence to the Inquiry shows that the most significant barrier to collaboration between industry and universities is the reward structure in universities, which places 'a high value on publications as a measure of research quality and impact'.¹⁴⁵ According to the 2015 report, *Innovate and prosper*, 'there is little incentive and no imperative for these publications to focus on collaborative research; there is no weighting to industry-research engagement or even research outcomes such as job creation, patents and product income'.¹⁴⁶ In discussing the 'weak industry/academia linkages', Professor Peter Klinken explained that this, in part, was due to the:

*drivers of University success. The metrics for measuring success are based largely on publications and grant success, with few incentives for academics to engage with industry. This model is great for high impact papers and international rankings, but it is not conducive for industry engagement.*¹⁴⁷

145 Australian Technology Network of Universities and the Ai Group, *Innovate and prosper. Ensuring Australia's future competitiveness through university–industry collaboration*, report prepared by PwC, Sydney, 2015, p 12.

146 *ibid.*

147 Submission No. 14 from Professor Peter Klinken, Chief Scientist of Western Australia, Office of Science, 28 August 2015, p 4. See also: Dr Adam Osseiran, Director, Innovate Australia, *Transcript of Evidence*, 11 February 2016, p 3; Dr Darren Gibson, Manager, Collaboration and Innovation, Edith Cowan University, *Transcript of Evidence*, 12 February 2016, p 4; and Submission No. 36 from Australian National Data Service.

4.30 The general tenor of the evidence is exemplified in a submission from the Technology and Industry Advisory Council (TIAC):

The culture encouraging publication over industry engagement in the Australian public research sector can pit academia against industry, rather than encourage them to work together as natural partners. In Australia there is a common view that if an academic works closely with industry then the research is being compromised. The view tends to be reinforced through the Commonwealth grant application processes and university funding models. Academic journal publications are central to research standing and successful grant applications, and industry liaison or collaboration has not historically been considered as a measure of quality. Therefore the current reward systems for researchers generally exclude industry collaboration—and implicitly encourage its exclusion.¹⁴⁸

4.31 The impact of this culture for academics was highlighted by Dr Adam Osseiran:

The idea that is pushed there is that you need to publish in journals. If you do not publish in journals, you do not get the points, you do not get the funding, and probably you will be thanked and left out of the university and out of a job. We hear that. And I hear that not only in my university in Western Australia. I travelled for my previous job to a number of universities in Australia and everyone was saying the same thing.¹⁴⁹

4.32 While attracting funding by producing a high volume of quality publications is a major driver for universities, the innovation driver for business is improved productivity and profit. This difference was clearly articulated by ECU in describing academic culture as a challenge to collaboration:

The culture within academia is to publish and to seek the true/perfect result. However, in business publishing is rarely needed and in some cases only a minimal (5%) or incremental improvement in process is all that is required for success.¹⁵⁰

4.33 Universities and businesses—and small to medium enterprises (SMEs) in particular—that try to collaborate are disadvantaged through the funding bodies' focus on

148 Submission No. 21 from Technology and Industry Advisory Council, 28 August 2015, p 11.

149 Dr Adam Osseiran, Director, Innovate Australia, *Transcript of Evidence*, 11 February 2016, p 3.

150 Submission No. 10 from Edith Cowan University, 28 August 2015, p 3.

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publications.¹⁵¹ It can be difficult for researchers and industry partners ‘without a track record of publications in high ranking journals [...] to secure much needed investment from funding bodies. This puts SMEs and universities who focus on industry experience over publications at a financial disadvantage’.¹⁵²

4.34 Furthermore, where there is collaboration, it is generally the academics, rather than the business representatives, who apply for the funding. The fate of such funding applications is often determined by academics with ‘little prior experience of commercialising research or ... [comprehension of its] commercial application’.¹⁵³ The lack of researchers’ ‘experience in dealing with industry is clearly a systemic issue’.¹⁵⁴

4.35 According to *Innovate and prosper*, though, there is an appetite for collaboration and ‘universities are increasingly conscious of their economic role [...] and] over time we have seen some universities extend their missions from teaching and research to include a third mission—driving external engagement, such as regional economic development’.¹⁵⁵

4.36 A further challenge to collaboration relates to universities and businesses often having different timeframes in which to achieve results. As Mr Mark Pivac submitted, ‘collaboration between government (local, state or federal), universities and business is difficult’, in part because:

*commercial interests usually want the innovation now to solve an immediate problem or fill an immediate opportunity, whereas government funding is usually tied to a budgetary cycle. Furthermore, grants are time consuming to apply for, there is no certainty of the grant, and the then project usually has to start straight away. There is often a catch 22 situation of the government needing matching funding, but also requiring a need for funding, which is often at odds with private investment in that private investment wants certainty before funding.*¹⁵⁶

4.37 This observation was echoed by Mr Peter Clarke’s argument that ‘universities are driven by a different set of KPIs and incentives, and they like to do three, five, ten-year research projects and get lots of papers out of it’.¹⁵⁷

151 Australian Technology Network of Universities and the Ai Group, *Innovate and prosper. Ensuring Australia’s future competitiveness through university–industry collaboration*, report prepared by PwC, Sydney, 2015, p 12.

152 *ibid.*

153 *ibid.*

154 *ibid.*

155 *ibid.*

156 Submission No. 24 from Mr Mark J Pivac, 3 September 2015, p 1.

157 Mr Peter Clarke, *Transcript of Evidence*, 11 February, pp 3–4.

Lack of awareness and understanding of requirements and capabilities

4.38 This misalignment of incentives both creates and results from a general lack of awareness and understanding of universities' needs and capabilities by businesses and *vice versa*.

4.39 As Murdoch University submitted, universities are:

*generally unaware of market demands and how their research might meet industry needs or even develop into potentially disruptive industries. [...] The insular nature of academic research, however, means that business and industry generally don't know about the research within universities that might help meet their requirements. Equally, researchers often don't see potential commercial opportunities for innovations, for example research into blue-green algae generated an algaecide to help clear algal blooms in the Swan River which was used commercially in anti-fouling paint for boat hulls.*¹⁵⁸

4.40 Mr Peter Clarke suggested that rather than business being fearful of or unwilling to engage with universities, 'they are just not aware that that is out there for them and that potentially they can tap into it and get some value'.¹⁵⁹ This may be because businesses, particularly SMEs, 'are focussed on surviving [...] because they have to pay salaries and they have to pay increased costs all the time, so they do not often see the value of putting that \$100 000 into a research project'.¹⁶⁰

4.41 Furthermore, businesses that have approached a university 'usually had a poor experience'.¹⁶¹ This was also emphasised by Professor Peter Klinken's explanation that:

*industry finds it difficult to navigate the structures of research organizations, and often find it hard to identify researchers interested in solving their real-world problems. Industry can also view academics as cynically seeking a source of funds for their research, without genuinely contributing towards the partnership and solving problems that industry need addressed.*¹⁶²

158 Submission No. 18 from Murdoch University, 28 August 2015, p 2. See also: Submission No. 1 from Dr Stewart Dallas, p 2.

159 Mr Peter Clarke, *Transcript of Evidence*, 11 February, p 3.

160 Dr Darren Gibson, Manager, Collaboration and innovation, Edith Cowan University, *Transcript of Evidence*, 12 February 2015, p 3. See also: Professor Peter Klinken, Chief Scientist, Office of Science, Department of the Premier and Cabinet, *Transcript of Evidence*, 11 February 2016, p 9.

161 Mr Peter Clarke, *Transcript of Evidence*, 11 February, p 3.

162 Submission No. 14 from Chief Scientist of Western Australia, Office of Science, 28 August 2015, p 4. See also: Mr Lindsay O'Sullivan, Chief Operating Officer, Chamber of Commerce and Industry of Western Australia (Inc), *Transcript of Evidence*, 17 February 2016, pp 4–5.

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4.42 The number of collaborative partnerships between universities and major corporations, particularly in the resources sector, suggests that this is less of a problem for larger businesses. As BHP submitted, 'there is sufficient drive from industry to engage directly with universities and research institutions'.¹⁶³ Nevertheless, this problem is particularly acute for SMES:

*They are small, they are trying to build a business and they feel intimidated, awkward, uncomfortable dealing with dirty great big bureaucracies like universities who talk to people who have titles called professor and who are supposed to be incredibly smart. There should be much easier ways to navigate through universities, and I think it is incumbent upon universities to actually make it easier for those interactions to take place.*¹⁶⁴

4.43 This lack of awareness between universities to be used properly'.¹⁶⁵ Many PhD researchers enter and exit their PhD 'thinking they are just going to get an academic job'.¹⁶⁶ While PhD research skills can be of value to industry and industry extends to PhD students. With only approximately 50 per cent of Australian PhD researchers working in industry, there is a 'resource that is begging, 'the truth is industry does not actually know or understand what PhDs can do for them. ... [I]n some instances, ... they will not employ PhDs because they do not really get it. They do not understand their value'.¹⁶⁷

4.44 Nevertheless, there are some small businesses that understand the value of employing PhDs. For example, DownUnder GeoSolutions, an innovative geoscience company in West Perth, employs 26 PhDs globally, 21 of those in Australia.¹⁶⁸

4.45 In discussing the Industry and PhD Research Engagement Program (iPREP),¹⁶⁹ Dr Natasha Ayers noted that this situation is beginning to change, with companies starting to recognise the benefits of engaging PhDs and PhDs are seeing the work being done in industry:

163 Submission No. 16 from BHP Billiton Iron Ore Pty Ltd, 28 August 2015, p 2.

164 Professor Peter Klinken, Chief Scientist, Office of Science, Department of the Premier and Cabinet, *Transcript of Evidence*, 11 February 2016, p 9.

165 Professor Joseph Luca, Dean, Graduate Research School, Edith Cowan University, *Transcript of Evidence*, 11 February 2012, p 2.

166 Dr Natasha Ayers, iPREP Coordinator, Edith Cowan University, *Transcript of Evidence*, 11 February 2016, p 2.

167 Professor Joseph Luca, Dean, Graduate Research School, Edith Cowan University, *Transcript of Evidence*, 11 February 2012, p 2.

168 Dr Matthew Lamont, Managing Director of DownUnder GeoSolutions, *Briefing*, 12 April 2016; and Ms Josephine Leong, Group HR Manager, DownUnder GeoSolutions, Email, 21 June 2016.

*The companies are telling us that the researchers are bringing fresh eyes, a new perspective, their critical thinking, their problem solving skills, an innovative way of thinking. Whereas some of them may have in their minds that researchers are too narrow minded. We are trying to break down some of those myths about researchers and on the other hand trying to show these researchers that, actually, research being done in industry is really exciting. There is more out there than just academic jobs.*¹⁷⁰

4.46 The overall lack of awareness of each other's needs and capabilities is partly due to the lack of good communication and a lack of plain language.¹⁷¹ As ECU explained, for 'collaboration to flourish', language must be simple, 'with no acronyms' so that all parties will understand.¹⁷² Dr Darren Gibson explained that communication can help to 'break down those barriers between industry and academia' as:

*a lot of the time business people engage with business people, or industries with industries, in different types of forums, so they will go to a conference and it will be all industry leaders at that conference, and very few academics, and vice versa... very rarely will you have the two sectors interacting. The only time you would really see industry within an academic conference is normally the sales teams of, "Do you want this piece of technology for your industry?", rather than, "How can we actually work together?"*¹⁷³

4.47 In describing ECU's efforts to break down the communication barrier, Dr Gibson explained that the university is putting 'the language from the university into business terms'.¹⁷⁴ ECU is:

working with local government, and with a lot of the start-up and small business sectors, to actually turn the language that we use in academia into business terms. We might say one thing, and everyone within the university understands what that means, but business will go, "What does that actually mean?" There is no connection from a business point of view to drive the business forward. It is the same

170 Dr Natasha Ayers, iPREP Coordinator, Edith Cowan University, *Transcript of Evidence*, 11 February 2016, p 3.

171 Submission No. 10 from Edith Cowan University, 28 August 2015, p 3.

172 *ibid.*

173 Dr Darren Gibson, Manager, Collaboration and innovation, Edith Cowan University, *Transcript of Evidence*, 12 February 2015, p 2.

174 *ibid.*

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*thing; it is just that the word is slightly different. The same outcomes can be achieved.*¹⁷⁵

Scale and size issues

- 4.48 Many submissions from large businesses outlined their collaborative work with universities and government, including collaborative research projects through specially developed research ventures such as WA:ERA, the MRIWA and the Perth USAsia Centre, as well as through the funding of university Chairs.¹⁷⁶ In fact, BHP Billiton argued that ‘there appears to be sufficient drive from industry to engage directly with universities and research institutions’.¹⁷⁷
- 4.49 Despite this drive, engagement with universities is difficult for SMEs. In addition to the reasons noted above, SMEs ‘often do not have the basic foundation of knowledge internally or the economies of scale that allow for successful engagement with research intensive universities’.¹⁷⁸
- 4.50 This is a significant problem, particularly because Australia ‘has over 2 million SMEs, accounting for slightly less than one-half of private sector industry employment and contributing approximately one-third of private sector industry value added’.¹⁷⁹ In WA, at the end June 2015, there were 214,197 actively trading small businesses—meaning that SMEs represented 97 per cent of all businesses in the state.¹⁸⁰ While nearly 62 per cent of SMEs were non-employed (mostly self-managed superannuation funds), approximately 35 per cent employed between one to 19 staff, and 3 per cent employed between 20 and 199 staff.¹⁸¹ See Figure 4.1 below.
- 4.51 While SMEs make a significant contribution to employment and jobs growth, they may not be responsible for the greatest *rate* of job creation. In Australia, 65 per cent of the total private sector employment growth between 2009–2010 and 2014–2015 occurred in businesses with over 200 employees, that is, large businesses.¹⁸² Small businesses, or

175 *ibid.*

176 See, for example, Submission No. 26 from Rio Tinto Iron Ore, 7 September 2015, p 6; Submission No. 31 from Shell Australia Pty Ltd, 11 September 2015, p 2; Submission No. 32 from Woodside Energy, 11 September 2015, p 2; and BHP Billiton Iron Ore Pty Ltd, Submission No. 16, 28 August 2015, pp 6–7.

177 BHP Billiton Iron Ore Pty Ltd, Submission No. 16, 28 August 2015, p 6.

178 Australian Technology Network of Universities and the Ai Group, *Innovate and prosper. Ensuring Australia’s future competitiveness through university–industry collaboration*, report prepared by PwC, Sydney, 2015, p 12.

179 *ibid.*

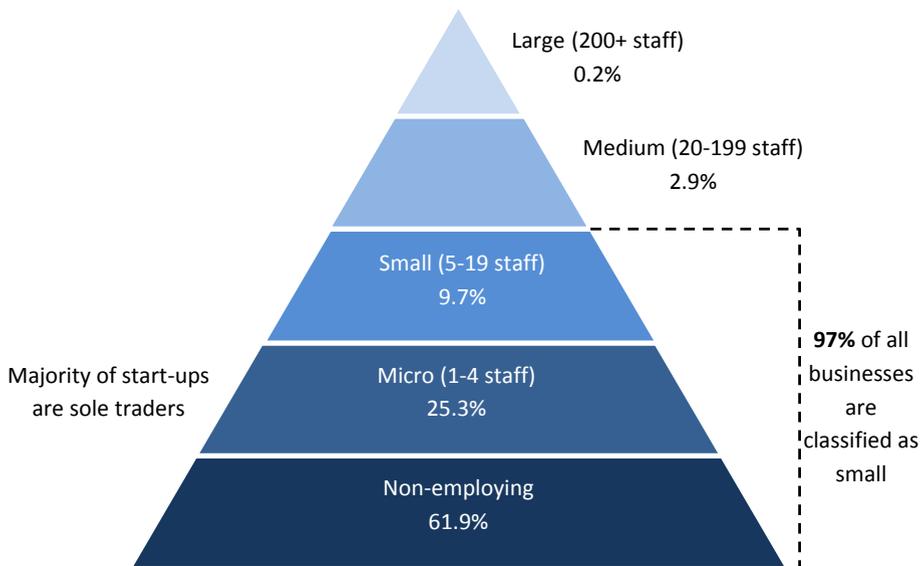
180 Small Business Development Corporation, *Facts and statistics*, nd, np. Available at: <http://www.smallbusiness.wa.gov.au/business-in-wa/what-is-a-small-business/small-business-statistics>. Accessed on 26 April 2016.

181 *ibid.*

182 Andrews, Dan, Criscuolo, Chiara, Gal, Peter and Menon, Carlo, ‘Firm Dynamics and Public Policy: Evidence from OECD Countries’, *Conference Volume 2015*, Reserve Bank of Australia, p 205 of pp 205–228; Creighton, Adam, ‘Cost of jobs and growth: Myths hobble company tax debate’, *The*

those with less than 20 employees, made up less than 5 per cent of the jobs growth for the same period. One major reason for this is the relatively low survival rate for new businesses which, by definition, are small businesses. Just 25 per cent of small businesses that existed in 2011 were still operating four years later, compared with 83 per cent of the large businesses. It seems that the ‘primary drivers of job creation’ are not SMEs but young firms as they ‘systematically create more jobs than they destroy’.¹⁸³

Figure 4.1 The proportion of Western Australian businesses per small business category¹⁸⁴



4.52

The relatively small size of these businesses exacerbates the difficulty of collaborating with universities. It also makes engagement with large businesses more challenging. As StartupWA noted, ‘when entrepreneurs come up with a new concept, product or a service, it is very hard for them to engage with industry. They are an unknown entity; they have no credibility’.¹⁸⁵

Finding 2

It is particularly difficult for SMEs to collaborate with universities and major companies.

Australian, 3 June 2016; and Holden, Richard, ‘Is small business really the engine room of Australia’s economy?’ *The Conversation*, 10 June 2016.

183 Andrews, Dan, Criscuolo, Chiara, Gal, Peter and Menon, Carlo, ‘Firm Dynamics and Public Policy: Evidence from OECD Countries’, *Small Business Conditions and Finance Conference Volume 2015*, Reserve Bank of Australia, p 210 of pp 205–228.

184 Small Business Development Corporation, *Facts and statistics*, nd, np. Available at: <http://www.smallbusiness.wa.gov.au/business-in-wa/what-is-a-small-business/small-business-statistics>. Accessed on 26 April 2016.

185 Ms Sheryl Frame, Director, StartupWA, *Transcript of Evidence*, 11 February 2016, p 4.

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4.53 As well as the size of a business being a barrier to collaboration and innovation, the size of particular industries also presents a challenge. According to *Innovate and prosper*:

*there is simply not sufficient scale and size in many industries to justify significant investment in innovation, [...]. This is compounded by the fact that it is often the small and medium sized (SME) businesses in Australia, particularly those that cannot fund internal investment in innovation, that are paying the highest price for a lack of action on industry-university collaboration.*¹⁸⁶

4.54 A separate, yet compounding, issue is the conservative nature of the largest sector within the state's economy, namely the resources sector. Although there are numerous contributing factors, the resources sector is essentially conservative as a result of both the danger associated with extracting resources from the earth, and because of the large sums of capital tied up in resources sector projects. This 'inherent conservatism' was acknowledged by the Australian Petroleum Production and Exploration Association (APPEA) who agreed that the 'challenge of SMEs engaging with majors in our industry is a real one'.¹⁸⁷

A culture based on competition rather than collaboration

4.55 A further barrier to collaboration is competition between potential partners. Academics compete in funding rounds for a portion of limited government grants, and companies compete for market share. Researchers and companies are also generally very protective of their intellectual property.¹⁸⁸

4.56 During the Committee's previous inquiries relating to floating LNG facilities, it became clear that companies are often reluctant to cooperate with each other. This fact was confirmed earlier in 2016, with a Deloitte report arguing that the unprecedented growth in Australia's LNG capacity that 'turned Australia into a gas exporting powerhouse provided valuable lessons on the need for better industry collaboration and a less blinkered view on competition'.¹⁸⁹ Despite various businesses all pursuing a common goal of getting product to market as soon as possible, the industry as a whole

186 Australian Technology Network of Universities and the Ai Group, *Innovate and prosper. Ensuring Australia's future competitiveness through university–industry collaboration*, report prepared by PwC, Sydney, 2015, p 12.

187 Mr Stedman Ellis, Chief Operating Officer, Western Region, Australian Petroleum Production and Exploration Association, *Transcript of Evidence*, 19 April 2016, p 4.

188 IP is discussed further in Chapter 5.

189 Macdonald-Smith, Angela, 'Lessons from LNG "arms race"', *Australian Financial Review*, 11 April 2106, p 8.

failed to take advantage of ‘opportunities that might have been afforded through better industry collaboration’.¹⁹⁰

4.57 This view was echoed by Shell Australia’s Mr Andrew Smith who called for ‘industry leaders to drop their egos and get serious about collaboration to reduce costs, deliver better returns and improve competitiveness’.¹⁹¹ To move from construction to sustainable operations, the industry ‘must be clever in how [...] collaborates across the industry—all the while driving greater innovation’.¹⁹²

4.58 These comments echo those of WA’s Chief Scientist, Professor Peter Klinken. Based on the fact that ‘competition is global, not local’, Professor Klinken argued that ‘collaboration is crucial. We are too small to spend our time fighting amongst ourselves. [...] We need to take a “team WA” approach’.¹⁹³

The path to increased collaboration

4.59 The majority of university funding for research comes from the federal government through the Research Block Grants funding model, with an estimated \$1.8 billion distributed to universities in 2015—\$786 million for research, and \$980 million for PhD and Master student research training.¹⁹⁴ Over \$750 million of the funding for research support is distributed based on complex formulae that reward publications and income from competitive research grants. Given this, it might seem that ‘there is not a lot the WA government can do’ about the research funding allocation.¹⁹⁵ As Dr Gibson explained, ‘one of the biggest changes will probably have to come from the federal government, and that would be around the grants funding schemes, where they are always looking at track record’.¹⁹⁶

4.60 There are, though, a number of measures the state government can implement to facilitate an increased level of collaboration between universities, industry and government.

4.61 In relation to funding, TIAC submitted that research funding provided by government could be ‘conditional and applied to specific functions’ such as ‘industry engagement,

190 Mr Jamie Hamilton, Deloitte partner, cited in Macdonald-Smith, Angela, ‘Lessons from LNG “arms race”’, *Australian Financial Review*, 11 April 2106, p 8.

191 Macdonald-Smith, Angela, ‘Shell Australia calls for LNG collaboration’, *Australian Financial Review*, 15 April 2106, p 26.

192 *ibid.*

193 Professor Peter Klinken, Chief Scientist, Office of Science, Department of the Premier and Cabinet, *Transcript of Evidence*, 11 February 2016, p 3.

194 Australian Technology Network of Universities and the Ai Group, *Innovate and prosper. Ensuring Australia’s future competitiveness through university–industry collaboration*, report prepared by PwC, Sydney, 2015, p 18.

195 Mr Peter Clarke, *Transcript of Evidence*, 11 February, p 4.

196 Dr Darren Gibson, Manager, Collaboration and innovation, Edith Cowan University, *Transcript of Evidence*, 12 February 2015, p 4.

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commercialisation and technology transfer'.¹⁹⁷ As Professor Klinken suggested the government can:

*just make a very, very clear, loud statement: "This is what we expect." In future, we will be providing funds for various initiatives and we will consider those based on how well you guys have been playing in the sandpit up until now. If you have not been nice kids playing happily in the sandpit, you are not going to get your money.*¹⁹⁸

Finding 3

There is a considerable need for increased levels of effective collaboration between universities and industry.

4.62 There were also a number of general and specific suggestions about the role of the state government in fostering collaboration. Specific suggestions included that the state government:

- take a leadership role to ensure the right environment is provided for increased collaboration and innovation;¹⁹⁹
- should 'focus its leveraged research support to bridging the industry-university technology transfer gap and [...] provide support for paid industry internships as well as Industry Fellowships to establish joint appointments between industry and academe';²⁰⁰
- should facilitate the creation of 'forums, education and sector building events and activities to increase opportunities for collaboration and support between these players in the Startup Ecosystem';²⁰¹
- 'continu[e] to invest in the much-discussed interface organisations that sit between the players and innovation';²⁰² and
- 'use its purchasing budget to encourage innovation rather than only purchasing items off the shelf. [...] Where Government directly contributes to research it should insist on SME engagement initiatives and support specific technology transfer activities that involve SMEs'.²⁰³

4.63 These and other suggestions are discussed further in the following chapters of this report where appropriate.

197 Submission No. 21 from Technology and Industry Advisory Council, 2 September 2015, pp 10–11.

198 Professor Peter Klinken, Chief Scientist, Office of Science, Department of the Premier and Cabinet, *Transcript of Evidence*, 11 February 2016, p 8.

199 This was a major theme in the evidence and is discussed in detail in Chapter 9.

200 Submission No. 21 from Technology and Industry Advisory Council, 2 September 2015, p 11.

201 Submission No. 11 from StartupWA, 28 August 2015, p 7.

202 Mr Emmanuel Hondros, Manager, People Strategies, Chamber of Minerals and Energy of Western Australia, *Transcript of Evidence*, 19 April 2016, p 3.

203 Submission No. 28 from Department of Commerce, 9 September 2015, p 14.

4.64 The state government alone cannot meet the challenge of fostering more collaboration. Improvement in this area will require a concerted and collaborative effort by governments at all levels, as well as by universities, industry and associated entities, labour organisations, entrepreneurs, venture capitalists and all other agents in the innovation ecosystem.

4.65 The Committee is aware of the considerable efforts being made in WA to increase collaboration. For example:

- ECU has its Enterprise Tuesday program ‘aimed at looking at small businesses, entrepreneurs, government officials, both state and local, academics, and students, and bring them into the room to talk about the journey of actually establishing a business’;²⁰⁴
- UWA is partnering with industry to create ‘a new collaboration and co-working lounge—a 100m² of space for industry, staff and students to focus on the challenges, ideas and problems associated with ocean engineering. [...] This dedicated space will be located in the new Indian Ocean Marine Research Centre, in the midst of hundreds of research staff and PhDs all working on marine science and ocean engineering; two critical areas of competitive advantage for Western Australia’;²⁰⁵ and
- Resource Innovation and Information Technology (RIIT) engages with industry ‘to understand the kinds of challenges that they have that can be addressed by technology’.²⁰⁶ Those challenges are used as the subject matter for ‘hackathon’ events, at which ‘independent innovators build prototype solutions in a weekend’.²⁰⁷ RIIT advised it was working with Woodside to convene one such ‘hackathon’ during the 2016 LNG18 conference in Perth.²⁰⁸

4.66 The Committee is also aware of the efforts of Innovate Australia, a not-for-profit organisation, that began as a group of passionate and motivated individuals who wanted to ‘assist and proactively promote Australian innovation [...] and] work with industry to bring about innovation, encourage innovation, [and] develop programs and innovation networks’.²⁰⁹ The Committee attended a number of Innovate Australia forums and has seen first-hand the effectiveness of this initiative in bringing people together to build networks that, in turn, foster innovation. Innovate Australia is discussed further in Chapter 6.

204 Dr Darren Gibson, Manager, Collaboration and Innovation, Edith Cowan University, *Transcript of Evidence*, 12 February 2016, p 2.

205 Submission No. 22 from the University of Western Australia, 22 August 2015, p 10.

206 Mr Justin Strharsky, Director, Resource Innovation and Information Technology, *Transcript of Evidence*, 11 February 2016, p 4.

207 *ibid.*

208 *ibid.*, p 10.

209 Innovate Australia, *Services*, np, nd. Available at: <http://www.innovateaustralia.org/#service>. Accessed on 18 May 2016.

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4.67 Despite these efforts, at present the collaboration between universities and industries is still less than it needs to be, particularly at the SME level.

WA:ERA—a model for collaboration

4.68 WA:ERA is widely regarded as a successful collaborative effort in the petroleum resources sector. A joint venture between CSIRO, Curtin University, UWA, Woodside Energy, Chevron Australia and Shell Australia, WA:ERA was established in 2003 with the help of a \$20 million state government grant. This joint venture brings together enormous industry experience in exploration, development and operations, research experience and capability, and professional training and postgraduate research, which together can be leveraged to build the state's innovation capability.²¹⁰ WA:ERA's aim is to 'deliver collaborative research outcomes with real impact', focusing 'on meeting the research and development needs of the oil and gas industry in the areas of offshore infrastructure on the seabed (subsea and pipelines), through the water column (risers) and on the surface (floaters)'.²¹¹

4.69 WA:ERA submitted that 'collaboration between government, universities/CSIRO and business has been a driving force since' it was established,²¹² with joint venture partners seeing enormous benefit to their collaboration. For example, CSIRO's work in WA 'has actually built upon a very strong collaborative relationship with both the university sector and the industry sector that probably started with the Western Australian Energy Research Alliance—WA:ERA—which has been very successful in operation'.²¹³ Shell sees WA:ERA as a facilitator of collaboration between petroleum companies in WA.²¹⁴ Shell encourages collaboration through joint ventures such as WA:ERA because:

*they can see what our challenges are, for the researchers and innovators to respond to our challenges. So, this is for us a very effective mechanism to find out first of all what is the capability—what is out there—but also then to start talking about how we can collaborate together, not necessarily just as Shell and an oil provider, but also as an industry.*²¹⁵

210 Submission No. 12 from Western Australian Energy Research Alliance, 27 August 2015, p 2. See also: *Welcome to WA:ERA*, nd, np. Available at: <http://www.waera.com.au/>. Accessed on 26 April 2016.

211 Western Australian Energy Research Alliance, *Facilities and innovative technologies*, nd, np. Available at: <http://www.waera.com.au/Facilities-and-Innovative-Technologies>. Accessed on 26 April 2016.

212 Submission No. 12 from Western Australian Energy Research Alliance, 27 August 2015, p 2.

213 Dr Alex Wonhas, Executive Director, Energy, Environment and Resources, Commonwealth Scientific and Industrial Research Organisation, *Transcript of Evidence*, 19 April 2016, p 2.

214 Dr Claus Otto, Technology Manager, Shell Australia, *Transcript of Evidence*, 16 March 2016, p 3.

215 *ibid*.

- 4.70 Similarly, Woodside stated that WA:ERA ‘enable[s] a collaboration to occur, and we can align with other people in the industry, so it is a lot more forceful if the whole industry lines up and says that this is the type of research that we look at’.²¹⁶
- 4.71 WA:ERA also provides a catalyst for further collaboration and co-location. For example, ‘the existing relationships between WA:ERA and the petroleum industry provide[d] a significant springboard for the extension of carbon storage research in support of emissions reduction’,²¹⁷ with WA:ERA receiving a Commonwealth Government capital grant of \$48.4 million over 2012–2015 for a National Geosequestration Laboratory (NGL) in Perth.²¹⁸ Officially opened on 22 July 2015, the NGL consists of ‘a gas processing laboratory node at the University of Western Australia, a test well at Curtin University and custom-designed rock characterisation facilities operated by CSIRO at the Australian Resources Research Centre’.²¹⁹ It was ‘established to conduct and deploy critical research and development to enable commercial-scale carbon storage options for Australia’.²²⁰ NGL will also be involved in the education and training of the state’s future petroleum industry workers.
- 4.72 WA:ERA also collaborates with the resources industry more widely, having recently integrated with the National Resource Sciences Precinct (NRSP), with the aim of increasing the state’s capability, as well as providing increased opportunities for oil, gas and resources industries and growing state and national exports.²²¹
- 4.73 Opened in 2014, the NRSP is a collaborative research venture between the CSIRO, Curtin University and UWA, with the Geological Survey of Western Australia (a component within the Department of Mines and Petroleum) formally joining the NRSP in 2016. Part of the NRSP’s aim is to shift the focus of the resources industry ‘from domestic competition to domestic collaboration, so that Australia can become more competitive internationally’.²²² Centred in Perth, and close to the Asian market, the

216 Mr Brian Haggerty, Vice President, Innovation Capability, Woodside Energy Ltd, *Transcript of Evidence*, 16 March 2016, p 3.

217 Western Australian Energy Research Alliance, *National Geosequestration Laboratory*, nd, np. Available at: <http://www.waera.com.au/National-Geosequestration-Laboratory>. Accessed on 26 April 2016.

218 Western Australian Energy Research Alliance, *Welcome to WA:ERA*, nd, np. Available at: <http://www.waera.com.au>. Accessed on 26 April 2016.

219 National Geosequestration Laboratory, *Our facilities*, nd, np. Available at: <http://ngl.org.au/our-facilities>. Accessed on 26 April 2016; and Submission No. 12 from Western Australian Energy Research Alliance, 27 August 2015, p 1.

220 National Geosequestration Laboratory, *About NGL*, nd, np. Available at: <http://ngl.org.au/about-ngl>. Accessed on 26 April 2016.

221 National Resources Sciences Precinct, Media Release, *WA:ERA & NRSP join forces to boost research capability and impact*, 1 February 2016, np. Available at: <http://www.nrsp.com.au/news/media-release/>. Accessed on 26 April 2016. WA:ERA and NRSP will have a single CEO and Chairperson.

222 National Resources Sciences Precinct, *About NRSP*, nd, np. Available at: <http://www.nrsp.com.au/about-nrsp>. Accessed on 26 April 2016.

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NRSP can take advantage of the concentration of multinational resource companies and world-recognised research capabilities in the region.²²³

4.74

It has also been announced that the Australian Energy Resources Growth Centre, trading as National Energy Resources Australia (NERA) will be co-located with WA:ERA and the CSIRO in the Australian Resources Research Centre (ARRC) building at Curtin University.²²⁴ This will allow further linkages across ‘the oil and gas industry, the coal industry and the uranium industry to find some of the opportunities there’.²²⁵ WA:ERA industry partners were generally supportive of the location of NERA in close proximity to WA:ERA.²²⁶ However, as Chevron noted, there is ‘a lot of overlap’ between NERA, WA:ERA, APPEA and the Institute of Engineers, with each having ‘quite broad’ terms of reference.²²⁷ This makes effective and open communication even more important, not only to enhance ‘cross-learning with other industries’,²²⁸ but also to avoid duplication and the possible inefficient allocation of resources.

Finding 4

WA:ERA is a collaborative model that could possibly be utilised in other sectors of the economy.

Recommendation 2

The Western Australian Government explores the WA:ERA model, as well as those in other jurisdictions, as the basis for collaborative frameworks across the economy.

223 *ibid.*

224 Submission No. 27 from Chamber of Minerals and Energy of Western Australia, 9 September 2015, p 2.

225 Mr Stedman Ellis, Chief Operating Officer, Western Region, Australian Petroleum Production and Exploration Association, *Transcript of Evidence*, 19 April 2016, pp 3–4.

226 See, for example: Mr Stedman Ellis, Chief Operating Officer, Western Region, Australian Petroleum Production and Exploration Association, *Transcript of Evidence*, 19 April 2016, p 8; and Dr Claus Otto, Technology Manager, Shell Australia, *Transcript of Evidence*, 16 March 2016, p 2 and p 3.

227 Mr Mark Titley, Global Technology Centre Manager, Chevron Australia, 6 April 2016, p 7.

228 *ibid.*

Chapter 5

Investing in Innovation

Ideas need capital

- 5.1 Innovation does not automatically lead to the creation of value—implementing a new or improved product, process or service needs investment. For this reason, just as collaboration is a key element of any healthy innovation ecosystem, so too is the availability of capital.
- 5.2 Investment in innovation can be divided into two broad categories. First, there is investment in research and development, which is largely aimed at developing (and to some extent refining) new innovative ideas through scientific research. Second, there is the investment required to bring innovative ideas to market, which is commonly referred to as the process of commercialisation.
- 5.3 In a flourishing innovation ecosystem, capital will be allocated for research and development, and for commercialisation. It is therefore useful to consider each investment phase separately.

Investment in research and development

- 5.4 Though there are many different sources of innovation, it is investment in research and development (R&D) that drives the development of new technologies.²²⁹ When new technologies are devised, the impact is often vast—as American Economist Michael Porter has observed:

*[t]echnological change can create new possibilities for the design of a product, the way it is marketed, produced, or delivered, and the ancillary services provided. It is the most common precursor of strategic innovation. Industries are born when technological change makes a new product feasible.*²³⁰

- 5.5 In essence, investment in R&D represents an investment in the development of the products, processes and services of the future. So intrinsic is the link between R&D and innovation that the Commonwealth Government's 'R&D Tax Incentive'—through which

229 To avoid excessive repetition, the term 'technologies' in this chapter also includes processes and services, which also require investment.

230 Porter, Michael, *The competitive advantage of nations*, Macmillan, London, 1990, pp 46–47.

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businesses are offered a tax offset to encourage investment in R&D—is simply described as a program ‘to support Australian companies to be more innovative, productive and competitive in the global marketplace’.²³¹ More pointedly, the Technology and Industry Advisory Council (TIAC) submitted that:

*[t]he development and application of [technology and innovation] to address community issues and generate business opportunities has created the modern and comfortable lifestyles we currently enjoy.*²³²

5.6 TIAC also submitted that ‘Western Australia performs well, when compared to other states, in respect to research and innovation activities’, citing data from the Australian Bureau of Statistics (ABS) to support this assertion.²³³ According to TIAC, ‘the total value of all R&D [in WA is] estimated to be \$4.5 billion’.²³⁴

Setting a target

5.7 While \$4.5 billion is obviously a significant figure, it is impossible to specify whether it represents an appropriate figure. Instead, R&D investment as a percentage of gross production is a useful metric for policy development in this area. The most recent figures published by the Organisation for Economic Co-operation and Development (OECD) indicate that the average investment in R&D by OECD member nations in 2014 represented 2.37 per cent of those nations’ gross domestic product.²³⁵ Furthermore, global leaders in this metric are widely recognised as being among the world’s leading innovators. The R&D investment as a percentage of GDP for the top 10 nations is provided in Table 5.1.

231 Department of Industry, Innovation and Science, *Innovation and R&D*. Available at: <http://www.business.gov.au/grants-and-assistance/innovation-rd/Pages/default.aspx>. Accessed on 5 May 2016.

232 Submission No. 21 from Technology and Industry Advisory Council, 31 August 2015, p 1.

233 *ibid*, p 2.

234 *ibid*.

235 Organisation for Economic Co-operation and Development, *Gross domestic spending on R&D*. Available at: <https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm>. Accessed on 4 May 2016.

Table 5.1: Gross domestic spending on R&D (2014)—the top ten²³⁶

Nation	R&D investment (percentage of GDP)
South Korea	4.292
Israel	4.109
Japan	3.583
Finland	3.174
Sweden	3.161
Denmark	3.051
Chinese Taipei	3.006
Austria	3.001*
Switzerland	2.967*
Germany	2.842
OECD average	2.371

* data for Austria is from 2015; data from Switzerland is from 2012.

5.8 In Western Australia (WA), the estimated \$4.5 billion R&D investment represents about 1.8 per cent of gross state product.²³⁷ This suggests that there is room for more R&D investment by businesses, government and research institutions in Western Australia (WA). For WA to be recognised as a state of innovation, an R&D investment goal of at least three per cent of gross state product would place the state in the same territory as the global top 10.

Finding 5

The estimated R&D expenditure across the Western Australian economy is approximately 1.8 per cent of gross state product, which is low relative to the world's top ten nations.

Recommendation 3

The Western Australian Government sets an aspirational target for R&D investment across the economy of three per cent of gross state product, and monitor and report on progress in reaching this goal.

5.9 Setting such a goal would, however, require a better understanding of the annual value of R&D investment in WA.

Measuring success

5.10 ABS statistics on R&D investment around Australia are based on responses to surveys of sampled Australian businesses, government and non-profit entities, and institutions

236 *ibid.*

237 This assumes that the \$4.5 billion figure cited by TIAC occurred in one of that past five financial years—a period in which WA's mean annual gross state product has been \$244 billion.

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of higher education.²³⁸ As each sector is surveyed separately and at different times, however, it is effectively impossible to determine Australian R&D investment figures for specific years—for example, while data for business R&D investment is available for 2011–2012 and 2013–2014,²³⁹ data for government R&D investment is available for 2012–2013.²⁴⁰

5.11 Furthermore, where almost all other OECD members survey R&D expenditure annually, in Australia the surveys are conducted biannually. While gathering data is costly, the most recent data for business R&D investment in WA highlights the problem with biannual surveying. Where WA businesses expended almost \$3.6 billion on R&D in 2011–2012, by 2013–2014 this figure had dropped to just \$2.7 billion—a 25 per cent decline.²⁴¹ It is clearly difficult to form (and, more pointedly, measure the impact of) policies aimed at stimulating R&D investment when data on this investment is both infrequent and subject to such significant fluctuation. More regular and frequent data collection would provide more reliable data, which, in turn, could be used by government to set and measure policy objectives, and by industry to measure the return on R&D investment.

Finding 6

Data on Western Australian Government R&D investment is incomplete and not easily accessible.

5.12 It is also difficult to understand why ABS data on R&D investment is based upon surveys, when actual R&D investment data must be provided to the Australian Tax Office by any business seeking to take advantage of the ‘R&D Tax Incentive’. Plainly, data on the actual amount of expenditure claimed as R&D investment by businesses in Australia should be available.

5.13 Being able to better quantify the link between R&D investment and the return on that investment is critical. While it is clear that this investment can generate substantial returns, it is by its very nature extremely speculative. It can be easy for businesses to find reasons not to invest in R&D—especially during times of economic downturn. With businesses being the source of significantly more R&D investment than any other sector, government must create an environment in which R&D is pursued irrespective

238 Australian Bureau of Statistics, *Research and experimental development, businesses, Australia, 2013–14, Explanatory notes* (Cat. No. 8104.0), 4 September 2015. The survey is based on the OECD definition of R&D.

239 Australian Bureau of Statistics, *Research and experimental development, businesses, Australia, 2013–14* (Cat. No. 8104.0), 4 September 2015. In 2013, when Australia last provided data to the OECD, it ranked 14th with R&D investment equivalent to 2.114 per cent of GDP. See Organisation for Economic Co-operation and Development, *Gross domestic spending on R&D*. Available at: <https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm>. Accessed on 4 May 2016.

240 Australian Bureau of Statistics, *Research and experimental development, government and private non-profit organisations, Australia, 2012–13* (Cat. No. 8104.0), 9 July 2014.

241 *ibid.*

of the prevailing economic circumstances. Creating such an environment requires a better understanding of which businesses actually invest in R&D, what they are investing in, and ultimately the outcomes of that investment.

The current (estimated) state of play

5.14 At present the data compiled and published by the ABS represents the best available estimate of R&D investment in WA. The most recently published data indicates that:

- Businesses invested \$2.7 billion in R&D in 2013–2014;²⁴²
- Commonwealth Government investment totalled \$117 million in 2012–2013;²⁴³
- University R&D expenditure totalled \$845 million in 2012;²⁴⁴ and
- State government investment totalled \$128 million in 2012–2013.²⁴⁵

5.15 Rather than the figures themselves, it is the trend in R&D investment—especially in relation to the performance of the state economy—that offers the most insight. As Figure 5.1 below highlights, growth in the WA economy over the past 25 years has been largely reflected in growth in R&D investment by businesses, universities and the Commonwealth Government. State government R&D investment exhibited almost no growth over this time period.

242 Australian Bureau of Statistics, *Research and Experimental Development, Businesses, Australia, 2013-14* (Cat. No. 8104.0), 4 September 2015. See also Submission No. 28 from the Department of Commerce.

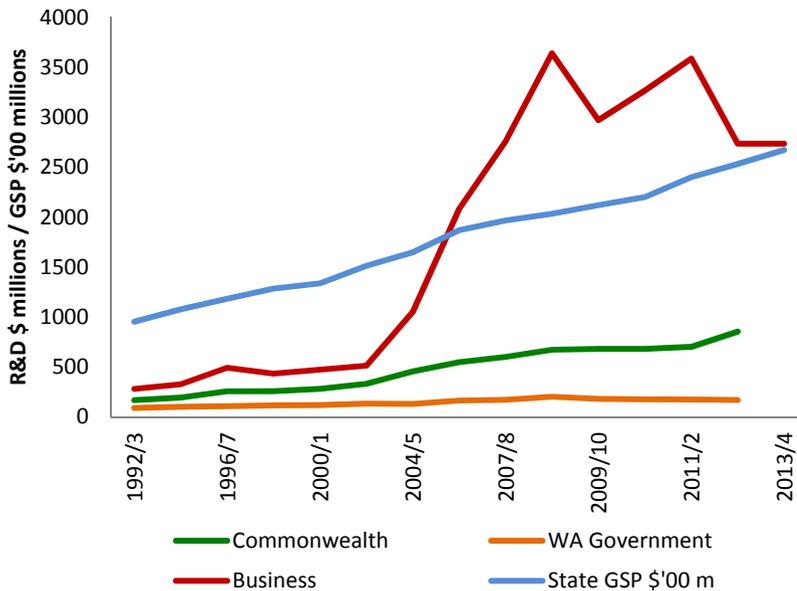
243 Australian Bureau of Statistics, *Research and experimental development, government and private non-profit organisations, Australia, 2012–13*, (Cat. No. 8111.0), 9 Jul 2014.

244 Australian Bureau of Statistics, *Research and experimental development, higher education organisations, Australia, 2012* (Cat. No. 8111.0), 20 May 2014.

245 Australian Bureau of Statistics, *Research and experimental development, government and private non-profit organisations, Australia, 2012–13* (Cat. No. 8111.0), 9 Jul 2014.

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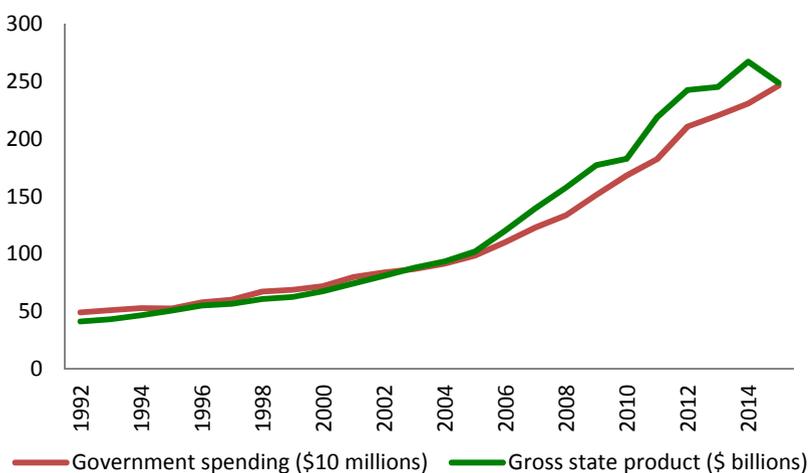
Figure 5.1: R&D investment in Western Australia, relative to gross state product²⁴⁶



5.16

In interpreting the plateau in R&D investment by the Western Australian Government, it must be recognised that the manner in which government functions are discharged in WA has changed markedly over the past 25 years. It is equally true, however, that state government spending in WA²⁴⁷ has largely kept pace with the growth of the economy as a whole over this period, as demonstrated by Figure 5.2:

Figure 5.2: Growth in the Western Australian economy and Western Australian government spending²⁴⁸



246 Submission No. 28b from the Department of Commerce, 6 May 2016.

247 Statistics compiled by the ABS on state government spending are also inclusive of local government spending.

248 Australian Bureau of Statistics, *Australian National Accounts: State Accounts, Table 6. Expenditure, Income and Industry Components of Gross State Product, Western Australia, Chain volume measures and current prices* (Cat. No. 5220.0).

5.17 Notwithstanding concerns about the R&D investment data, it serves to show that R&D investment by the Western Australian Government has not kept pace with the growth of the state economy, or of the government itself.

What can the Western Australian Government do?

5.18 In Australia, R&D investment is primarily supported by the Commonwealth Government. Commonwealth grants are the main source of funding for universities and research institutions, and because corporate tax is a federal responsibility, it is the Commonwealth Government that is best able to incentivise R&D investment by businesses through tax relief. Most notably, the Commonwealth ‘R&D Tax Incentive’ seeks to encourage business R&D investment by effectively offering a subsidy in the vicinity of 10 to 15 per cent for businesses to undertake R&D investment.²⁴⁹

5.19 By contrast, the ability of the Western Australian Government to incentivise business R&D investment is constrained by the fact that state governments are limited in their ability to tax businesses in the first place. In essence, the state government is unable to provide revenue-side R&D investment incentives.²⁵⁰

Finding 7

The Western Australian Government has limited capacity to encourage R&D investment through taxation measures.

5.20 Where the Western Australian Government can—and does—impact upon R&D investment is through its own expenditure. Although there has been very little growth in government R&D investment in WA over the past 25 years, \$128 million was invested by state government entities in R&D during 2012–2013.²⁵¹

5.21 Increasing its own direct R&D investment is something that the state government could do to stimulate and encourage innovation in WA. More importantly, the Western Australian Government needs to ensure that its own direct R&D investment is strategic, with the goal of maximising the overall return generated by this investment.

249 Although this is ultimately how the R&D Tax Incentive operates, because it is a tax offset arriving at this outcome is a complex process. See Department of Industry, Innovation and Science, *R&D tax incentive*. Available at: <http://www.business.gov.au/grants-and-assistance/innovation-rd/RD-TaxIncentive/Pages/default.aspx>. Accessed on 8 May 2016.

250 The state government does levy payroll tax, but because it is both relatively small and simple, it would be impractical to offer payroll tax concessions as a way to incentivise R&D.

251 Australian Bureau of Statistics, *Research and experimental development, government and private non-profit organisations, Australia, 2012–13* (Cat. No. 8111.0), 9 Jul 2014.

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5.22 TIAC submitted that this could be achieved through the state government identifying R&D investment opportunities where its own funding will function as a catalyst for further investment by business and the Commonwealth Government.²⁵² According to TIAC:

rather than the State Government providing a lump sum grant to a research group that is applying for, and subsequently awarded, a substantial Commonwealth grant, the State government could direct funds to specific support activities such as:

- *Pre-application funding and practical support for the Business case preparation*
 - *Access to Government information*
 - *Support to engage with industry*
 - *Identification of end-user priority research areas*
 - *Intellectual Property strategy*
- *Research organisation operational support*
 - *Funding for a business development manager*
 - *IP protection support funding*
- *Technology Transfer*
 - *Promotion of opportunities through investor networks*

*This approach would enable the State to better capture the potential benefits that flow from the Commonwealth's investment in research in Western Australia.*²⁵³

5.23 A useful starting point for any such government R&D investment strategy would be the state's *Science statement*, launched by the Premier and Minister for Science, Hon Colin Barnett MLA, on 21 April 2015. The statement identifies five specific areas 'in which the advancement and application of science can help broaden the economy and create a new generation of jobs'.²⁵⁴ The *Science statement* is discussed in Chapter 8.

5.24 In determining appropriate and strategic targets for public R&D investment, it is also important that government has a clear understanding of what R&D investment activities are being undertaken by businesses. This will help to ensure that private research initiatives are complemented, and not simply duplicated, and that

252 Submission No. 21 from Technology and Industry Advisory Council, 31 August 2015, p 7.

253 Submission No. 21 from Technology and Industry Advisory Council, 31 August 2015, p 7.

254 Office of Science, *Science statement*, 5 May 2016. Available at: <https://www.dpc.wa.gov.au/science/ScienceStatement/Pages/default.aspx>. Accessed on 16 May 2016.

government funding will be directed to research that the state has an interest in, even if the market does not.

Recommendation 4

The Western Australian Government ensures that it is not investing in R&D that could be or is being conducted by industry or other institutions

- 5.25 The importance of using state funds in a strategic manner was also emphasised by Professor Peter Gray and Mr Bob McCarthy AM of the Australian Institute for Bioengineering and Nanotechnology (AIBN), who advised that the AIBN is one of five new university facilities constructed at various campuses in Brisbane as part of the ‘Smart State’ initiative, which commenced in 2003. The initial \$75 million in funding for the AIBN infrastructure came in equal parts from the Queensland Government, the University of Queensland, and a wealthy benefactor.²⁵⁵
- 5.26 Subsequent to this initial amount, the AIBN has received a further \$61 million in research funding, just \$13 million of which has come from the state government. Today the AIBN employs some 500 research scientists, and is widely regarded as one of the world’s premier bioengineering and nanotechnology research institutes, with particular expertise in the emerging field of biologics.²⁵⁶ The success of the AIBN demonstrates how a state government can stimulate R&D investment. By making a targeted investment in an emerging field of science, the Queensland Government was able to attract larger funding commitments from elsewhere, and become home to a world-leading research institute.
- 5.27 It is also important to recognise that state government money can be allocated on a more reliable basis than grant funding, and thus used to remove an element of uncertainty from the operations of research institutes. This point was made during a site visit to the Harry Perkins Institute of Medical Research. Founded in 2003 as the Western Australian Institute for Medical Research, the Harry Perkins Institute is today one of the world’s premier medical research institutes. Within the Institute, teams of doctors, scientists, biostatisticians and pathologists work together to discover new medical technologies and translate these discoveries into more effective treatments and cures.²⁵⁷
- 5.28 According to the Chief Operating Officer of the Harry Perkins Institute, Mr John Fitzgerald, one of the most difficult challenges faced by all research institutes is the fact that research is undertaken (and funded, primarily through Commonwealth grants) on

255 Professor Peter Gray and Mr Bob McCarthy AM, Directors, Australian Institute of Bioengineering & Nanotechnology, *Briefing*, 4 November 2015.

256 Further information about the AIBN is available at: <http://www.aibn.uq.edu.au/>.

257 Harry Perkins Institute of Medical Research, *Welcome to the Perkins*. Available at: <https://www.perkins.org.au/about-us/>. Accessed on 8 May 2016.

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a project-by-project basis. Mr Fitzgerald explained that while there is clear merit to this funding model, the process of obtaining grant funding can be a difficult distraction, particularly where that funding is relied upon not just to pursue specific research projects, but also for meeting the underlying operating expenses of the institute in question.²⁵⁸

- 5.29 It is clear that institutes like the Harry Perkins Institute require funds to meet essential operating expenses. Rather than providing grant funding to match (or indeed, compete with) the Commonwealth Government, there would be value in the Western Australian Government helping the many valuable research institutions in WA meet their underlying operating expenses. Doing so would permit WA-based researchers to devote more of their efforts to the research process, and thus offer an opportunity for the state government to help WA become a state of innovation with a relatively modest investment.

Recommendation 5

The Western Australian Government develops an R&D funding strategy to better direct funding to where it will have most impact and function as a catalyst for further investment by business and/or the federal government.

Venture capital—money and mentoring

- 5.30 Every bit as important as investment in R&D is the investment required to take an idea to market. Capital is fundamental to commercial success: put simply, growing a business—whether that means expanding the operations of an existing business, or taking a new idea to market for the first time—costs money. Largely (though not entirely) for this reason, the ability for entrepreneurs to access and raise capital is a key component of any healthy innovation ecosystem.
- 5.31 Before an innovative product, service or process can generate value, it must be brought to (or brought to bear upon) the market. The process, which is generally referred to as commercialisation, requires long-term investment—in Australia, commercialisation investments have an average five to seven-year period before any potential return is realised, which is considerably longer than the average 1.2 year holding period of shares listed on the Australian Stock Exchange.²⁵⁹ Furthermore, though commercialisation investors ‘place long term growth in value ahead of short term profit considerations’, the impossibility of knowing in advance how the market will respond

258 Mr John Fitzgerald, Chief Operating Officer, Harry Perkins Institute of Medical Research, *Briefing*, 18 April 2016.

259 Australian Private Equity & Venture Capital Association, *Private equity and venture capital explained*, April 2015, p 3. Available at: <http://www.avcal.com.au/documents/item/47>. Accessed on 3 May 2016.

to an innovative product, process or service means that commercialisation represents a high-risk class of investment.²⁶⁰

- 5.32 Commercialisation investment is generally classified under the umbrella term of ‘venture capital’. Venture capital can be further divided into different investment classes, based on such things as the maturity of the destination business, the objective of the investment and, of course, its total value. Importantly, all venture capital is equity finance, which means that money is only part of the investment equation. By taking an equity stake in a commercialisation investment, investors also bring their skills to bear upon the business development process. The Chief Executive Officer of the Australian Private Equity & Venture Capital Association (AVCAL), Mr Yasser El-Ansary, characterised the role of a venture capital investor as someone who would invest money in a business, and also ‘roll their sleeves up’ and work with the business in pursuit of a mutually beneficial outcome.²⁶¹ South Australia’s Chief Scientist, Dr Leanna Read, described venture capital as an investment of both ‘money and mentoring’.²⁶²

Finding 8

Venture capital is not just money—it consists of both money and mentoring.

- 5.33 How much money and mentoring is needed for a particular commercialisation effort depends upon a variety of different factors. AVCAL makes a distinction between venture capital and private equity investment, by explaining that:

*[private equity] and [venture capital] firms provide capital to companies to make those businesses more valuable. These companies are at different stages of growth, from an early concept with high commercial potential or a company in need of capital to expand, to distressed businesses in need of a turnaround or publicly-listed companies.*²⁶³

- 5.34 Noting that there are ‘areas of overlap’, AVCAL further explains that venture capital ‘usually invests in early stage firms and [private equity] generally invests in growth/expansion and buyout stages’.²⁶⁴ It is also important to distinguish between venture capital and the seed capital (often provided by ‘angel investors’ and thus referred to as ‘angel investment’) to enable a company to form and begin operations in

260 *ibid.*

261 Mr Yasser El-Ansary, Chief Executive Officer, Australian Private Equity & Venture Capital Association, *Briefing*, 2 November 2015.

262 Dr Leanna Read, Chief Scientist of South Australia, *Briefing*, 28 October 2015.

263 Australian Private Equity & Venture Capital Association, *Private equity and venture capital explained*, April 2015, p 2. Available at: <http://www.avcal.com.au/documents/item/47>. Accessed on 3 May 2016.

264 *ibid.*

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pursuit of a commercialisation objective. To appreciate this distinction, it is useful to outline the distinct characteristics of angel investment, venture capital and private equity.

Angel investment

- 5.35 The first steps in commercialising new research are generally small in scope, involving such things as establishing a business, developing and testing a prototype and identifying a customer base. This phase of business development, while certainly costly (especially in respect of a business that has no immediate revenue stream), usually involves smaller levels of investment than subsequent phases. Often referred to as ‘start-ups’, businesses at this early stage are generally self-financing or obtain funds from ‘family, friends and fools’. When external capital is sought, businesses generally seek to obtain seed capital from ‘angel investors’, who are often high net worth individuals, but whose individual investments (whether done alone or as part of a group) are much smaller than those typically made by venture capital and private equity fund managers. According to Mr El-Ansary, \$5 million is typically the investment ceiling for angel investment.²⁶⁵
- 5.36 The expertise of angel investors is also largely specific to their space within the commercialisation chain. Because they invest at such an early stage, angel investors often assist entrepreneurs to develop a business plan, and to understand the regulatory requirements and initial financial commitments associated with getting a new company started. The importance of this expertise was referred to by Mr Michael Dickson of the Department of Commerce, who explained that the Department is ‘supporting and working with Angel Investors networks... to improve the quality of the commercial outcomes’.²⁶⁶
- 5.37 Though angel investors have existed for many years in WA, a formal group of angel investors—Western Australian Angel Investors—was only established in 2010. With a mission ‘to facilitate the efficient sourcing and allocation of incubation and early-stage investment capital for investment-ready opportunities in WA’, the group aims to provide quality investment opportunities for professional angel investors by working to strengthen the network between entrepreneurs and investors in Western Australia.²⁶⁷

Venture capital

- 5.38 Although the term ‘venture capital’ is often used to refer to all funding made available for commercialisation, it perhaps best describes investment ‘in early stage companies

265 Mr Yasser El-Ansary, Chief Executive Officer, Australian Private Equity & Venture Capital Association, *Briefing*, 2 November 2015.

266 Mr Michael Dickson, Public Servant, Department of Commerce, *Transcript of Evidence*, 16 March 2016, p 9.

267 Western Australian Angel Investors, *Welcome to the WA Angel Investors!*. Available at: <http://www.waai.net.au/>. Accessed on 5 May 2016.

that are developing new and innovative technologies, therapies, systems and processes.²⁶⁸ In providing capital and commercialisation skills to companies that are generally at the early development phase, venture capital investments typically take longer to mature and have a higher risk and return profile than investments made later in the commercialisation chain. Venture capital is distinguished from angel investment in that it is larger in scope and sum, and thus managed under fund-type arrangements. Like angel investors, venture capitalists do not generally use debt in their transactions.

- 5.39 AVCAL estimated that there are 37 venture capital firms, managing one or more venture capital funds, operating in Australia. Yuuwa Capital is understood to be the only such firm based in Western Australia.²⁶⁹ Although there is no precise minimum quantity of capital managed in a single venture capital fund, it should be noted a fund has to manage at least \$10 million in order to be registered with AusIndustry as an ‘Early Stage Venture Capital Limited Partnership’.²⁷⁰ According to Mr El-Ansary, most venture capital funds would manage at least \$20 million.²⁷¹

Finding 9

There is possibly only one venture capital firm based in Western Australia.

- 5.40 Venture capital is ordinarily invested into businesses that are established, but need an injection of capital to fund the implementation of some new innovation. Rather than benefitting from expertise and advice about turning an idea into a business, these companies benefit from mentorship on the process of identifying and supplying a market with a new product or service, and on managing the challenges associated with rapid business expansion. As such, AVCAL noted that ‘[m]any venture capitalists come to the industry from successful careers as scientists, engineers, doctors or entrepreneurs’.²⁷² That is, venture capital often comes from successful past innovators—people whose advice on generating value from innovation is invaluable.

Private equity

- 5.41 Private equity can be conceptualised as late-stage venture capital, which is typically aimed at helping an established business expand its operations into new markets. In

268 Australian Private Equity & Venture Capital Association, *Private equity and venture capital explained*, April 2015, p 3. Available at: <http://www.avcal.com.au/documents/item/47>. Accessed on 3 May 2016.

269 Mr Kosta Sinelnikov, Australian Private Equity & Venture Capital Association, Electronic Mail, 11 December 2015.

270 Department of Industry, Innovation and Science, *Early stage venture capital limited partnerships (ESVCLP)*. Available at: <http://www.business.gov.au/grants-and-assistance/venture-capital/esvclp/Pages/default.aspx>. Accessed on 5 May 2016.

271 Mr Yasser El-Ansary, Chief Executive Officer, Australian Private Equity & Venture Capital Association, *Briefing*, 2 November 2015.

272 Australian Private Equity & Venture Capital Association, *Private equity and venture capital explained*, April 2015, p 3. Available at: <http://www.avcal.com.au/documents/item/47>. Accessed on 3 May 2016.

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Australia, almost all private equity arrives through institutional funds, which seek to buy into and unlock the high growth potential of targeted established businesses.²⁷³

5.42 According to AVCAL, private equity has the greatest impact with companies that require such things as expansion capital, greater management attention, particular strategic direction and turnaround capabilities, succession planning, the capability to acquire similar businesses and merging with existing investments, or the ability to acquire and consolidate a number of businesses within a fragmented market.²⁷⁴ Private equity acquisitions are typically financed with a combination of equity and debt.

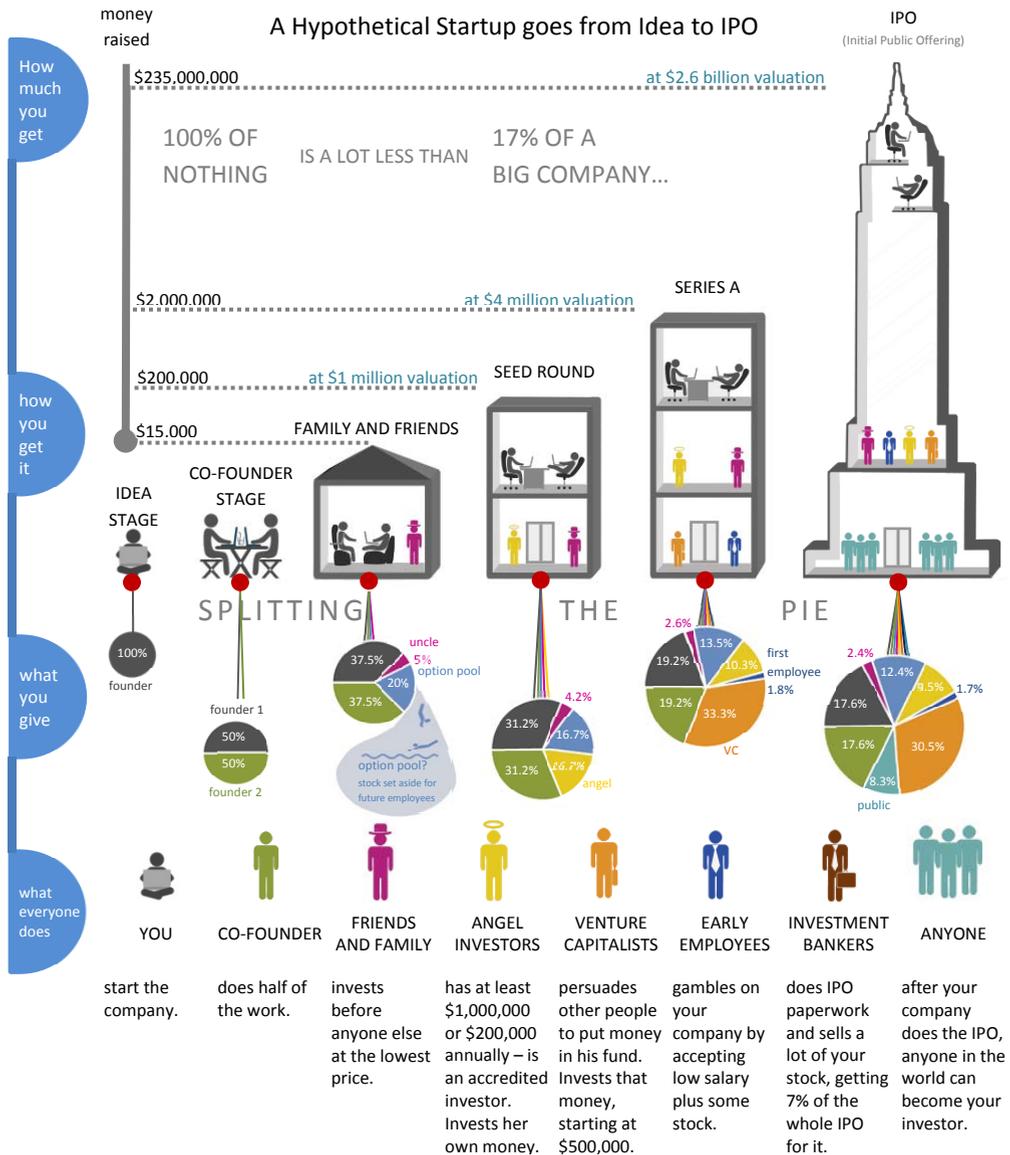
The start-up funding journey

5.43 The typical funding journey for a start-up business is illustrated in Figure 5.3.

273 *ibid.*

274 *ibid.*

Figure 5.3: How start-up funding works²⁷⁵



275 Anne Vital, Funders and Founders, *How funding works—Splitting the equity pie with investors*, 9 May 2013. Available at: <http://fundersandfounders.com/how-funding-works-splitting-equity/>. Accessed on 9 May 2016.

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5.44

The commercialisation journey was also recently exemplified in WA by the establishment, growth and ultimate acquisition of resources technology firm Scanalyse.

Scanalyse²⁷⁶

Scanalyse was a company formed in 2005 to commercialise a suite of products that were developed from research into 3D laser scanning undertaken collaboratively between staff at Curtin University and the Cooperative Research Centre for Spatial Information.

Scanalyse's 'MillMapper' invention involved using laser scanning technology to provide in-situ monitoring of wear on equipment used in mining and mineral processing applications. MillMapper can quickly and accurately measure wear in the metal linings of giant mills used to grind ores in the precious metals industry. It enables maintenance and operational personnel to extend liner life cycles, optimise liner design, prevent liner failures, optimise throughput and improve mill performance. It also improves worker safety by eliminating the need for confined space entry and physical inspection. A second product—'CrusherMapper'—uses similar technology to provide forecasting and wear rate modelling on gyratory crusher mantles and concave liners.

By enabling more efficient maintenance of expensive mining equipment and lessening the need to undertake overhaul maintenance, it was quickly recognised that these products could help the global mining industry to operate more safely, as well as save millions of dollars in downtime. As a result, Mr Peter Clarke and his team at Scanalyse won the 2007 WA Inventor of the Year award, which helped to raise the profile of the company, and enabled it to raise some \$1 million of funding through 2008.

Scanalyse subsequently received more than \$1.5 million in Commercialisation Australia grants to enable it to roll its products out to the marketplace. By 2013, the company's 36 Perth-based employees were serving more than 50 major mining clients around the world (including Alcoa and BHP Billiton), generating more than \$10 million in annual turnover.

Scanalyse was acquired by Finnish minerals and metals processing technology and services supplier Outotec in March 2013 for an undisclosed sum. In Australia, Outotec operates across nine office locations, three of which are located in Western Australia.

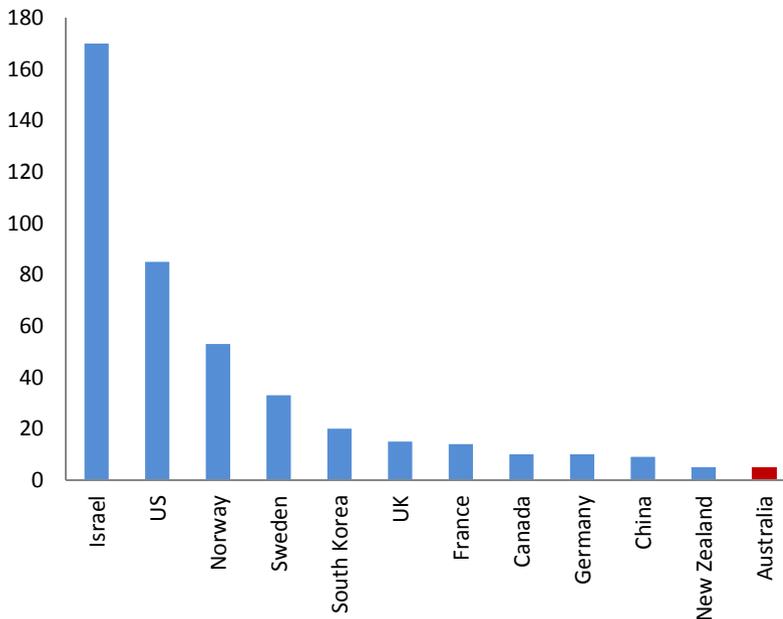
276 See Department of Commerce, *The high-tech minnow that became a global mining services leader*. Available at: <https://www.commerce.wa.gov.au/sites/default/files/atoms/files/scanalyse.pdf>. Accessed on 16 May 2016; Curtin University, *Curtin spin out company Scanalyse acquired by Outotec*, 5 March 2013. Available at: <http://news.curtin.edu.au/media-releases/curtin-spin-out-company-scanalyse-acquired-by-outotec/>. Accessed on 16 May 2016; Austmine, *Scanalyse awarded two major grants*. Available at: <http://www.austmine.com.au/News/articleType/ArticleView/articleId/1316/Scanalyse-Awarded-Two-Major-Grants>. Accessed on 16 May 2016; and Outotec, *Outotec completes the acquisition of Scanalyse in Australia*, 19 March 2013. Available at: <http://www.outotec.com/en/Media/News/2013/Outotec-completes-the-acquisition-of-Scanalyse-in-Australia/>. Accessed on 16 May 2016.

Structural challenges

5.45 In light of the importance of capital in stimulating innovation, it is perhaps unsurprising that the availability of capital (or the purported lack thereof, particularly for commercialisation) was a topic of frequent discussion throughout this Inquiry. Citing the 2015 *Crossroads* report by entrepreneur advocacy group StartupAUS, Resource Innovation and Information Technology (RIIT) submitted that '[i]n Australia, only \$4.50 per capita in start-up capital is available to startups, compared to \$120 in Israel, \$85 in the US, \$20 in South Korea and \$15 in the UK'.²⁷⁷

5.46 The figures cited by RIIT were extracted from the 2014 *Crossroads* report, published by StartupAus, in which Australian per capital venture capital investment was unfavourably compared with 11 other nations, as illustrated in Figure 5.4:

Figure 5.4: Venture capital investment per capita (\$US)²⁷⁸



5.47 This was echoed by StartupWA Director, Ms Sheryl Frame, who explained that:

there are a number of areas where these entrepreneurs are struggling. The initial funding is very difficult to come by. There is a lot of money and even with the new announcement from the federal government there is money being put into the research side of things, so it is not at that stage that they are struggling. But once they get to be able to build a prototype, and sometimes even to build that initial prototype,

277 Submission No. 9 from Resource Innovation & Information Technology, 27 August 2016, p 5.

278 StartupAus, *Crossroads*, April 2014, p 48. Available at: <http://startupaus.org/wp-content/uploads/2014/04/StartupAUS-Crossroads-report-FINAL.pdf>. Accessed on 17 June 2016.

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*funding is very lacking and they are unable to attract any sort of investment... More funding is needed right at that very early seed stage.*²⁷⁹

5.48 In qualifying her evidence on this point, Ms Frame provided important insight into the value of mentorship by explaining that ‘another challenge that we face in WA... is that many of the private investors... understand mining [but] we need to educate them in how to invest in other segments of the economy’.²⁸⁰ This view was also supported by the Directors of RIIT, Mr Zane Prickett and Mr Justin Strharsky. According to Mr Strharsky:

*[t]here happens to be a lot of capital in this state, and right now that money is not flowing into resources exploration projects. That money probably wants to go into diversifying its opportunity for return, in particular in investments in technology.*²⁸¹

5.49 Mr Prickett agreed with this view, adding that:

*[t]he risk capital is here [in Perth]... The challenge is that we have been doing the exploration funnel and the geology funnel for decades, so there are tonnes of great players, and they understand the [resources] market, and it is a very simple equation for them to manage... There is a whole bit of education that has to go on and support to get that going in the technology space.*²⁸²

Finding 10

Western Australian investors generally understand investment in the resources sector, but need to be better informed as to how to invest in other sectors of the economy.

5.50 This was also supported by WA’s Chief Scientist, Professor Peter Klinken, who expressed the view that, in order for the state’s innovation ecosystem to flourish:

[t]he financial environment has to be improved. Local investors in Western Australia are very comfortable understanding risk when it pertains to resources, minerals, oil and gas; they have a real problem understanding the risk associated with other areas—IT, life sciences

279 Ms Sheryl Frame, Director, StartupWA, *Transcript of Evidence*, 11 February 2016, p 2.

280 *ibid*, p 5.

281 Mr Justin Strharsky, Director, Resource Innovation & Information Technology, *Transcript of Evidence*, 11 February 2016, p 6.

282 Mr Zane Prickett, Director, Resource Innovation & Information Technology, *Transcript of Evidence*, 11 February 2016, p 6.

*and so on. There is an education process that needs to happen in that regard.*²⁸³

5.51 In essence, each of these observations highlighted the need to promote stronger links between agents, resources and human capital within WA's innovation ecosystem as described in Chapter 3.

5.52 A further structural problem was highlighted by TIAC, which submitted that:

*Australia has a large corporate finance sector that is risk averse and not structured to finance, support and encourage research commercialisation... currently in Australia, to finance an innovation, the entrepreneur often needs to put a house ownership and family security on the line. Is this realistic and optimum, or does it scare entrepreneurs away and reinforce the negative image of failure?*²⁸⁴

5.53 TIAC's submission raised an important point that was further emphasised by the directors of numerous successful SMEs: Australia's banks will simply not provide loans secured solely against business assets. Unless directors agree to use their personal (real) property as security (and thereby relinquish the key benefit of incorporation), debt financing is largely unavailable to Australian SMEs.²⁸⁵

Finding 11

As banks will generally not provide loans secured solely against business assets, SMEs in particular experience significant difficulty in obtaining debt financing.

5.54 A number of these points were echoed by the observation by the Department of Commerce that:

[v]enture Capitalists and other commercialisation investors seek scale and choice. The small size of WA's commercialisation sector means that there is a lack of scale in the innovation pipeline and consistency of access to new ideas. Venture funding organisations do not see sufficient opportunities to invest in dedicated commercialisation funding vehicles in WA. [...]

283 Professor Peter Klinken, Chief Scientist, Office of Science, Department of the Premier and Cabinet, *Transcript of Evidence*, 11 February 2016, p 3.

284 Submission No. 21 from Technology and Industry Advisory Council, 31 August 2016, p 11.

285 This point was impressed upon the Committee by Directors of several high-growth businesses at meetings in Western Australia, Victoria and Queensland.

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*Distance from major financial hubs also means that the range of financial skills and depth of venture capital capability do not readily exist in WA.*²⁸⁶

- 5.55 Mr Dickson of the Department of Commerce emphasised this point, observing that however much capital may be available, investors will always be prudent, and to a large extent the availability of capital is a function of investment opportunity. According to Mr Dickson:

*there is a lot of money out there [in WA]. If you talk to the people who do not get money, they say that there is no money out there. But you have to remember that three people out of 100 are going to get funded. Some of the issues are around actually having commercial-ready opportunities. How do you maximise the pipeline? If you want more than three funded, you need 1 000 proposals to be able to do 30.*²⁸⁷

- 5.56 The Department of Commerce also raised an important point about the possibility of obtaining venture capital from Australia's large pool of superannuation funds, pointing out that for commercialisation:

*the size of the investment opportunity is sub-optimal for many superannuation funds. The size of a venture capital investment is far smaller than the normal superannuation portfolio and of a higher risk profile, thus making the investment decision unattractive for investment managers.*²⁸⁸

- 5.57 The apparent incompatibility between superannuation funds and venture capital investment is a source of confusion. Australian superannuation funds hold in excess of \$2 trillion, and this pool of wealth is often suggested as a possible source of venture capital. This suggestion is based on misunderstanding of the structure of the superannuation industry and its investment objectives. Mr El-Ansary explained that the almost exclusive focus on fund management fees represents a significant structural problem in the Australian superannuation system because it results in a very narrow focus on investment choices, and a corresponding focus on highly liquid asset classes.²⁸⁹ Investments that require multi-year commitment—such as backing a new business to bring an innovative product to market—are simply beyond the purview of superannuation funds. On this point, Mr Peter Chesworth of the Commonwealth

286 Submission No. 28 from Department of Commerce, 9 September 2016, pp 9–10.

287 Mr Michael Dickson, Public Servant, Department of Commerce, *Transcript of Evidence*, 16 March 2016, p 9.

288 Submission No. 28 from Department of Commerce, 9 September 2016, p 10.

289 Mr Yasser El-Ansary, Chief Executive Officer, Australian Private Equity & Venture Capital Association, *Briefing*, 2 November 2015.

Department of Industry, Innovation and Science pointed out that there are ‘prudential reasons’ for the investment strategies pursued by superannuation fund managers.²⁹⁰ Furthermore, the fees associated with devoting resources to managing a number of smaller venture capital investments would very likely fall foul of government superannuation regulation.

5.58 The Chief Executive Officer of the Australian Private Equity & Venture Capital Association (AVCAL), Mr Yasser El-Ansary, characterised the role of a venture capital investor as someone who would invest money in a business, and also work directly with the business in pursuit of a mutually beneficial outcome.²⁹¹

5.59 Mr El-Ansary argued that, while it may take considerable time and effort, an entrepreneur with a good idea would be able to source sufficient funding in Australia to progress the idea. However, the problems begin when a business seeks to expand to the next stage of development, requiring millions of dollars. As Mr El-Ansary explained many businesses needing such large sums fail to attract funding in Australia, not because they are not good businesses, but because there are many good businesses vying for the same capital. It is these companies who end up seeking funding overseas.²⁹²

Finding 12

Funding for the expansion stage of a business is limited, which means that many good businesses miss the opportunity to grow.

Recommendation 6

The Western Australian Government promotes the presence of venture capital companies in Western Australia through the encouragement of local companies or the attraction of national and international venture capital funds.

Recommendation 7

The Western Australian Government considers sponsoring a venture capital conference in Perth.

Taking the first step

5.60 While there are a variety of challenges to be faced throughout the process of creating value from an idea, the initial steps of the commercialisation journey are some of the most challenging. With the goal of helping researchers and budding entrepreneurs

290 Mr Peter Chesworth, Head of Division for Sectoral Growth Policy, Department of Industry, Innovation and Science, *Briefing*, 30 October 2015.

291 Mr Yasser El-Ansary, Chief Executive Officer, Australian Private Equity & Venture Capital Association, *Briefing*, 2 November 2015.

292 *ibid.*

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overcome what is a steep learning curve, a number of initiatives—both public and private—have emerged in recent times, each with the aim of determining more rapidly whether value can be extracted from a new idea.

Incubators and accelerators

- 5.61 A relatively recent and novel method for addressing the challenge of obtaining seed capital and business guidance to assist the development of an idea—particularly in the realm of software development—has been the emergence of ‘incubator’ and ‘accelerator’ programs and facilities.
- 5.62 An incubator is essentially shared, low-cost work space for budding entrepreneurs. The Spacecubed facility, which is located on two floors at 45 St Georges Terrace, was one of the first incubators to be established in Perth. Essentially the Spacecubed facility, like other similar incubator facilities, allows entrepreneurs to sublet a small portion of a piece of commercial real estate for a short time period, and then use that space as a low-cost business headquarters while working to develop a fledgling business idea.²⁹³
- 5.63 Incubator facilities are typically home to multiple start-up companies at any one time. As a result, they have the further benefit of placing budding entrepreneurs in close working proximity, enhancing the prospect of collaboration and shared learning.
- 5.64 Accelerator programs differ from incubators in that they are structured programs aimed at quickly progressing ideas to assess their commercialisation potential. In Australia, the Commonwealth Government’s ‘Accelerating Commercialisation’ program follows the accelerator model, and works by:
- providing [participants] with expert guidance and connections through Commercialisation Advisers to help [participants] to find the right commercialisation solutions for [their] novel product, process or service.*²⁹⁴
- 5.65 The ‘Accelerating Commercialisation’ program also offers grant funding to qualifying participants. In essence, it represents an effort by the Commonwealth Government to address the deficiency of venture capital and mentorship available for early-stage commercialisation activities in Australia.
- 5.66 The ‘Accelerating Commercialisation’ model is a typical (albeit publicly-funded) commercialisation accelerator initiative. There are also numerous private accelerators, through which large businesses seek to support the development of innovative ideas,

293 Mr Brodie McCulloch, Managing Director, Spacecubed, *Briefing*, 18 April 2016. See also Submission No. 11 from StatupWA.

294 Department of Industry, Innovation and Science, *Accelerating commercialisation*. Available at: <http://www.business.gov.au/advice-and-support/EIP/Accelerating-Commercialisation/Pages/default.aspx>. Accessed on 6 May 2016.

either as a corporate growth strategy, or else as a way to help the business develop strategies for the future. In WA, examples of these private accelerators include the RAC ‘SeedSpark’ accelerator and Woodside’s ‘FutureLab’ initiative. Providing insight into the establishment of the FutureLab initiative, Mr Shaun Gregory, Senior Vice President and Chief Technology Officer at Woodside, explained that:

*innovation is not about new ideas; it is about solving problems. It is through solving that problem that you are going to get innovation and value back. So, for us, it has been, “What are our problems?” So through FutureLab we expose—and if you have a look at ocean engineering, we exposed the problems that we have in ocean engineering and then we engaged through ARC and the universities and then formed a collaboration to address that problem.*²⁹⁵

5.67 Similarly, RAC’s SeedSpark program ‘is a startup accelerator that provides funding and support to create an idea for a better WA’.²⁹⁶ The first SeedSpark program ran in late 2015 and, through a competitive format, three start-up businesses were each awarded \$20,000 and the ongoing support of RAC mentors; the RAC took a four per cent equity stake in two of these three businesses.²⁹⁷ Importantly, the SeedSpark program was also supported by Perth incubator facility Spacecubed.

University commercialisation initiatives

5.68 As prime spaces for the development of new ideas, accelerating the process of commercialisation has long been a core business activity undertaken by universities around Australia. Typically this function is performed by a central university department, which provides faculty staff with various services and guidance to help create value from research. For example, Curtin University has a Director, IP Commercialisation position.

5.69 University-led commercialisation is essentially a particular form of venture capital in which the mentors are more familiar than typical venture capitalists with the challenges and nuances of the university research environment, as well as the various government-backed programs through which capital can be raised. This was acknowledged by Professor Christopher Hutchison, Director of Research and Development at Murdoch University, who explained that the university had recruited him because:

295 Mr Shaun Gregory, Senior Vice President and Chief Technology Officer, Woodside Energy Ltd, *Transcript of Evidence*, 16 March 2016, p 3.

296 RAC, *What is SeekSpark?*. Available at: <http://www.racseedspark.com.au/>. Accessed on 8 May 2016.

297 *ibid.*

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*my background is actually in developing commercial opportunities from universities into either improvements for existing industries or new opportunities for new businesses. The focus that I have in my role is very much around how we actually utilise the knowledge base within the university in order to integrate our activities with industry.*²⁹⁸

- 5.70 Similarly, Mr David Harrison, Director, Government and Corporate Communications at UWA, explained that university commercialisation teams have a critical role in helping researchers obtain funding for their ideas. As Mr Harrison put it, the ‘valley of death’ (a term used to describe business failure due to a venture capital shortfall) exists not just because of a shortfall of money:

*you have the valley of death where you need to have the human capital as well as the money to get across that gap. That has always been one of the key issues that commentators in this space have pointed out; that is, as opposed to Massachusetts or Silicon Valley, Western Australia has lower access to venture capital, unless perhaps you are a goldminer, which we are much more prepared to fund and take a risk on.*²⁹⁹

Intellectual property

- 5.71 An important aspect of commercialising new research is the protection of intellectual property. Obtaining a patent over a new idea is often a critical early step in the commercialisation process, because obtaining exclusive rights to use a new discovery provides time to identify how best to market that discovery. Patents can also become valuable business assets—valuable enough to function as a form of security for attracting capital.
- 5.72 The process of protecting intellectual property is, however, relatively underutilised in Australia. The 2015 *Global Innovation Index* (GII) ranked Australia 34th in domestic patent applications—well below the nation’s overall innovation ranking of 17th.

Finding 13

While obtaining a patent over a new idea is often critical in the early stages of commercialisation, the process of protecting intellectual property is relatively underutilised in Australia.

- 5.73 If—as is generally claimed—Australia is good at performing research, it is difficult to identify why we are comparatively poor at protecting the most immediate product of

298 Professor Christopher Hutchison, Director of Research and Development, Murdoch University, *Transcript of Evidence*, 12 February 2016, pp 1–2.

299 Mr David Harrison, Director, Government and Corporate Communications, University of Western Australia, *Transcript of Evidence*, 12 February 2016, p 11.

research from exploitation by others. Very few of those who contributed to this inquiry raised the issue of intellectual property, although Professor Hutchison of Murdoch University did explain that:

the start-up opportunity [often] starts with a research grant, but the product of the research grant is a patent or, better still, a portfolio of patents. Of course, that portfolio of patents can be the basis for a small start-up company, but quite often the patent is underdeveloped. The patent is based on an idea and it is based on novelty, but the concept is not necessarily proven. At that stage, the patent and the patent bundle lack value and, therefore, if you go straight to a venture capitalist, they are either going to ask you for an arm and a leg and everything, or they are not going to fund it.³⁰⁰

5.74 Notably, Professor Hutchison was speaking broadly of his prior experience in the United Kingdom, which suggests that there is a greater emphasis on protecting intellectual property through patents outside Australia than is the case here. Very few submissions made to this Inquiry explored the topic of intellectual property protection—potentially indicative of either an unfamiliarity with the patent process, or perhaps even a cultural aversion to it. Whatever the case may be, the Chamber of Commerce and Industry of Western Australia (Inc) (CCIWA) highlighted a curious statistic about patents in Australia, explaining that:

[o]n average, Australian resident applications for Australian patents only make up 10 per cent of total applications. Notably, Australian residents file roughly three times more patents overseas than they file in Australia.³⁰¹

5.75 As the patent process is an important step in the commercialisation process, it seems that this is an area in need of attention. The state government would do well to investigate the reasons why Australians seem to be more comfortable obtaining patents overseas than locally, with a view to addressing this gap in the local innovation ecosystem.

What can the state government do?

5.76 Stimulating the development of an innovation ecosystem clearly requires government to address the structural issues that function to stifle the current venture capital environment. Much of the evidence to this Inquiry has suggested that while it is often difficult to obtain money to commercialise an idea, it is not because of a lack of

300 Professor Christopher Hutchison, Director of Research and Development, Murdoch University, *Transcript of Evidence*, 12 February 2016, p 2.

301 Submission No. 34 from Chamber of Commerce and Industry of Western Australia (Inc), 18 September 2015, p 13.

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available capital. Rather, there is a lack of familiarity in investing in commercialisation efforts.

5.77 This was perhaps best emphasised by Mr Peter Clarke, a WA-based entrepreneur and founding Chief Executive Officer of Scanalyse, who now serves as a commercialisation adviser to the Commonwealth Government. Asked about the role of government in addressing issues with the availability of venture capital, Mr Clarke said that the answer was not simply to provide funds. Noting that ‘state government money, particularly in WA, is pretty scarce, so it has to be spent very, very wisely and effectively’, Mr Clark said where ‘the state government can have the most impact is really in providing a cornerstone or platforms for developing the community and the ecosystem’.³⁰² At the present, Perth does not have sufficient critical mass, so rather than ‘investing in direct projects’, the state government needs to invest in ‘generally supporting this community and this ecosystem to grow’.³⁰³

5.78 Government investment aimed at supporting the growth of an innovation ecosystem is exemplified by the Queensland Government’s *Advance Queensland* initiative. Under this initiative, \$180 million will be invested over four years in a range of areas, from supporting Queensland’s scientific research community, to encouraging collaboration between businesses and research institutions in Queensland. As part of the *Advance Queensland* initiative, \$40 million in public funding will also be made available as a matching investment in high-growth businesses that have already secured private venture capital, in an effort to help encourage a greater flow of venture capital in Queensland.³⁰⁴

5.79 This is a critical issue. As Mr Clarke advised:

*there has been incredible progress over the last two or three years in growing the numbers of people and growing the visibility of the innovation process, but we are a long way behind the eastern states in terms of the size of those communities, simply because of the very nature of the size of our state.*³⁰⁵

5.80 For Mr Clarke, given ‘the importance of [...] co-location and the communication between innovators and [that] the communications between innovators and clients is

302 Mr Peter Clarke, *Transcript of Evidence*, 11 February 2016, p 2.

303 *ibid.*

304 Queensland Government, *Business development fund*, 6 April 2016. Available at: <http://advance.qld.gov.au/entrepreneurs-startups/business-development-fund.aspx>. Accessed on 17 June 2016.

305 Mr Peter Clarke, *Transcript of Evidence*, 11 February 2016, p 2.

very, very important’, money could be better spent on ‘supporting the culture, supporting perhaps some fundamental facilities’.³⁰⁶ This could take the form of:

*assistance with rentals or whatever the current innovation centre provides; very low cost office facilities for the companies who are at that very early stage, so just easing the barriers into this process and education and culture and promotion of what we are doing in WA, because we are doing some good things.*³⁰⁷

5.81 Mr Clarke also emphasised the importance of ensuring that good ideas are commercialised because they have actual value within the marketplace, by adding that:

*in terms of sustainability, if the government spends money and supports innovation by investing directly in it, really it is the private sector’s job, and we need to build a sustainable model. If we are going to rely on government funding, we are always going to rely on government funding. We need to build a sustainable model so that that is done by the corporates and by the private sector.*³⁰⁸

5.82 Again, it is important to emphasise that venture capital is not just money: it is a combination of money and mentorship. Furthermore, the process of commercialisation is fundamentally about generating financial value from an innovative idea—and because the financial worth of something is ultimately determined by market forces, it is clear that the market is uniquely positioned to determine which innovative ideas are the best candidates for successful commercialisation. That is, although public money can be used in pursuit of commercialisation, government is not equipped to provide mentorship to budding entrepreneurs in the same way as a private investor with a background in building successful businesses. It must also be recognised that while private investment is made with a singular focus, governments often have a range of objectives for public capital—some of which may be counterproductive to business success.

5.83 Indeed, the 2015 bankruptcy of boutique chocolatier Koko Black is instructive in this regard. Established in Melbourne in 2003, Koko Black was a successful small business for many years, before undergoing a period of rapid expansion beginning in early 2014—on the back of a \$3 million grant by the Victorian Government. This grant was provided as a significant part of Koko Black’s \$10.9 million ‘Alchemy Hall Project’, which was to include a manufacturing centre of excellence, a research and development facility and an interactive visitor centre. In announcing the grant, then Victorian Premier Dr Denis Napthine said that his government was ‘proud to make strategic co-

306 *ibid*, p 3.

307 *ibid*, pp 2–3.

308 *ibid*, p 3.

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investments with businesses like Koko Black to create quality employment opportunities in growing industries'.³⁰⁹ At the announcement, it was also noted that the funding source—the Melbourne's North Innovation and Investment Fund—was being used to deliver 'innovative and exciting projects', and that the \$3 million for Koko Black represented:

*another great example of how providing support for investment by local businesses results in new, sustainable jobs and assists the region to diversify its economic base.*³¹⁰

5.84 Koko Black went into voluntary administration in November 2015. While a range of factors no doubt contributed to this outcome, the various reasons cited for the grant by the Victorian Government serve to highlight the fact that governments may have multiple (and even competing) objectives when they provide public funds to businesses. Investors of venture capital, by contrast, have a single objective—an objective which they then pursue directly by ensuring that the objects of their investments benefit from their own expertise.

Finding 14

Human capital is just as necessary to the commercialisation process as funding.

Venture capital limited partnerships

5.85 Rather than seeking to provide capital, the state government can aid commercialisation in WA by ensuring that the business environment remains conducive to private investment. An immediate way in which this could be easily achieved would be by amending the *Limited Partnerships Act 1909* to enable the creation of venture capital limited partnerships in WA.

5.86 This move was suggested by the Department of Commerce, which submitted that the Western Australian Government should:

*[e]nact legislation supporting Venture Capital Limited Partnerships that encourage and support venture capital funds to operate in WA and be eligible for specialised tax treatment (Drafting of this legislation is nearing completion).*³¹¹

5.87 Limited partnerships in WA are currently regulated by the *Limited Partnerships Act 1909*. Critically, the *Limited Partnerships Act* does not provide for the registration of

309 Department of Industry, Innovation and Science, *New Koko Black project to deliver jobs and investment in Melbourne's north*, 15 April 2014. Available at: <http://www.minister.industry.gov.au/ministers/macfarlane/media-releases/new-koko-black-project-deliver-jobs-and-investment-melbournes>. Accessed on 8 May 2016.

310 *ibid.*

311 Submission No. 28 from Department of Commerce, 9 September 2016, p 11.

incorporated limited partnerships, which are a partnership structure that was introduced in Australia for investors with the passage of the *Venture Capital Act 2002* (Cth). Incorporated limited partnerships can be registered under the *Venture Capital Act* (instead of the *Corporations Act 2001* (Cth)); when registered under the *Venture Capital Act*, limited partnerships are entitled to flow-through tax treatment (meaning that taxation responsibilities ‘flow-through’ to investors, instead of falling upon the partnership itself). WA is the only state not to have amended its regulation of limited partnerships since the *Venture Capital Act* was proclaimed in 2002. As a result, WA is the only state where venture capital limited partnerships cannot be formed.

Finding 15

Western Australia is the only Australian state where venture capital limited partnerships cannot be formed.

5.88

The Department of Commerce issued a discussion paper on this matter in November 2013, proposing to update the law as required. After a period of public comment, six submissions were received by the Department of Commerce by the February 2014 closing date, and by November 2014 it was at ‘the next stage of the review,’ which was ‘to prepare a draft Bill containing the proposed amendments to the *Limited Partnerships Act 1909*.’ While the status of this review is presently unknown, addressing this legal quirk is imperative if WA is to become a state of innovation.

Recommendation 8

The Western Australia Government, as a priority, completes the review of the *Limited Partnerships Act 1909* and introduces legislation to amend the Act to allow the formation of venture capital limited partnerships in Western Australia.

Chapter 6

Innovation Infrastructure

Infrastructure to support interaction within an innovation ecosystem

- 6.1 Useful and efficient infrastructure is vital to the positive performance of any economy. In the February 2016 *Australian infrastructure plan*, Infrastructure Australia observed that while the Australian economy is founded upon ‘our vast natural resources and highly skilled workforce’, it is infrastructure that ‘unlocks opportunities for economic development... by providing the means to connect and compete across domestic and global markets’.³¹² It is clear that ‘[m]ore efficient infrastructure will support a more productive economy and help to create a more prosperous and equitable Australia’.³¹³
- 6.2 In essence it is infrastructure—whether physical infrastructure such as roads, telecommunications networks and buildings, or intellectual infrastructure such as education, research data and government regulation—that helps to connect the various, and perhaps otherwise disparate elements of an economy together in a productive way. Infrastructure is also a critical component of any flourishing innovation ecosystem as a resource that facilitates efficient interaction between agents, human capital and other resources.³¹⁴
- 6.3 Some infrastructure is particularly geared towards stimulating important innovation outcomes, such as collaboration, learning, research and invention. Dedicated physical ‘innovation infrastructure’—including innovation precincts like Technology Park, research facilities like the Pawsey Supercomputing Centre and cultural institutions like Scitech—represents the ‘bricks and mortar’ infrastructure that supports innovation. In addition, intellectual infrastructure—such as the Technology and Industry Advisory Council (TIAC), industry networking forums and even macroeconomic capability maps—plays an equally important role in fostering a culture of innovation. It is useful to consider each of these in turn.

312 Infrastructure Australia, *Australian infrastructure plan*, February 2016, p 14. Available at: http://infrastructureaustralia.gov.au/policy-publications/publications/files/Australian_Infrastructure_Plan.pdf. Accessed on 20 May 2016.

313 *ibid.*

314 The elements of an innovation ecosystem, and the various ways in which those resources interact, are described in Chapter 3.

Physical infrastructure

Strategic land use

6.4 The strategic designation and use of land by government has long been a method of using physical infrastructure to promote innovation. Land use policies of this nature are essentially aimed at harnessing the power of collaboration by stimulating the formation of business clusters.

6.5 It is well accepted that business clusters—geographic concentrations of interconnected businesses—enhance productivity and the capacity of businesses to innovate. This was originally explained by economist Michael Porter, who observed that:

[o]nce a cluster forms, the whole group of industries becomes mutually supporting. Benefits flow forward, backward and horizontally. Aggressive rivalry in one industry tends to spread to others in the cluster, through the exercise of bargaining power, spin-offs, and related diversification by established firms. Entry from other industries within the cluster spurs upgrading by stimulating diversity in R&D approaches and providing a means for introducing new strategies and skills. Information flows freely and innovations diffuse rapidly through the conduits of suppliers or customers who have contact with multiple competitors. Interconnections within one cluster, often unanticipated, lead to the perception of new ways of competing and entirely new opportunities. People and ideas combine in new ways.³¹⁵

6.6 The importance of clustering was emphasised by the Dean of UTS Business School, Professor Roy Green, who explained that ‘the whole world knows that clustering and geographical concentration has been a key competitive advantage since the 19th century’.³¹⁶ According to Professor Green, state governments can design planning policies aimed at encouraging and promoting the clustering of particular industries, with profound and positive economic effect.

6.7 Indeed, recognising the many benefits of business clusters, governments around the world have long attempted to stimulate their formation through catalytic planning policies. In Western Australia (WA), one of the most widely-recognised successes in strategic land use can be seen in the example of the Australian Marine Complex (AMC) in Henderson, and details of this are provided in Chapter 3.

6.8 Other examples of effective clusters are those formed around the QEII Medical Centre and Curtin University.

315 Porter, Michael, *The competitive advantage of nations*, Macmillan, London, 1990, p 151.

316 Professor Roy Green, Dean, UTS Business School, *Briefing*, 3 November 2015.

The Queen Elizabeth II Medical Centre

- 6.9 The growth and success of the Queen Elizabeth II Medical Centre (QEII MC) in WA exemplifies both the value of business clustering, and the important role that government can play in helping to stimulate it. Indeed, a defining feature of the precinct has been its rapid growth as a medical technology park over the past two decades, following government efforts to remove regulatory and administrative impediments.
- 6.10 Like many parts of WA, the 28 hectare site of the QEII MC has been a space of substantial historic transformation. At the turn of the twentieth century, the land in question was for grazing dairy cattle.³¹⁷ After being purchased by the state government in 1910, the land was leased to the University of Western Australia (UWA), and in 1953 was designated for development as a tuberculosis sanatorium and teaching hospital.³¹⁸ The Perth Chest Hospital (later re-named Sir Charles Gairdner Hospital) would open in 1958, but even during its planning and construction ‘the hope cherished by both government and University authorities was that it would become the hub of a centre of medical excellence: a concept then without precedent’.³¹⁹
- 6.11 Despite the adjacent operations of the UWA Faculties of Dentistry and Medicine (founded in 1946 and 1956 respectively), the further development of the QEII MC was largely constrained by the operation of the Perth Medical Centre Act 1966 (WA) (re-named the Queen Elizabeth II Trust Act in 1977), which restricted the further use of available land within the precinct.³²⁰ This situation was highlighted by the Select Committee on Science and Technology which, in its 1994 report to Parliament, recommended that ‘[t]he Queen Elizabeth II Trust Act be amended to enable the development of a medical technology park’.³²¹ In a subsequent speech to Parliament in 1997, the then Member for Collie (and former Member of the Select Committee), Dr Hilda Turnbull, remarked that:

the Queen Elizabeth II Medical Centre in Nedlands... would be an excellent site for a medical technology park. It has large precincts and already has two very outstanding medical facilities... These people are

317 Polizzotto, Carolyn, *A Fair Sized Town*, Sir Charles Gairdner Hospital, East Perth, 1988, p 16.

318 Queen Elizabeth II Medical Centre, *History of the QEII MC*, 16 June 2014. Available at: <http://www.qeii.mc.health.wa.gov.au/historyqeii/>. Accessed on 20 June 2016.

319 Polizzotto, Carolyn, *A Fair Sized Town*, Sir Charles Gairdner Hospital, East Perth, 1988, p 16.

320 Queen Elizabeth II Medical Centre, *History of the QEII MC*, 16 June 2014. Available at: <http://www.qeii.mc.health.wa.gov.au/historyqeii/>. Accessed on 20 June 2016.

321 Select Committee on Science and Technology, *Final Report*, State Law Publisher, Western Australia, 24 November 1994, p xii.

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*developing a critical mass, along with the university Department of Medicine and the very active QEII medical research group.*³²²

- 6.12 Dr Turnbull also observed that the role for government in helping the QEIIMC to realise its full potential would be to help facilitate, rather than direct, the growth of the precinct:

*The medical research group, ... is working on the creation of a medical foundation for the whole of Western Australia... we must get together the critical mass of other scientists involved in medical research in Western Australia. The best way to do that is not to create more buildings but to work in a collaborative fashion with the scientists at the QEII campus, the Royal Perth Hospital campus and the Fremantle Hospital campus. We should encourage them to agree to involve themselves in a cooperative effort in establishing the Western Australian medical research centre.*³²³

- 6.13 Ultimately the passage of the Trustees Amendment Bill 1997 (WA), which gave trustees a wider discretion in investing trust funds, paved the way for the accelerated development of the precinct as a medical technology cluster. As a result, over the past 20 years the QEIIMC has grown to become the largest medical centre in the southern hemisphere.³²⁴

- 6.14 With the recent addition of Ronald McDonald House on 4 December 2015, there are currently 27 separate medical health, research, education and support organisations—as well as several associated retail and hospitality businesses—operating within the precinct.³²⁵

322 Dr Hilda Turnbull, Member for Collie, Western Australia, Legislative Assembly, *Parliamentary Debates* (Hansard), 11 November 1997, p 7551/1.

323 *ibid.*

324 Queen Elizabeth II Medical Centre, *About QEIIMC*, 16 June 2014. Available at: <http://www.qeiimc.health.wa.gov.au/about-qeiimc/>. Accessed on 20 June 2016.

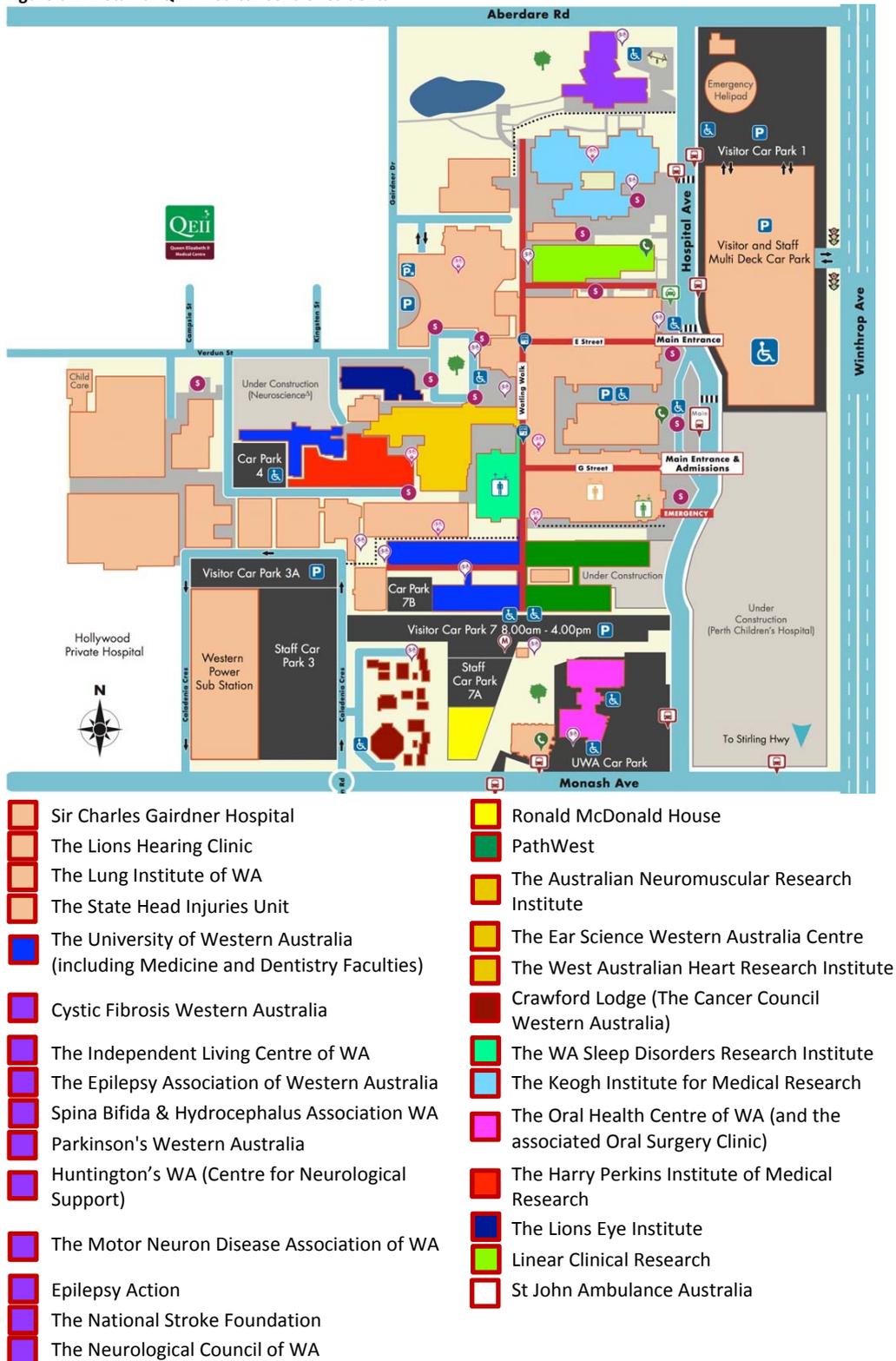
325 *ibid.*

Figure 6.1: QEII Medical Centre and surrounds



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Figure 6.2: Detail of QEII Medical Centre residents



- 6.15 These organisations will soon be joined by the new Perth Children’s Hospital, which is scheduled to open in late 2016.³²⁶
- 6.16 The successful and rapid growth of the QEII MC is in many ways exemplified by the development of Linear Clinical Research (Linear). Linear, which is a wholly-owned subsidiary of the Harry Perkins Institute of Medical Research, first opened in 2010 and was a finalist in the national Health and Biotechnology Australian Export Awards in both 2013 and 2014.³²⁷ As a start-up conducting early phase clinical trials, Linear employed four staff. Today it has 40 full-time and 30 contract staff, with a payroll of approximately \$3.5 million. Eighty-five per cent of Linear’s business comes from overseas, with more than 70 per cent from the United States.³²⁸
- 6.17 In the main, of course, the success of Linear reflects the dedication and hard work of its executive officers and staff. Clearly, however, Linear benefits from being a member of ‘an extremely vibrant and busy medical centre with an estimated 1.8 million vehicle traffic movements at the campus annually and over 8,000 employees working daily on the site’.³²⁹ The success of the QEII MC as a whole is testament to the role that government can play in helping to encourage the establishment and growth of business clusters in key industries, and strategic geographic locations.
- 6.18 The Committee considers that further development of medical research in Western Australia is worthy of a separate Inquiry.

Science and technology parks

- 6.19 In the context of technological innovation, successful business clusters are usually located in close proximity to places of research, such as university campuses or government departments for whom science is a fundamental business activity. Around the world, clusters of this nature are generally referred to as ‘technology parks’ or ‘science parks’.
- 6.20 Silicon Valley in the San Francisco Bay Area—which has Stanford University at its epicentre—is perhaps the most famous global example of a technology park. Needless to say, there are numerous other business clusters growing in areas around research

326 Mr John Day, Minister for Health, Government of Western Australia, *Transcript of Evidence (Assembly Estimates Committee A)*, 25 May 2016, p 251b.

327 Australian Export Awards, *2013 Western Australian industry and export awards*. Available at: <http://www.exportawards.gov.au/Finalists/2013/WA>. Accessed on 20 June 2016; and Australian Export Awards, *2014 Western Australian industry and export awards*. Available at: <http://www.exportawards.gov.au/Finalists/2014/wa>. Accessed on 20 June 2016.

328 Dr Janakan Krishnarajah, CEO/Medical Director, Linear Clinical Research; and Mr John Fitzgerald, Chief Operating Officer, Harry Perkins Institute of Medical Research, *Briefing*, 14 October 2015.

329 Queen Elizabeth II Medical Centre Trust, *Annual Report 2014-15*, 7 September 2015, p 24. Available at:

http://www.qeii.mc.health.wa.gov.au/uploads/60094/ufiles/QE11000056_A4_REPORT_Low_resolution.PDF. Accessed on 20 June 2016.

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institutions worldwide. Some of the benefits associated with this phenomenon were highlighted by WA's Chief Scientist, Professor Peter Klinken, who observed that:

*Oxford and Cambridge are small cities of about 150 000 people. Twenty-five years ago they were described as market cities with very large universities next door. They are now considered high-tech hubs where, in each of those cities, there are between 50 000 and 60 000 high-tech jobs and 1 500 high-tech companies. In the space of a single generation, they have gone from a market village with a big university to centres of massive high-tech industries. San Diego, similarly, a generation ago, was a place where wealthy Americans went to retire and was the home of the 7th Fleet. It is now the third biggest biotechnology hub in the world.*³³⁰

6.21 Because technological development is integral to the creation of future comparative advantage, governments around the world frequently seek to emulate the successes of technology parks in places like Oxford, Cambridge and San Diego by designating geographically appropriate tracts of public land for use as technology parks, and managing those parks in a manner designed to promote innovation. Indeed, this was essentially why the Western Australian Government established Technology Park in Bentley in 1985.³³¹

Technology Park Bentley

6.22 Described as 'an important catalyst for science and technology development in Western Australia', Technology Park Bentley is situated adjacent to Curtin University, approximately six kilometres from the Perth CBD.³³² According to the Department of Commerce, Technology Park Bentley, which operates under the provisions of the *Technology and Industry Development Act 1998 (WA)*, is 'home to more than 100 organisations including technology based industry, research and development, academia and support organisations'.³³³ In the course of this Inquiry, the Committee undertook a number of site visits to businesses and other entities operating in Technology Park Bentley, including the Innovation Centre, Motium, AnaeCo, Gray Surgical, WA:ERA, the CSIRO's Mineral Resources Flagship, the Pawsey Supercomputing Centre and Curtin University's Fuels and Energy Technology Institute. The Committee

330 Professor Peter Klinken, Chief Scientist of Western Australia, Office of Science, Department of Premier and Cabinet, *Transcript of Evidence*, 11 February 2106, p 2.

331 Technology Park Bentley WA, *Purpose and objectives*, 2015. Available at: <http://techparkwa.com.au/about/purpose-and-objectives/>. Accessed on 26 May 2016.

332 Technology Park Bentley WA, *Location*, 2015. Available at: <http://techparkwa.com.au/about/location/>. Accessed on 26 May 2016.

333 Department of Commerce, *Technology Park Bentley WA*, 21 May 2014. Available at: <http://www.commerce.wa.gov.au/industry-and-innovation/technology-park-bentley-wa>. Accessed on 26 May 2016.

also attended a number of ‘Innovation Network’ events convened by Innovate Australia at different venues within Technology Park Bentley.

6.23 It should be noted that there are two precincts within Technology Park Bentley: in addition to the original area bounded by Hayman Road, Kent Street and Jarrah Road, a second ‘western precinct’, across from Kent Street and housing the Australian Resources Research Centre, was opened in 1987.

6.24 Technology Park Bentley holds significant potential to be a catalyst for innovation in WA. This was emphasised by various witnesses during Inquiry hearings. Dr Adam Osseiran of Innovate Australia explained that one of the companies he started was ‘incubated’ in the Innovation Centre within Technology Park, and that this was ‘a fantastic result’.³³⁴ As Dr Osseiran further explained:

*I have never had so much interaction with the other incubates, and the projects that were born and some projects are still developing—Bombora, Ecocentric Energy. There is also a company that started there called BrainChip that has now left on an opportunity to the US.*³³⁵

6.25 Similarly, Curtin University’s Deputy Vice-Chancellor of Research, Professor Graeme Wright, observed that Technology Park Bentley:

*has, in one form or another, stood the test of time... From Curtin’s perspective, it has been highly beneficial... From our point of view—this is looking at the greater area, not just the Technology Park component itself as a core—for Curtin University to be sitting alongside CSIRO, Pawsey, DPaW [Department of Parks and Wildlife] and so on, that is a huge advantage so that clustering is significant and it is of great benefit.*³³⁶

6.26 Professor Wright, however, also confirmed the Committee’s own observation that much of the potential of Technology Park Bentley remains unrealised, particularly in terms of industry development. As Professor Wright acknowledged:

I have not mentioned any industry-based components there. That is where it has been less successful and, of course, I think that strikes to the core of what Technology Park was there for in the first place. It was not designed for Curtin University to put lots of things on site—to put some things on site, yes. We have got our SKA group sitting on the site in the old Rio Tinto building. We have got our Fuels and Energy

334 Dr Adam Osseiran, Director, Innovate Australia, *Transcript of Evidence*, 11 February 2016, p 8.

335 *ibid.*

336 Professor Graeme Wright, Deputy Vice-Chancellor, Research, Curtin University, *Transcript of Evidence*, 12 February 2016, p 10.

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*Technology Institute... The Technology Park is exactly what is required for those types of activities but our interaction with the industry tenants and owners of Technology Park is much less than it could be.*³³⁷

6.27 This sentiment was also expressed by WA's Chief Scientist:

*I think the fundamentals are in place to have a very successful technology park there; it just needs to have a bit of revitalisation, a bit of reorganisation, and a bit of energy... The body and the fundamentals are there: you have got a good university, you have got CSIRO and you have got the Pawsey supercomputer right next door, and that should be a really humming place.*³³⁸

6.28 Rather than simply lamenting the unrealised potential of Technology Park Bentley, the Chief Scientist argued that the present state of affairs should be embraced as an opportunity. In making this point, he referred again to the example of the technology park around Cambridge University, which when it was first built:

*was dormant for a very long time. It was seen as a white elephant, to be honest, until they managed to get a serious anchor tenant... they went out and negotiated directly with a big company to relocate to Cambridge. Since then I have discovered that this is a fairly standard approach: that if you bring a big anchor tenant in, the smaller ones tend to feel very comfortable coming in around them.*³³⁹

Finding 16

While the CSIRO is a major tenant of Technology Park Bentley, there is a need for a major commercial anchor tenant to help attract others to the park.

Recommendation 9

The Western Australian Government encourage a major commercial anchor tenant(s) to relocate to Technology Park Bentley.

6.29 The view that Technology Park Bentley could be transformed into a vital piece of innovation infrastructure was echoed by Hon Dr Mal Bryce AO who, in serving as Deputy Premier of WA between 1983 and 1988, was the driving force behind its original establishment. On the question of attracting a large anchor tenant, Dr Bryce pointed out that 'you could not get a bigger anchor tenant than CSIRO'.³⁴⁰ For Dr Bryce,

337 *ibid.*

338 Professor Peter Klinken, Chief Scientist of Western Australia, Office of Science, Department of Premier and Cabinet, *Transcript of Evidence*, 11 February 2106, p 4.

339 *ibid.*

340 Hon Dr Mal Bryce AO, former Deputy Premier of Western Australia, *Briefing*, 13 May 2016.

rather than focussing on attracting a large, new anchor tenant, focus would be best directed toward bringing Technology Park Bentley under a new management model, and demonstrating commitment to the ongoing success of the precinct, perhaps by:

- revisiting plans to establish a ‘school of the future’ within the precinct;
- establishing faster and more efficient transport (including public transport) links between Technology Park Bentley and the Perth CBD;
- bridging the divide between the precinct and the primary Curtin University campus, and encouraging and facilitating interaction between university students and industry within the precinct; and
- aiding the establishment of various amenities within the precinct, including short and medium-term accommodation for visiting international researchers, meeting and dining facilities, and conference and networking facilities.³⁴¹

6.30 Technology Park Bentley consists of two adjacent precincts, the original and the western precincts. While the original precinct has not grown significantly since the park was established, the western precinct, which includes the Australian Resources Research Centre (ARRC), has recently experienced some development. In addition to being home to the CSIRO’s Mineral Resources Flagship, the ARRC has become home to both WA:ERA and the newly-established National Energy Resources Australia (NERA).³⁴²

6.31 Ultimately, if the full potential of Technology Park Bentley is to be harnessed, effort must be made to ‘get more people in it’. For Dr Osseiran of Innovate Australia:

*how we get more people in it is to get those people from the universities who are there, who are aching to get out and do some entrepreneurship, and get them to go and start something.*³⁴³

6.32 Dr Osseiran’s colleague at Innovate Australia, Mr Peter Kasprzak, believes that unlocking the potential of Technology Park Bentley will involve a number of disparate initiatives. As Mr Kasprzak argued:

*[t]he precinct is great. Take a part of it and put some life into it. Build a cafeteria; have a signed cinema where kids can go and business can go; have events—somewhere that people can interact—a few cafeterias. Have a hotel. There are people working for CSIRO, working for a lot of these organisations. Have a hotel so they can jog to work—things like that.*³⁴⁴

341 *ibid.*

342 DesignInc, *CSIRO Australian Resources Research Centre*. Available at: <http://www.designinc.com.au/projects/csiro-australian-resources-research-centre>. Accessed on 26 May 2016. The ARRC was constructed in 2002 in a project that was jointly funded by the WA Government and the CSIRO.

343 Dr Adam Osseiran, Director, Innovate Australia, *Transcript of Evidence*, 11 February 2016, p 8.

344 Mr Peter Kasprzak, Chief Executive Officer, Innovate Australia, *Transcript of Evidence*, 11 February 2016, p 6.

Figure 6.3: Technology Park Bentley and surrounds



Co-located government departments and research facilities

- 6.33 Any government-led effort to unlock the full potential of Technology Park Bentley will ultimately aim to kick-start it as a cluster of interconnected research and development activity by attracting a critical mass of people to work and interact there. In a similar vein, there may be opportunity to harness cluster-like outcomes by locating (or even co-locating) key government departments that perform scientific research, such as the Departments of Fisheries, Agriculture and Food, Health, Transport, Environment Regulation, and Water in close proximity to each other, and in strategic geographic areas. This would require redevelopment of the area, maximising the use of the site.
- 6.34 The Queensland Government has, for example, recently established the EcoSciences Precinct in the area formerly occupied by the Boggo Road Gaol in Brisbane, spending \$270 million to co-locate all of the government departments concerned with environmental and natural resource sciences in a single building. The building, which was purpose-built for scientific research, was opened in 2011, and is the centrepiece of a 20-year planned development of the site.³⁴⁵
- 6.35 An extension of using government research capabilities as a catalyst for innovation clusters is to ensure optimum benefit to the state economy from the use of government research facilities. In particular, the SME sector can often derive significant benefit from being able to access otherwise prohibitively expensive facilities owned by the government or research sectors.
- 6.36 An example of this is the CSIRO's Manufacturing Flagship in Clayton, Victoria, in which the CSIRO has made a significant investment in 3D printing capabilities, including printing from powdered metals. This technology is both developing and, at present, extremely expensive. The Manufacturing Flagship provides industry representatives with the opportunity to learn through experience what components they can 'print' from titanium oxide, for example.³⁴⁶ Without this investment by CSIRO, it would be difficult for industry to become familiar with what the implications of this technology might be.
- 6.37 The value of government assistance to industry by making new and emerging technologies available was referred to by the Assistant Secretary of UnionsWA, Mr Owen Whittle, who mentioned:

the innovation precincts: we have some really strong natural advantages in this state to support manufacturing in places like the AMC [... Henderson], where there is a good group of businesses that are keen to invest in themselves but maybe from time to time might

345 Dr Mark Jacobs and Mrs Sonia Winnington-Martin, Queensland EcoSciences Precinct, *Briefing*, 5 November 2015.

346 CSIRO, *Briefing*, 29 October 2015.

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*need some government nudging around where to go and where to invest.*³⁴⁷

6.38 However the role is approached, it is clear that government occupies a critical space in the innovation ecosystem—especially as a catalyst to innovation within industry.

Scitech

6.39 Cultural institutions are another key area in which government can provide physical infrastructure with the aim of fostering a culture of innovation. While all museums make an important contribution to this outcome, Scitech’s greatest contribution is in stimulating student interest in science and mathematics.

6.40 Established in 1988 as ‘a not-for-profit organisation that seeks to increase awareness, interest, capability and participation by all Western Australians in science, technology, engineering and mathematics’, Scitech hosts more than 500,000 visitors annually, and is supported financially through ticket sales and ongoing financial support from government.³⁴⁸ Since being established, Scitech has been located in the City West building in West Perth; the lease for that accommodation, however, will expire in 2019, with a future location uncertain.

6.41 During the 2016 Estimates Committee hearings the Premier stated:

*The government made a commitment to provide a site and \$15 million towards a new Scitech. I recognise that a new-built Scitech will cost significantly above that; we are always conscious of that. Scitech has some years to go on its existing lease at its current location. The state government has provided some limited further financial assistance for the minor upgrade of some facilities there. The new site for a new Scitech will be within the cultural centre, but that project is still probably a few years away. We are working with Scitech on that. Basically, it will be near the new Museum—in that broad vicinity.*³⁴⁹

6.42 This is an acknowledgment of the importance to the state’s innovation ecosystem of stimulating a culture of innovation in WA.

Finding 17

In the context of a modern innovation ecosystem, Scitech’s future role needs to be reviewed.

347 Mr Owen Whittle, Assistant Secretary, UnionsWA, *Transcript of Evidence*, 24 February 2016, p 3.

348 Scitech, *The Scitech story*. Available at: <http://www.scitech.org.au/business-centre/about-scitech/1623-about-us>. Accessed on 26 May 2016.

349 Hon Colin Barnett, MLA, Premier, *Assembly Estimates Committee A—Transcript of Evidence*, 24 May 2016, p E40.

Recommendation 10

The Western Australian Government undertakes a review of Scitech’s future role in the innovation ecosystem to ensure it can meet the challenges presented by the recent and continuing rapid developments in science and technology.

Intellectual infrastructure

6.43 The establishment of both Scitech and Technology Park Bentley during the 1980s was not a coincidence: they were two elements of a seven-part ‘technology plan’ devised and implemented by Dr Bryce during his time as Deputy Premier. Importantly, as Dr Bryce explained, while physical, ‘bricks and mortar’ innovation infrastructure can more easily be seen and understood, intellectual infrastructure is even more important in the development of a flourishing innovation ecosystem—essentially because intellectual infrastructure is the currency of future innovation.³⁵⁰

6.44 The seven-part ‘technology plan’ implemented by Dr Bryce consisted of:

- Technology Park Bentley;
- The Department of Computing and Information Technology (DOCIT);
- The Technology and Industry Advisory Council (TIAC);
- Scitech;
- The Institute for Science and Technology Policy (ISTP);
- The Small Business Development Corporation (SBDC); and
- The School of Biotechnology at Murdoch University.³⁵¹

6.45 While most of these elements have endured, in the 30 years that have elapsed since the technology plan was implemented their roles and functions have evolved. Equally, however, the logic underpinning this plan—that innovation infrastructure is both physical and intellectual—remains vital. In the sphere of intellectual infrastructure, the two most critical elements are ensuring that government decisions are informed by a detailed understanding of technology (and indeed the future of technology), and that the capabilities and strengths of the Western Australian economy are well known, in order to build the state of Western Australia as a ‘business cluster’ in its own right.

The Technology and Industry Advisory Council

6.46 According to Dr Bryce, the Technology and Industry Advisory Council (TIAC) was initially established to function as an independent body to provide advice on matters of science and technological development with the aim of enhancing executive government decision-making.³⁵² While TIAC continues to function as ‘the preeminent advisory body

350 Hon Dr Mal Bryce AO, former Deputy Premier of Western Australia, *Briefing*, 13 May 2016.

351 *ibid.*

352 *ibid.*

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to the State Government on strategic industry, science and technology matters in Western Australia', in 2016 TIAC reports primarily to the Minister for Commerce.³⁵³

6.47 Comprised of a panel of seven members, TIAC 'looks to the future to provide strategic, evidence-based advice to government aimed at identifying and encouraging innovative approaches to development in industry, science, technology and government that drive sustainable and diverse economic growth in Western Australia'.³⁵⁴ This is primarily done via the commissioning (and production) of studies into various relevant topics concerning science and technology, with a focus on 'achieving sustainable and economic growth in Western Australia' and promoting 'industry, scientific and technological developments as key drivers of Western Australia's long-term prosperity'.³⁵⁵ In pursuing this outcome, TIAC aims to:

- *Demonstrate and promote the economic benefits of industry, science and technology.*
- *Champion innovative approaches to challenges facing WA, over the short term and long term.*
- *Explore the implications to WA's changing economy of leverage new technologies and emerging industries.*³⁵⁶

6.48 In addition to making a comprehensive submission to the Committee for this Inquiry, three TIAC members gave evidence on a wide range of matters during a hearing.³⁵⁷ Both the submission and oral evidence made it clear that TIAC is equipped to offer a wealth of useful advice on new and emerging developments on science and technology to government and the Western Australian community more broadly.

6.49 The importance of TIAC to all WA Governments cannot be overstated as technological change is often so profound as to render an earlier version of the world unrecognisable to future generations. It is critical that government draws upon the advice of those who are expert in technology to ensure all policy decisions are built upon an informed appreciation of what the future may hold.

6.50 As discussed in Chapter 8, government's regulatory settings need to accommodate technological change. The role of a government advisory and research body external to the general public service that can advise both the Minister and thereby Cabinet on

353 Technology and Industry Advisory Council, *TIAC's purpose and focus*, 20 December 2012, Available at: <http://www.tiac.wa.gov.au/About-Tiac/TIAC-purpose-and-focus.aspx>. Accessed on 26 May 2016.

354 *ibid.*

355 *ibid.*

356 *ibid.*

357 See Submission No. 21 from Technology and Industry Advisory Council, 2 September 2015, and Mr Alan Bansemer, Chair; Mr Andy Farrant, Member; and Mr Shaun Collin, Member, Technology and Industry Advisory Council, *Transcript of Evidence*, 11 February 2016.

both technological change and regulatory settings reinforces the need for TIAC to play a critical role as an independent advisor to government.

6.51 Dr Bryce argued that, given the magnitude of change currently being experienced by key industries in WA, TIAC’s research focus should be on industry in the short- to medium-term. In particular, Dr Bryce suggested that TIAC could produce reports to help WA society better understand emerging technologies and their implications, with a particular focus on the topics of:

1. Robotics;
2. Artificial intelligence;
3. The internet of things (particularly with respect to ‘things’ that are not yet connected);
4. Cyber security and crime (and in particular the threat that this poses for industry);
5. The Square Kilometre Array;
6. The Western Australian innovation ecosystem; and
7. Education, training and skills development for WA industry.³⁵⁸

6.52 Ultimately if WA is to become a state of innovation, Government Ministers must take advantage of TIAC as a resource and direct it to take on more of a leadership role and ensure that government decisions are made with a clear understanding of what future technology may bring.

Finding 18

For WA to become a state of innovation, Government Ministers should take advantage of the Technical and Industry Advisory Council as a resource and direct it to take on more of a leadership role to ensure that government decisions are made with a clear understanding of what future technology may bring.

Recommendation 11

The Western Australian Government appoints the Chief Scientist of Western Australia to the Technical and Industry Advisory Council’s board.

Capability mapping

6.53 Another critical piece of intellectual innovation infrastructure in WA is a clear and detailed understanding of all the various elements of the state economy.

6.54 One of the key reasons why business clusters enhance the productivity of their various members is that, by operating in close geographic proximity, businesses in a cluster become more closely connected. Armed with better knowledge of the operations of

358 Hon Dr Mal Bryce AO, former Deputy Premier of Western Australia, *Briefing*, 13 May 2016.

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their neighbours, businesses in a cluster have a natural tendency to collaborate as they are more aware of the various strengths of their neighbours.

- 6.55 In light of the benefits associated with increased collaboration, one of the key efforts undertaken by government around the world has been to synthesise the cluster effect across an entire domestic economy, essentially by producing a ‘map’ of the capabilities of all of the various agents operating within that economy. Such ‘capability mapping’ has the potential to yield vast benefits within a domestic economy, much in the same way that being a member of a business cluster aids the growth of member businesses.
- 6.56 In Victoria, for example, the Department of Economic Development, Jobs, Transport and Resources has undertaken a ‘deep dive analysis’ of the entire economy of the State of Victoria.³⁵⁹ According to the Department’s Lead Deputy Secretary, Mr Justin Hanney, with the aid of an external consultant the Department had identified eleven distinct sectors within the Victorian economy, and had then set about developing plans to stimulate the growth of each of those sectors through various targeted programs.
- 6.57 In performing this analysis, the Department had produced a map of all of the different businesses that collectively comprise the Victorian economy—a map that is useful both for developing economic growth policies, and for ensuring that the various businesses are more aware of their own place within the economy overall.³⁶⁰ Essentially the Victorian Government has produced a map that helps businesses to understand where to best focus their investment, armed with the knowledge of what businesses exist in Victoria, how they interact, and what gaps (or opportunities) exist within the economic ecosystem. While the scope of such a project is immense, its difficulty is outweighed by its potential positive outcomes.
- 6.58 In WA, the Chamber of Commerce and Industry of Western Australia (Inc) (CCIWA) has recently embarked upon such a mapping exercise. According to its Chief Operating Officer, Mr Lindsay O’Sullivan, CCIWA ‘wanted to try to come up with a practical tool’ for businesses and investors in WA:

[s]o we said, “Why don’t we go and map to see who is there playing in that space?” Effectively, it will be across those two dimensions—size of business and maturity of business—and where you are in the innovation lifecycle, so idea creation, development or commercialisation... Eventually, what we will have is a tool that, if you are a small business and you are saying, “I’ve got an idea; who can help me form that idea?”, here is who is in the market who can try to

359 Mr Justin Hanney, Lead Deputy Secretary, Victorian Department of Economic Development, Jobs, Transport and Resources, *Briefing*, 29 October 2015.

360 *ibid.*

*help you: “I have an idea. I know what I’ve got to do but I’ve got no idea. How do I go and build it? It’s a piece of software. Who is out there who can help me work out how to code it? I’ve got my idea all ready to go; I’ve got to prototype it. I’ve got no idea how I’m going to make some money or where I’m going to take it. Who is going to help me attract an investor to help me take this thing international?” You will know who is currently playing it. That is one aspect of it—it is a tool. The other one is that it is a way of trying to think about policy, so are there gaps in that ecosystem that we can try to focus our attention on to build up that capacity within that ecosystem?*³⁶¹

- 6.59 The Department of Commerce advised that there are discussions occurring between them and the CCI in relation to this initiative.
- 6.60 The fact that CCIWA has taken the initiative and begun producing a capability map for WA is a positive and important development for the state—because the absence of such a map represents a gap in the innovation ecosystem. Clearly the government has an interest in ensuring that this gap is filled in a manner that is beneficial to the state as a whole, which is why consultations between the Department of Commerce, TIAC and CCIWA, as alluded to by Ms Driscoll, are so important. Equally, however, it is unnecessary for government to proscribe the form of any such map; ultimately a map that best serves the interests of the Western Australian business community will also serve the interests of government by helping to stimulate economic growth.
- 6.61 In light of this fact, and given the resources that will undoubtedly be required to produce (and maintain) a useful capability map, it would be reasonable for government to approach future consultations with CCIWA from the perspective of how the state can assist in the capability mapping exercise—whether through resources or otherwise. Ultimately, irrespective of who produces it, a detailed capability map, which is universally accessible, will significantly benefit the WA economy.

Finding 19

A detailed and well-maintained capability map, which is universally accessible, will significantly benefit the WA economy.

Finding 20

The Chamber of Commerce and Industry of Western Australia (Inc) is producing a capability map of Western Australia. The Committee is supportive of this initiative.

361 Mr Lindsay O’Sullivan, Chief Operating Officer, Chamber of Commerce and Industry of Western Australia (Inc), *Transcript of Evidence*, 17 February 2016, p 7.

Innovation networking

- 6.62 Events designed to draw together community, industry, research and government representatives are also important components of intellectual infrastructure as they help to stimulate collaboration between agents within the innovation ecosystem. Dr Bryce explained that one of TIAC's early initiatives was to host a series of ten '20/20 breakfasts' each year at which people would meet and network. According to Dr Bryce, these breakfasts would typically attract large numbers of attendees, leading to significant 'stimulation and cross-fertilisation' of ideas.³⁶²
- 6.63 Unfortunately these '20/20 breakfasts' have not endured, and although there are numerous networking and speaking circuit events hosted across Perth each month, most of these are facilitated by private businesses and require attendees to purchase tickets. While these events are important and mostly well-attended, they are not always accessible to all levels of industry in WA.
- 6.64 Recently, however, an organisation called Innovate Australia has established an alternative speaking and networking circuit, under the *Innovation Network* banner. In 2016, Innovate Australia will convene 16 *Innovation Network* events on various topics, including agriculture, mining, medical science, the built environment, biomimicry and energy, as well as five 'summits' on similar topics.³⁶³ Mr Kasprzak, who founded Innovate Australia, explained that the organisation 'is just over a year old... although informally we have been organising a lot of free networking events for just over five years'.³⁶⁴ According to Mr Kasprzak, these events are:

*a simple format for networking. We get people who come in. We try to get good speakers—interesting speakers. We get networking and then we give a little introduction to people about who we are and what we do. It is first speaker, questions and answers, second speaker, questions and answers and then networking.*³⁶⁵

- 6.65 Importantly, anyone is free to attend the events convened by Innovate Australia. Asked about funding for the events, Mr Kasprzak explained that running Innovate Australia:

does not require much funding because it is basically goodwill. We travel around usually. We have to give great credit to the Department of Commerce, especially Sandra Draper, because she has been a great supporter. Very often we can use the facilities of the Innovation Centre of WA in [Technology Park] Bentley. We actually use it free of charge

362 Hon Dr Mal Bryce AO, former Deputy Premier of Western Australia, *Briefing*, 13 May 2016.

363 Submission No. 45 from Innovate Australia, 11 February 2016.

364 Mr Peter Kasprzak, Chief Executive Officer, Innovate Australia, *Transcript of Evidence*, 11 February 2016, p 2.

365 *ibid.*

*and usually Sandra provides coffee and tea. It is not a huge expense to the department. It is a win-win situation for everybody because it brings activities basically to the place. We also work closely with Deloitte. We have events at Ernst and Young and different universities. If you think about it, it is just a matter of asking somebody and just organising it. Basically we need time and effort but it does not really require much funding. That is what is great about it. All our events are free. Therefore, we can get a lot of PhD students and younger people also attending, so there is no barrier to entry.*³⁶⁶

6.66 In the course of this Inquiry, the Committee has attended a number of *Innovation Network* events, with the attendance at each underscoring their popularity. Events of this nature are fundamental within a flourishing innovation ecosystem, and it is critical that the resources required to support them into the future remain available.

Finding 21

Speaking and networking events that are freely accessible by the business, university and student communities are a critical component of the intellectual infrastructure for Western Australia's innovation ecosystem.

Recommendation 12

The Western Australian Government supports future speaking and networking events that are freely accessible by the business, university and student communities as an important component of its role in supporting innovation in Western Australia.

366 Mr Peter Kasprzak, Chief Executive Officer, Innovate Australia, *Transcript of Evidence*, 11 February 2016, p 2.

Chapter 7

An Innovation-ready Workforce

An economy in transition will need an adaptive workforce

- 7.1 As ‘new industries and new sources of wealth are emerging’, economies around the world are changing.³⁶⁷ The Western Australian economy, too, is undergoing structural change, particularly ‘as the resources investment peaks and major projects move into the operational phase’.³⁶⁸
- 7.2 Much of this global economic change is a result of technological innovation. According to the Commonwealth’s Office of the Chief Scientist, ‘it is estimated, for example, that scientific and technological advances have produced roughly half of all US economic growth in the last 50 years. In Australia, 65 per cent of economic growth per capita from 1964 to 2005 can be ascribed to improvements in our use of capital, labour and technological innovation’.³⁶⁹
- 7.3 According to the Committee for Economic Development of Australia (CEDA), ‘technological change over the last two decades has been extremely fast and that is likely to continue’.³⁷⁰ This is having a significant disrupting impact on employment, with new skills, and a different mix of skills, required for employees ‘at all levels’ and across a wide range of sectors, including agriculture, resources and manufacturing.³⁷¹

367 Office of the Chief Scientist, *Science, technology, engineering and mathematics: Australia’s future*, Australian Government, Canberra, September 2014, p 5.

368 Ms Deidre Willmott, Chief Executive, Chamber of Commerce and Industry of Western Australia (Inc), in report prepared by Department of Training and Workforce Development, *Skilling WA—A workforce development plan for Western Australia*, Second Edition, Government of Western Australia, Perth, 2014, np.

369 Office of the Chief Scientist, *Science, technology, engineering and mathematics: Australia’s future*, Australian Government, Canberra, September 2014, p 7.

370 Committee for Economic Development of Australia, *Australia’s future workforce*, Melbourne, June 2015, p 6.

371 Office of the Chief Scientist, *Science, technology, engineering and mathematics: Australia’s future*, Australian Government, Canberra, September 2014, p 5. See also: STEM—WA, *STEM education, innovation and youth unemployment: Rising to the challenges*, Perth, August 2015, p 3; Department of Training and Workforce Development, *Skilling WA—A workforce development plan for Western Australia*, Second Edition, Government of Western Australia, Perth, 2014, p 5; Committee for Economic Development of Australia, *Australia’s future workforce*, Melbourne, June 2015, p 6.

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7.4 CEDA argues that ‘our labour market will be fundamentally reshaped by the scope and breadth of technological change’ and suggests that:

*almost five million jobs face a high probability of being replaced in the next decade or two while a further 18.4 per cent of the workforce has a medium probability of having their roles eliminated. Jobs that involve low levels of social interaction, low levels of creativity, or low levels of mobility and dexterity are more likely to be replaced by automation.*³⁷²

7.5 Alongside the technology-driven changes occurring in the Western Australian economy, there is greater emphasis on the need for employees to have diverse skill sets, and the associated fact that employers are finding it more difficult to recruit qualified staff. According to the Department of Training and Workforce Development (DTWD), ‘forecasts indicat[e] that employers will increasingly look for applicants who hold some level of post school qualifications, and have higher skill levels’.³⁷³

7.6 Traditionally, job training has been designed on a ‘qualification with a set of tasks and competencies that meet a job outcome today’; that is, there has been a ‘qualification–to–job relationship’.³⁷⁴ Now, though, it is generally accepted that ‘the nature of work will be different in the future’,³⁷⁵ with organisations such as CEDA, PwC and the Foundation for Young Australians forecasting that over 40 per cent of the workforce, or around five million Australians, risk being replaced by computerisation and automation in the next 10 to 15 years.³⁷⁶

7.7 This is a particularly significant issue for young people or those currently studying or training. The Foundation for Young Australians has reported that:

- *currently around 70% of young Australians are getting their first job in roles that will either look very different or be completely lost in the next 10 to 15 years due to automation [and]*

372 Committee for Economic Development of Australia, *Australia’s future workforce*, Melbourne, June 2015, p 8.

373 Department of Training and Workforce Development, *Skilling WA—A workforce development plan for Western Australia*, Second Edition, Government of Western Australia, Perth, 2014, p 5. For other forecasts of increased qualification requirements, see: Centre of Policy Studies, September 2013 forecasts, *Employment growth by ASCED attainment level, WA, ‘000 persons. 2012-3 to 2020-1*, cited in Department of Training and Workforce Development, *Skilling WA—A workforce development plan for Western Australia*, Second Edition, Government of Western Australia, Perth, 2014, p 6.

374 Mr Simon Walker, Executive Director, Policy, Planning and Innovation, Department of Training and Workforce Development, *Transcript of Evidence*, 6 April 2016, p 6.

375 *ibid.*

376 Foundation for Young Australians, *New work order: Ensuring young Australians have skills and experience for the jobs of the future, not the past*, Melbourne, 2015, p 7 and p 23; Committee for Economic Development of Australia, *Australia’s future workforce*, Melbourne, June 2015, p 8 and p 10; and PwC, *A smart move: Future-proofing Australia’s workforce by growing skills in science, technology, engineering and maths (STEM)*, April 2015, p 4.

- *nearly 60% of Australian students (70% in VET) are currently studying or training for occupations where at least two thirds of jobs will be automated.*³⁷⁷

7.8 In WA, DTWD reported that their modelling of workforce projections for a number of scenarios reveals that:

*qualifications at the post graduate and undergraduate levels show the highest levels of demand exceeding supply, with the projections showing a shortage of these qualifications in all scenarios over time. VET level qualifications tend to show an excess of supply for Certificate I/II and III/IV level qualifications, while at the Diploma level there is a tendency towards a small excess of demand. However, these VET qualifications, in particular at the Certificate I/II level, play an important role in providing an entry point into further education and training.*³⁷⁸

7.9 This situation represents a significant challenge for government, employers and workers.³⁷⁹ As DTWD acknowledged, there is a need for qualifications to provide ‘more adaptive capabilities’ because ‘training someone to do a specific job today may not be the nature of what we need to train people for into the future’.³⁸⁰

STEM skills are essential to a growing range of jobs

7.10 There is considerable present focus on the need for science, technology, engineering and mathematics (STEM) skills, with a general recognition in industry and government of the importance of the STEM disciplines and STEM literacy to the economic and social well-being of Australia.³⁸¹ According to the Edith Cowan Institute for Education

377 Foundation for Young Australians, *New work order: Ensuring young Australians have skills and experience for the jobs of the future, not the past*, Melbourne, 2015, p 2 and p 7.

378 Department of Training and Workforce Development, *Skilling WA—A workforce development plan for Western Australia*, Second Edition, Government of Western Australia, Perth, 2014, p 30.

379 Department of Training and Workforce Development, *Skilling WA—A Workforce Development Plan for Western Australia*, Second Edition, Government of Western Australia, Perth, 2014, p 30. While outside the scope of this report, it is important to acknowledge that there are a number of related challenges, including, but not limited to, the rapidly aging population and improving participation rates for those under-represented in the workforce.

380 Mr Simon Walker, Executive Director, Policy, Planning and Innovation, Department of Training and Workforce Development, *Transcript of Evidence*, 6 April 2016, p 6.

381 Australian Industry Group, *Progressing STEM skills in Australia*, Australian Industry Group, Sydney, March 2015, p 5. See also: Australian Industry Group, *Lifting our science, technology, engineering and maths (STEM) skills*, Australian Industry Group, Sydney, March 2013, p 1; Edith Cowan Institute for Education Research, *Optimising STEM education in WA schools*, February 2014; STEM—WA, *STEM education, innovation and youth unemployment: Rising to the challenges*, Perth, August 2015; Department of Training and Workforce Development, *Skilling WA—A workforce development plan for Western Australia*, Second Edition, Government of Western Australia, Perth, 2014; Committee for Economic Development of Australia, *Australia's future workforce*, Melbourne, June 2015; Office of the Chief Scientist, *Science, technology, engineering*

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Research, STEM education ‘is a powerful and productive driving force for economic growth’, and will underpin ‘an innovative and scientifically literate culture’.³⁸²

- 7.11 The need for STEM skills was a key theme in the evidence presented to the Committee, and indicated a general agreement on the need for STEM skills to meet employer and market requirements in a knowledge-based economy.³⁸³ The issue was also widely raised during the Committee’s numerous site visits in WA and interstate.³⁸⁴
- 7.12 This raises the related issue of up-skilling and retraining for those already in the workplace, and the changing nature of employment as a result of innovation. Any future re-training will necessarily involve increased STEM skill capacity.

Australia’s STEM skills levels are declining

- 7.13 The Commonwealth’s Office of the Chief Scientist reports that Australia has ‘worrying gaps in the STEM skills pipeline, from primary to tertiary education levels Australia’s performance in mathematical literacy in schools has fallen in absolute and relative terms’.³⁸⁵ Australia’s relative performance in ‘school-level scientific literacy’ has also fallen.³⁸⁶ The Office of the Chief Scientist also noted that:

and mathematics: Australia’s future, Australian Government, Canberra, September 2014, p 7; and Riley, James, ‘COAG agrees to new STEM formula’, *Innovation Aus.com*, 12 December 2015, np. Available at: <http://www.innovationaus.com/2015/12/COAG-agrees-to-new-STEM-formula>. Accessed on 28 April 2016.

- 382 Edith Cowan Institute for Education Research, *Optimising STEM education in WA schools*, February 2014, p 1.
- 383 See, for example, Submission No. 13 from Department of Training and Workforce Development; Submission No. 16 from BHP Billiton Iron Ore Pty Ltd; Mr Mark Titley, Global Technology Centre Manager, Chevron Australia, *Transcript of Evidence*, 6 April 2016, p 9; Submission No. 27 from Chamber of Minerals and Energy of Western Australia, 9 September 2015; Submission No. 3 from Interspatial Systems; Submission No. 7 from Engineers Australia; Submission No. 14 from Office of Science; Submission No. 21 from Technology and Industry Advisory Council; as well as transcripts of evidence from Rio Tinto Iron Ore; Chamber of Minerals and Energy of Western Australia; and National Energy Resources Australia.
- 384 For example, this was raised by: Dr Lachlan Blackhall, Co-founder and Chief Technology Officer, Reposit Power (30 October 2015); Mr Richard Kell, AM, Chair; Ms Alexandra Harrington, Chief Operating Officer; and Mr Ashley Brinson, Executive Director, Warren Centre for Advanced Engineering (3 November 2015); Professor Mary O’Kane, NSW Chief Scientist and Engineer (3 November 2015); Mr Andrew Sanderson, General Manager; Mr Greg Mason, Manager Innovation & Strategic Projects; and Mr Greg Twiner, Business Development Manager & Contracting Manager, TAE (4 November 2015); and Dr Geoff Garrett, Queensland Chief Scientist (5 November 2015).
- 385 Office of the Chief Scientist, *Science, technology, engineering and mathematics: Australia’s future*, Australian Government, Canberra, September 2014, p 11. See also, Australian Industry Group, *Progressing STEM skills in Australia*, Australian Industry Group, Sydney, March 2015, p 10.
- 386 Office of the Chief Scientist, *Science, technology, engineering and mathematics: Australia’s future*, Australian Government, Canberra, September 2014, p 11. Australia’s absolute performance in school-level scientific literacy did not change over the period tested.

- the rate of school student participation in science subjects is at its lowest level in 20 years; and
- While higher education enrolments in science have increased by almost 30 per cent since 2007, ‘study in key fields such as chemistry, physics and mathematics drops steeply after first year’.³⁸⁷

- 7.14 Analysis of Australian state and territory enrolment data from 1992 to 2012 shows that ‘the greatest rates of change occurred prior to 2001 and have been slower and steadier since’.³⁸⁸ Nevertheless, the decline continues and while this ‘may not amount to a crisis, there is undoubtedly serious cause for concern’.³⁸⁹
- 7.15 This concern was echoed in evidence to this Inquiry. Professor Peter Klinken, for example, advised that he is ‘concerned by the decrease in high school students undertaking science and mathematics subjects’.³⁹⁰ TIAC submitted that WA ‘currently lacks’ a strong STEM school education system and CMEWA argued for a revised curriculum framework due to the ‘evidence across the country of decreased attainment in maths and sciences in the school up to year 10’.³⁹¹
- 7.16 Australia’s declining enrolments in STEM need to be placed in the context of increasing student retention to year 12 (reaching nearly 82 per cent in 2013) and the accompanying diversification of the senior school curriculum.³⁹² With increased competition from ‘business studies, physical education, legal studies, hospitality and tourism, religious studies and drama’, STEM enrolments declined.³⁹³ This change flowed on to universities, which now have a much wider offering of courses, generally lower entry requirements, and fewer subject pre-requisites.³⁹⁴
- 7.17 Many inter-related reasons have been suggested as to why more students do not take STEM subjects in school, largely based on young people’s out-dated perceptions of jobs in science and industry, a lack of role models for young people; and a lack of vision or

387 Office of the Chief Scientist, *Science, technology, engineering and mathematics: Australia’s future*, Australian Government, Canberra, September 2014, p 11.

388 Kennedy, John, Lyons, Terry and Quinn, Frances, ‘The continuing decline of science and mathematics enrolments in Australian high schools’, *Teaching Science*, vol. 60, no. 2, June 2014, p 34.

389 *ibid.*

390 Submission No. 14 from Office of Science, Department of Premier and Cabinet, 28 August 2015, p 6.

391 Submission No. 21 from Technology and Industry Advisory Council, 28 August 2015, p 9. See also: Mr Emmanuel Hondros, Manager, People Strategies, Chamber of Minerals and Energy of Western Australia, *Transcript of Evidence*, 19 April 2016, p 8.

392 Dr Terry Lyons, cited in Strom, Marcus, ‘Four myths about why your kids aren’t studying science for the HSC’, *The Sydney Morning Herald*, 15 August 2015, p 5. Dr Lyons argues against the notions that children do not like science any more, the curriculum is boring, the teaching is uninspiring and students are now worse at science.

393 *ibid.*

394 *ibid.*, p 6.

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culture in the state that encourages young people to see and take advantage of the opportunities that exist through STEM education.³⁹⁵ Other reasons include the drive to get the highest score possible for university entry leads to students taking ‘easier’ subjects, rather than STEM subjects, and the increased breadth of subject choices available.³⁹⁶

- 7.18 One logical outcome of school students’ not wanting to take STEM subjects is that they are unlikely to want to take them at university or, if they are, they lack the basic prerequisites, despite available bridging courses.³⁹⁷

Finding 22

There was strong consensus throughout the evidence to this Inquiry on the need for improving the mathematics and science skills of Western Australian students.

Industry initiatives to improve STEM skills

- 7.19 In WA, there are several industry initiatives to improve STEM skills and increase student interest in those disciplines, and companies have also invested in education programs. These initiatives include, but are not limited to:

- Engineers Australia’s EngQuest and EngTalk programs, which connect volunteer engineers with schools, teachers and students to work on projects and promote engineering as an attractive career path.³⁹⁸

395 Submission No. 14 from Chief Scientist of Western Australia, Office of Science, 28 August 2015, p 6; Mr Andrew Harding, Product Group Director, Iron Ore, Rio Tinto Iron Ore, *Transcript of Evidence*, 23 March 2016, p 7 and p 8; Mr Adam Welch, Senior Policy Adviser, Australian Petroleum Production and Exploration Association, *Transcript of Evidence*, 19 April 2016, p 10; Mr Michael Gollschewski, Managing Director, Pilbara Mines, Rio Tinto Iron Ore, *Transcript of Evidence*, 23 March 2016, p 8; Dr Alex Wonhas, Executive Director, Energy, Environment and Resources, Commonwealth Scientific and Industrial Research Organisation, *Transcript of Evidence*, 19 April 2016, p 6 and p 9; Mr Stedman Ellis, Chief Operating Officer, Western Region, Australian Petroleum Production and Exploration Association, *Transcript of Evidence*, 19 April 2016, p 9; and Mr Emmanuel Hondros, Manager, People Strategies, Chamber of Minerals and Energy of Western Australia, *Transcript of Evidence*, 19 April 2016, p 10.

396 Mr Emmanuel Hondros, Manager, People Strategies, Chamber of Minerals and Energy of Western Australia, *Transcript of Evidence*, 19 April 2016, p 9. Mr John Fitzgerald, Chief Operating Officer, Harry Perkins Institute of Medical Research, *Briefing*, 18 April 2016; and Dr Terry Lyons, cited in Strom, Marcus, 'Four myths about why your kids aren't studying science for the HSC', *The Sydney Morning Herald*, 15 August 2015, p 6; and Kennedy, John, Lyons, Terry and Quinn, Frances, 'The continuing decline of science and mathematics enrolments in Australian high schools', *Teaching Science*, vol. 60, no. 2, June 2014, p 43.

397 This was discussed during briefings and site visits, including, for example, with Dr Leonie Walsh, Victorian Lead Scientist (29 October 2015); and Mr John Fitzgerald, CEO, Harry Perkins Institute (18 April 2016).

398 Submission No. 7 from Engineers Australia, 28 August 2015, pp 8–9.

- BHP Billiton invests in STEM education programs, partnering with Scitech, Curtin University, the University of Western Australia (UWA) and the Graham Farmer Foundation, as well as supporting the Australian Mathematical Sciences Institute and other programs to promote under-represented groups enter STEM professions.³⁹⁹
- Rio Tinto partners with organisations such as the Australian Academy of Technological Sciences and Engineering, UWA and Scitech to help increase interest in science and mathematics.⁴⁰⁰
- Earth Science Western Australia (ESWA) and the Minerals Tertiary Education Council both work to improve education geology, with ESWA concentrating on secondary schools and the Minerals Tertiary Education Council investing in undergraduate programs in geology, mining engineering and metallurgical engineering.⁴⁰¹ The ESWA approach has been proposed as a future model for STEM education (see discussion below).
- A number of companies support the Premier’s Science Awards, sponsoring various prizes such as the Early Career Scientist Award (Woodside), the Student Scientist of the Year (ExxonMobil) and the Science Engagement Initiative of the Year (Chevron).⁴⁰² In addition, BHP Billiton is a major sponsor of the WA Education Awards.

The state government’s role in STEM skills development

7.20 In light of some of the concerns expressed throughout this Inquiry, it is possible to draw the general conclusion that the ways in which young people are taught and encouraged to learn STEM throughout their school years and beyond can be improved. This conclusion is supported by a 2014 report from TIAC/ECU entitled *Optimising STEM education in WA schools*, and by a 2015 proposal by the STEM–WA Steering Committee for a WA pilot program.⁴⁰³

7.21 As well as drawing attention to the importance of STEM, declining student STEM participation and achievement, negative attitudes towards STEM, and the negative

399 Submission No. 16 from BHP Billiton Iron Ore Pty Ltd, 28 August 2016, pp 6–7. BHP Billiton’s investment in STEM education and promotion is detailed in the submission and in the *Transcript of Evidence* for the hearing of 23 March 2016.

400 Submission No. 26 from Rio Tinto Iron Ore, 8 September 2016, p 5.

401 Mr Emmanuel Hondros, Manager, People Strategies, Chamber of Minerals and Energy of Western Australia, *Transcript of Evidence*, 19 April 2016, pp 7–8.

402 Office of Science, *Premier’s science awards*, nd, np. Available at: <https://www.dpc.wa.gov.au/science/AwardPrograms/ScienceAwards/Pages/Default.aspx>. Accessed on 4 May 2016. See also: Mr Shaun Gregory, Senior Vice President and Chief Technology Officer, Woodside Energy Ltd, *Transcript of Evidence*, 16 March 2016, p 5; and Submission No. 32 from Woodside Energy Ltd, p 2.

403 Edith Cowan Institute for Education Research, *Optimising STEM education in WA schools*, February 2014; STEM–WA, *STEM education, innovation and youth unemployment: Rising to the challenges*, Perth, August 2015.

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impact of social disadvantage on STEM participation, the TIAC/ECU study revealed the following:

- *concern about the availability of teachers with requisite STEM expertise; [...]*
- *the absence of integrated strategies to build and strengthen the capacity of the STEM teaching workforce; [...]*
- *the diverse nature of initiatives providing support to STEM education, their uneven delivery to schools, and the willingness of industry to increase current support for STEM education; and,*
- *the barriers to optimising industry support for STEM education, and the strategies developed by education service providers to counter them.*⁴⁰⁴

7.22 The August 2015 proposal developed by the STEM–WA Steering Committee found the following key ‘priority needs to strategically strengthen STEM education in WA schools’:

- *leadership from Government, school sectors and schools;*
- *professional learning and curriculum resources to optimise teaching of primary and lower secondary school maths, science and technology, supported by cross-sectoral collaboration and coordination;*
- *increasing the engagement of Employers in the school education process, better coordination of the external resources they provide, and improving teacher access to these resources;*
- *emphasising STEM support for lower socioeconomic schools; and*
- *raising the profile of STEM education with school principals and the community.*⁴⁰⁵

7.23 The TIAC/ECU report concluded that ‘the study and its outcomes provide a compelling case for concerted action to address the current status of STEM education in our schools’.⁴⁰⁶

7.24 This Inquiry has not been into the state’s education system or curriculum and the Committee is not in a position to comment in detail on STEM education in WA. Nevertheless, it is clearly important that government takes a leadership role in advancing STEM education. BHP Billiton submitted that ‘Government has a critical role

404 Edith Cowan Institute for Education Research, *Optimising STEM education in WA schools*, February 2014, p 2. The study was based on a literature review, 20 interviews from people across the three education sectors, professional associations and significant STEM education providers, and interviews with 19 industry organisations that support STEM initiatives in schools.

405 STEM–WA, *STEM education, innovation and youth unemployment: Rising to the challenges*, Perth, August 2015.

406 Edith Cowan Institute for Education Research, *Optimising STEM education in WA schools*, February 2014, p 3.

to play as supporters and providers of education, training and skills development'.⁴⁰⁷ TIAC recommended that the state government 'takes a leading role in strengthening STEM education in WA schools and actively contributes to a policy environment that supports STEM education'.⁴⁰⁸ For APPEA, the focus for government should be on 'STEM and promoting STEM in all aspects of education and training'.⁴⁰⁹

7.25 It is also clear that improving STEM skills in WA requires a whole of government approach. The DTWD report *Skilling WA* argued that 'workforce planning and development cannot occur in isolation, and must be integrated with the wider planning functions of the State Government'.⁴¹⁰

7.26 Furthermore, workforce development and planning is not a short-term project and initiatives need regular review and amending to remain fit-for-purpose. The Department of Commerce submitted that the government:

*needs to continuously update skills prioritisation that will guide training especially at the vocational and tertiary level, while at primary and secondary schools ensuring a broad STEM base. The skills priority should focus on the medium to long term given the lag between a student commencing and completing education and training.*⁴¹¹

7.27 DTWD advised that the State Training Board will soon publish a report that examines the occupations of the future, based on four economic scenarios, out to 2030. The report will also show 'the profile of the educational needs of the working-age population in, say, 20 years' time'.⁴¹²

7.28 Industry also recognised that promoting STEM needs to be long term. For example, Rio Tinto's Iron Ore Group Executive, Mr Andrew Harding, argued that 'one of the more important roles' for the government is 'painting the picture' for young people, which would 'not get a payback in one or two years, but in the 10 to 20-year range, it will be astronomical'.⁴¹³

407 Submission No. 16 from BHP Billiton Iron Ore Pty Ltd, 28 August 2016, p 6.

408 Submission No. 21 from Technology and Industry Advisory Council, 28 August 2015, p 10.

409 Mr Stedman Ellis, Chief Operating Officer, Western Region, Australian Petroleum Production and Exploration Association, *Transcript of Evidence*, 19 April 2016, p 3.

410 Department of Training and Workforce Development, *Skilling WA—A workforce development plan for Western Australia*, Second Edition, Government of Western Australia, Perth, 2014, p 16.

411 Submission No. 28 from Department of Commerce, 9 September 2015, p 14.

412 Mr Simon Walker, Executive Director, Policy, Planning and Innovation, Department of Training and Workforce Development, *Transcript of Evidence*, 6 April 2016, p 2. The scenario situations are described as: long boom; smart recovery; terms of trade shock; ring of fire. See: *Skilling WA—A workforce development plan for Western Australia*, p 29.

413 Mr Andrew Harding, Product Group Director, Iron Ore, Rio Tinto Iron Ore, *Transcript of Evidence*, 23 March 2016, p 8.

A collaborative effort is essential

7.29 While government is primarily responsible for education and must provide leadership, it is essential that all STEM stakeholders take a collaborative approach to promoting and planning a STEM-capable workforce.⁴¹⁴ As DTWD recognised, ‘only through government, industry and employers collectively taking responsibility for workforce planning and development can the workforce be developed to meet the State’s needs’.⁴¹⁵

7.30 DTWD works with ten industry-based training councils who provide ‘a training and workforce development response to technological change in this instance and other changes in the economy’.⁴¹⁶ The Department purchases a range of information from the training councils, including:

*some contextual information about their industry, where their industry is heading into the future, what are the major issues that industry is facing—then working towards what are the major implications from a workforce perspective, and then that trickles down to the response from their perspective that they believe we should be looking at from a training and an education perspective.*⁴¹⁷

7.31 While industry investment into STEM education is imperative, further collaboration is required from all agents within the innovation ecosystem. The Committee’s previous work on the economic impact on floating LNG for the Western Australian economy drew attention to the work of the Australian Centre for Energy Process Training (ACEPT) based at Challenger Institute of Technology. ACEPT is viewed as a centre of excellence in workforce training and development for the petroleum industry, and has resulted from considerable government and industry collaboration.⁴¹⁸

414 STEM Stakeholders includes industry and all other employers that depend on professionals and vocational graduates with high level STEM skills, including the universities; Government agencies; the STEM professional teacher organisations; the vocational education system; school principals; the STEM professional organisations; and STEM education service providers. The term ‘Employers’ refers to all organisations that are dependent on tertiary and vocational graduates with STEM skills’. See: STEM—WA, *STEM education, innovation and youth unemployment: Rising to the challenges*, Perth, August 2015, p 2.

415 Department of Training and Workforce Development, *Skilling WA—A workforce development plan for Western Australia*, Government of Western Australia, Perth, 2014, p 2.

416 Mr Simon Walker, Executive Director, Policy, Planning and Innovation, Department of Training and Workforce Development, *Transcript of Evidence*, 6 April 2016, p 4.

417 Mr Gary Fitzgerald, Director, State Workforce Planning, Department of Training and Workforce Development, Department of Training and Workforce Development, *Transcript of Evidence*, 6 April 2016, p 3.

418 Economics and Industry Standing Committee, *The economic impact of floating LNG on Western Australia*, Volume 1, Parliament of Western Australia, Perth, May 2014, pp 200–205.

Workplace disruption due to technological change

- 7.32 WA has already experienced significant workforce disruption as a result of technological change. For example, as the Committee's previous report on the economic impact of FLNG technology on the Western Australian economy discussed, there is a need for ongoing up-skilling of the oil and gas industry workforce, including production operators, maintenance and associated trades such as electrical instrumentation.⁴¹⁹
- 7.33 Rio Tinto's Mine of the Future™ program provides an example of the impact of automation on the labour force required on WA mine sites. Launched in 2008, this program involves an operations centre that allows all Rio Tinto 'mines, ports and rails systems to be operated from a single location', an autonomous haulage system at the company's Pilbara sites, an automated drilling system, which is currently scheduled for deployment across those sites and a 'fully-autonomous heavy haul, long distance railway system' which is currently being trialled.⁴²⁰
- 7.34 While there is a continuing need for truck drivers on mine sites, for example, the introduction of programs such as Mine of the Future™ fundamentally changes future workforce requirements. Both Rio Tinto and BHP Billiton advised the Committee that truck drivers had taken up the opportunity for re-training to work in the companies' operation centres in Perth.⁴²¹
- 7.35 UnionsWA recognised the changes occurring in the workforce requirements, 'especially in waterfront and mining where you see innovative change really affect the amount of work that occurs on those sites'.⁴²² For example, automated trucks and above-ground rock breaking have led to a 'significant reduction' in labour requirements on mine sites.⁴²³ UnionsWA also acknowledged the safety improvements that can accompany such innovation, and 'really encourage[s] affiliates to invest in training for those workers [displaced by new technologies] to ensure that they transition'.⁴²⁴
- 7.36 According to UnionsWA, some workers have transitioned to different positions while others have been displaced. Some displaced workers have found work elsewhere, but finding alternative employment is not as easy as it once was. Furthermore, 'many of

419 *ibid*, p 188.

420 Submission No. 26 from Rio Tinto Iron Ore, 7 September 2015, p 7; and Rio Tinto Iron Ore, *Mine of the Future™*, nd, np. Available at: <http://www.riotinto.com/ironore/mine-of-the-future-9603.aspx>. Accessed on 2 May 2016.

421 Rio Tinto Iron Ore, *Briefing*, 18 April 2016; and BHP Billiton Iron Ore Pty Ltd, *Briefing*, 18 April 2016.

422 Mr Owen Whittle, Assistant Secretary, UnionsWA, *Transcript of Evidence*, 24 February 2015, p 2.

423 *ibid*.

424 *ibid*.

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those workers may not be confident in their capacity to transition to certain kinds of work as well'.⁴²⁵

- 7.37 The re-skilling and/or up-skilling of current employees is an important issue for all businesses seeking to embrace innovation, one that needs to be effectively managed to avoid unemployment and its economic and social consequences. This will also require a collaborative approach from all stakeholders including, but not limited to, employers, industry bodies, government, the education and training sector, and labour organisations.

Job ready graduates

- 7.38 The Commonwealth's Office of the Chief Scientist reports that globally R&D occurs in four main sectors: 'higher education (mainly universities), business enterprises, government agencies and private not-for-profit organisations (e.g. independent medical research institutes)', with the two largest sectors being business enterprises and higher education.⁴²⁶ Australia's R&D effort is largely in the higher education sector—'currently, Australia trains a large number of high quality scientists, with 60% securing jobs in academia'.⁴²⁷
- 7.39 The proportion of R&D workers in business in countries such as Sweden, Denmark and Finland is 'more than three times that of Australia'.⁴²⁸ The number of researchers in Australia's manufacturing and service sectors in 2009 was 3.1 per 1,000 employed in industry; for Scandinavian countries the figure was 10.0, and for the United States it was 10.5.⁴²⁹ Canada, which as Professor Ian Chubb noted, is 'perhaps our most similar country by population, GDP and geography', has 7 researchers for every 1,000 manufacturing industry workers.⁴³⁰ With 'PhD graduates [... being] some of our nation's most creative citizens' Australia's relatively poor employment of researchers in industry

425 *ibid*, p 5.

426 Pettigrew, A G, *Australia's position in the world of science, technology & innovation*, Occasional Paper Series, Issue 2, Office of the Chief Scientist, Canberra, 2012, p 2. Available at: <http://www.chiefscientist.gov.au/wp-content/uploads/OPS2-OECD-for-web-FINAL.pdf>. Accessed on 3 May 2016.

427 Submission No. 14 from Office of Science, Department of Premier and Cabinet, 28 August 2015, p 5. See also: Professor Joseph Luca, Dean, Graduate Research School, Edith Cowan University, *Transcript of Evidence*, 11 February 2016, p 2.

428 Pettigrew, A G, *Australia's position in the world of science, technology & innovation*, Occasional Paper Series, Issue 2, Office of the Chief Scientist, Canberra, 2012, p 2; and Submission No. 14 from Office of Science, Department of Premier and Cabinet, 28 August 2015, p 5. The R&D effort in the UK is also focussed in the higher education sector.

429 Pettigrew, A G, *Australia's position in the world of science, technology & innovation*, Occasional Paper Series, Issue 2, Office of the Chief Scientist, Canberra, 2012, p 2.

430 Professor Ian Chubb, Chief Scientist, 'Productivity, industry engagement and the PhD workforce', paper presented at AMSI Accelerate Australia Conference, 6 February 2013, p 7. Available at: <http://www.chiefscientist.gov.au/2013/02/productivity-industry-engagement-and-the-phd-workforce/>. Accessed on 3 May 2016.

'reveal[s] a critical lack of investment in, and a significant disadvantage for, innovation in Australia's industry sectors'.⁴³¹

7.40 This situation is partly explained by the generally held view that Australian PhDs are not business or industry ready, and do not understand employers' needs.⁴³² There is an acknowledgement from universities that their PhD graduates 'are potentially not as "industry ready" and their qualifications are therefore not as highly valued by their potential industry employers'.⁴³³

7.41 The reasons why this view exists, whether it is accurate or not, are similar to those discussed in Chapter 4 in relation to Australia's relatively poor performance in academic-industry collaboration. In brief, postgraduates 'are still evaluated on their academic outputs and their coursework is largely biased towards pursuing an academic career',⁴³⁴ while business 'seems to believe that the content of a degree is more important than the process of learning that underpins the content. You did physics? We don't need physics'.⁴³⁵

7.42 Professor Joseph Luca, Dean of Edith Cowan University's (ECU's) Graduate Research School, argued that 'the truth is industry does not actually know or understand what PhDs can do for them. In fact, in some instances [...] they will not employ PhDs because they do not really get it. They do not understand their value'.⁴³⁶ iPREPWA, in discussing the drivers for their PhD placement program, provided further insight:

- *PhD graduates not always prepared for careers outside the university.*
- *Perception from industry that PhD graduates are overly specialised and lack key skills required for the workplace such as communication, teamwork, project management and business acumen.*⁴³⁷

7.43 In discussing the ideal of having 'an oil and gas plant for the training of engineers', Professor Andris Stelbovics of Curtin University explained that the first opportunity graduate engineers have 'to see real-life working plant and analyse its complexity and

431 Pettigrew, A G, *Australia's position in the world of science, technology & innovation*, Occasional Paper Series, Issue 2, Office of the Chief Scientist, Canberra, 2012, p 2.

432 See, for example, Submission No. 40 from iPREPWA, p 2; Professor Christopher Hutchison, Director of Research and Development, Murdoch University, *Transcript of Evidence*, 12 February 2016; and Professor Ross Kingwell, Chief Economist, Australian Export Grains Innovation Centre, *Transcript of Evidence*, 17 February 2016, pp 6–7. The Australian Export Grains Innovation Centre also pointed to concerns in relation to undergraduate students and their lack of engagement with industry. See Submission No. 5 from Australian Export Grains Innovation Centre, p 5.

433 Submission No. 22 from University of Western Australia, 28 August 2015, p 14.

434 *ibid.* See also: Professor Ian Chubb, Chief Scientist, 'Productivity, industry engagement and the PhD workforce', paper presented at AMSI Accelerate Australia Conference, 6 February 2013, p 7.

435 *ibid.*

436 Professor Joseph Luca, Dean, Graduate Research School, Edith Cowan University, *Transcript of Evidence*, 11 February 2016, p 2.

437 Submission No. 40 from iPREPWA, 24 November 2015, p 2.

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learn all the procedures is when they get their first job'.⁴³⁸ Companies advise Professor Stelbovics that they need to train a graduate engineer for a further 12 months because, while university teaches theory, work 'is the real-life thing'.⁴³⁹

7.44 Not all businesses believe that Australian graduates are not industry ready. Shell Australia advised that they employed 16 graduates in 2016, mostly in 'engineering process, engineering civil, mechanics, [and] reservoir engineering', with many of them coming from WA universities.⁴⁴⁰ According to Shell Australia:

*they are very high-quality graduates. They all have not just an engineering degree, but another degree, either finance and economics or in IT, so you now have these double majors and a very broad spectrum. They are very informed about the industry as well.*⁴⁴¹

7.45 Similarly, Woodside Energy has very high regard for Australian graduates as very valuable, describing them as 'outstanding'.⁴⁴² According to Woodside Senior Vice-President and Chief Technology Officer, Mr Shaun Gregory, while 'we often hear the rhetoric of, "Jeez, the graduates aren't fit,"' and there are 'some skills they should add to their portfolio', the graduates employed by Woodside 'really do make you humble on what they can achieve'.⁴⁴³

7.46 Large businesses like Shell Australia and Woodside Energy, though, are in a position to attract top graduates and also have the resources to provide these graduates with extensive, structured graduate training.⁴⁴⁴ This was acknowledged by Mr Gregory, who stated that 'maybe it is because we attract so many. We have, I think, around 7 000 applicants for our hundred over the course of the year, so we are privileged in getting high calibre coming through the door'.⁴⁴⁵ The situation can be quite different for smaller businesses who are not always able to attract such high quality graduates or who do not have the resources to provide in-house professional development.

438 Professor Andris Stelbovics, Pro Vice-Chancellor, Faculty of Science and Engineering, Curtin University, *Transcript of Evidence*, 18 May 2016, p 6.

439 *ibid.*

440 Dr Claus Otto, Technology Manager, Shell Australia, *Transcript of Evidence*, 16 March 2016, p 9.

441 *ibid.*

442 Mr Shaun Gregory, Senior Vice President and Chief Technology Officer, Woodside Energy Ltd, *Transcript of Evidence*, 16 March 2016, p 7.

443 *ibid.*

444 *ibid.*; and Dr Claus Otto, Technology Manager, Shell Australia, *Transcript of Evidence*, 16 March 2016, p 9.

445 Mr Shaun Gregory, Senior Vice President and Chief Technology Officer, Woodside Energy Ltd, *Transcript of Evidence*, 16 March 2016, p 7.

University graduate development initiatives

- 7.47 Aware of the criticism that university graduates are not industry ready, universities have implemented programs to address the situation. For example:
- UWA has its UWA IQ strategy which, in part, aims to ‘help students gain valuable industry experience’, with discussions underway to extend the program to ‘significantly increase the number of students and staff members being placed in, or having sabbaticals in industry’.⁴⁴⁶
 - Curtin University has ‘a very significant aim around work-integrated learning. This is to give workplace experiences for undergraduate and also postgraduate students’, through industry coming to the university or students going to the workplace.⁴⁴⁷
 - In 2014, ECU developed and trialed the Industry and PhD Research Engagement Program (iPREPWA); this program has grown into a state based postgraduate placement program, with the collaboration of WA’s five universities.⁴⁴⁸
- 7.48 iPREPWA ran twice in 2015, with the five universities in WA signing a five-year agreement to run three rounds annually, beginning in 2016.⁴⁴⁹ The success of iPREPWA merits further consideration.

iPREPWA

- 7.49 iPREPWA was developed to address the Australia-wide problem ‘that universities and businesses are not truly engaging in joint research projects’.⁴⁵⁰ The program consists of:
- a two-day training program for postgraduates prior to their industry placement;
 - a six-week team project while being mentored by their industry partner;
 - a team presentation (oral and written) of their project solution to their industry partner;
 - a presentation evening during which certificates are presented by the Premier and the Minister for Commerce.⁴⁵¹
- 7.50 In its first 18 months of operation, iPREPWA had ‘20 projects, 16 different companies and 61 researchers go through’, with four companies participating twice.⁴⁵²

446 University of Western Australia, *UWA Innovation Quarter. The transforming power of innovation*, Perth, nd, p 15; and Submission No. 22 from University of Western Australia, 28 August 2015, p 14.

447 Professor Graeme Wright, Deputy Vice-Chancellor, Research, Curtin University, *Transcript of Evidence*, 12 February, p 5.

448 Submission No. 40 from iPREPWA, 24 November 2015, p 2.

449 *ibid*; and Dr Natasha Ayers, iPREP Coordinator, Edith Cowan University, *Transcript of Evidence*, 11 February 2016, p 2.

450 Dr Natasha Ayers, iPREP Coordinator, Edith Cowan University, *Transcript of Evidence*, 11 February 2016, pp 1–2.

451 Submission No. 40 from iPREPWA, 24 November 2015, pp 2–3.

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- 7.51 Feedback from students and industry partners was positive, with each group benefiting from their interactions with the other and developing new skills, knowledge and connections.⁴⁵³
- 7.52 iPREPWA's industry partners include large resources sector businesses, government departments, SMEs and start-ups.⁴⁵⁴ Professor Luca advised that while the program had only run in WA to date, other states were interested and a national agreement had been reached 'to try to roll it out' across Australia.⁴⁵⁵ Payments from industry partners range 'from \$5000 to \$10000 for a team of 3 PhD students for 6 weeks' and students receive 'a \$3000 scholarship for the 6 week program', half of which is paid by their home university.⁴⁵⁶
- 7.53 iPREPWA advised that managing the program 'in its current form' requires ECU to provide 'approximately 1.5 full time equivalent staff members' at a cost of around \$140,000 per annum.⁴⁵⁷ iPREPWA Coordinator, Dr Natasha Ayers, advised ECU receives 'a bit' of government support for the program, including \$5,000 from the Department of Commerce 'which went towards some of the administration, but mainly the celebration event that we had', and 'in-kind support' from the Department of Premier and Cabinet.⁴⁵⁸ AusIndustry has been very supportive in 'championing iPREP and putting us in touch with a lot of companies'.⁴⁵⁹
- 7.54 Expanding iPREPWA 'to target different industries and include programs at various stages for research students, would require an additional staff member' and a larger budget for promoting the program to industry, at a total cost of approximately \$220,000 per annum.⁴⁶⁰
- 7.55 As well as providing further financial support for iPREPWA, Professor Luca suggested the state government could also be involved in promoting the program, which is more

452 Dr Natasha Ayers, iPREP Coordinator, Edith Cowan University, *Transcript of Evidence*, 11 February 2016, p 2.

453 Submission No. 40 from iPREPWA, 24 November 2015, p 3.

454 Dr Natasha Ayers, iPREP Coordinator, Edith Cowan University, *Transcript of Evidence*, 11 February 2016, p 3.

455 Professor Joseph Luca, Dean, Graduate Research School, Edith Cowan University, *Transcript of Evidence*, 11 February 2016, p 4.

456 Submission No. 40 from iPREPWA, 24 November 2015, p 3.

457 Submission No. 40b from iPREPWA, 24 February 2016, p 1.

458 Dr Natasha Ayers, iPREP Coordinator, Edith Cowan University, *Transcript of Evidence*, 11 February 2016, p 5.

459 *ibid.*

460 Submission No. 40 from iPREPWA, 26 February 2016, p 1.

than simply ‘email-outs to companies’ and involves ‘thinking of how you can build an iPREP program into other initiatives’.⁴⁶¹

7.56 In recognition of the value of a collaborative approach ‘an overarching committee and brand’—Advancing Western Australia Research Education (AWARE)—has been created to ‘present a coordinated approach to the WA business community’.⁴⁶² iPREPWA submitted that collaboration between the five universities and industry partners ‘is critical to the success’ of the program.⁴⁶³

Finding 23

iPREPWA is an innovative and successful program with enormous potential to grow through targeting different industries. To deliver a successful program at scale iPREPWA will need to be better resourced.

Recommendation 13

The Western Australian Government supports iPREPWA by providing the funding necessary to make it available to more PhD students in Western Australia, in its current format of three rounds per year.

Finding 24

Any improvements in the level of government funding of iPREPWA should be on a co-funded basis with industry in order to meet agreed targets.

Subsea engineering

7.57 According to Curtin University, all universities in Australia ‘regularly look at where there is demand for new training opportunities’.⁴⁶⁴ A recent example of this is the university’s development of its two-year Master of Subsea Engineering degree. Based on recent and anticipated developments in the petroleum industry there is a recognised need for qualified and experienced subsea engineers.⁴⁶⁵

7.58 The need for qualified subsea engineers was brought to the university’s attention by GE Oil and Gas who advised there were no such courses in the southern hemisphere and asked if Curtin University ‘could develop such a subsea engineering program’.⁴⁶⁶ Recognising the opportunity to build on its petroleum engineering strengths, and in

461 Professor Joseph Luca, Dean, Graduate Research School, Edith Cowan University, *Transcript of Evidence*, 11 February 2016, p 6; and Dr Natasha Ayers, iPREP Coordinator, Edith Cowan University, *Transcript of Evidence*, 11 February 2016, p 6.

462 Submission No. 40 from iPREPWA, 24 February 2016, p 4.

463 *ibid.*

464 Professor Andris Stelbovics, Pro Vice-Chancellor, Faculty of Science and Engineering, Curtin University, *Transcript of Evidence*, 18 May 2016, p 6.

465 *ibid.*

466 Professor Brian Evans, Professor, Petroleum Engineering and Resources, Curtin University, *Transcript of Evidence*, 18 May 2016, p 4.

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consultation with industry, Curtin University developed its Masters program.⁴⁶⁷ This consists of a mix of academic and industry content—‘80 per cent of the first year is academic, plus 20 per cent is industry driven—industry lectured. Then the second year is entirely industry driven—entirely industry lectured’.⁴⁶⁸ While there was initial interest from companies and students in WA, it is proving difficult for students ‘to get sponsorship with companies’ as they ‘are laying off professional staff’.⁴⁶⁹

While the industry is currently experiencing a downturn, to reduce or stop training employees to advance their skills in a clearly required field such as subsea engineering is a short-sighted strategy. Industry would be better served by taking advantage of the downturn so that there are sufficient qualified and experienced subsea engineers in Australia when the demand arises. Failure to do this will result in a skills shortage and the need to import qualified engineers.

467 *ibid.*

468 *ibid.*

469 *ibid.*, p 8.

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Innovation through the Western Australian Government

8.1 As well as supporting research and development, and promoting and delivering STEM education, Western Australian Government agencies can encourage innovation in three main ways. They can be innovative in their own service delivery; foster innovation through their own procurement policies; and implement policies and regulations that foster innovation rather than hamper it.

Innovation in government service provision

8.2 Some Western Australian Government agencies advised that innovation is an important factor in their service delivery. For example, the Department of Fisheries ‘takes pride in its innovative work and considers it an essential part of continuously improving services and remaining relevant in changing environmental, economic and social conditions’.⁴⁷⁰ Furthermore, one of the Department’s ‘three core values’ is innovation.⁴⁷¹

8.3 For the Department of Agriculture and Food (DAFWA), innovation, or ‘change that adds value’, is involved in both reforming the business of the Department and the way it provides services.⁴⁷² DAFWA pointed to its annual operation plan, which aligns to the *Agrifood 2025+* strategic plan, and its Business Excellence Approach to planning and delivery, which involves the *oneDAFWA* way of working and the Australian Business Excellence Framework.⁴⁷³ DAFWA has also ‘establish[ed ...] an Innovation Facilitator and Organisational Excellence roles’.⁴⁷⁴

8.4 LandCorp’s approach to service provision also provides an instructive example. LandCorp advised that its mandate for innovation is found in three main areas. First, under s 16(1)(a) of the *Western Australian Land Authority Act 1992* (WA) LandCorp ‘is to balance as far as practicable the triple-bottom-line elements of all of its projects’,

470 Submission No. 2 from Department of Fisheries, 14 August 2015, p 1.

471 *ibid.*

472 Submission No. 33 from Department of Agriculture and Food, 17 September 2015, p 1.

473 *ibid.*, p 2.

474 *ibid.*, p 7.

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which ‘creates the environment to make innovation happen’.⁴⁷⁵ Second, government policy also requires ‘accelerat[ing] the rate of change in housing and built form development’ to be a key role for LandCorp.⁴⁷⁶ Third, LandCorp’s core strategy is ‘market leadership and innovation’, which incorporates a program of ‘innovation through demonstration’.⁴⁷⁷ LandCorp supports ‘innovation through demonstration projects that champion sustainable land and infrastructure development practices in cutting edge technologies [... and which also] demonstrate collaboration between government, universities and business’.⁴⁷⁸

- 8.5 LandCorp has recently executed a number of innovative projects in the areas of land use and residential housing design. These include projects using innovative architecture, ‘trial[ling] alternative approaches to infrastructure challenges’, affordable housing diversity and choice, and economic growth and diversity.⁴⁷⁹ LandCorp submitted that:

*it can add value by practically demonstrating to and working with industry, regulators, builders, developers, universities and peak bodies at different project level applications of the policy direction, with the aim of de-risking and accelerating the adoption of change by industry as a whole.*⁴⁸⁰

- 8.6 LandCorp’s approach is exemplified though the *Cool Earth Project*, which applies geothermal technology to housing design and construction. LandCorp’s Chief Executive Officer, Mr Frank Marra, explained that this project involves LandCorp:

*building two homes side by side in the infill suburb of Craigie. One is a standard home and the other is a very similar home, but we have applied geothermal heating and cooling technologies as a way of finding a way to heat and cool a home while having an open loop water system, which will, hopefully, save 50 per cent of energy use for heating and cooling purposes in Perth.*⁴⁸¹

- 8.7 This technology, which is mostly used for heating purposes, has not been used in Australian suburbs ‘in an individual house context’ as it ‘has not been de-risked and

475 Mr Frank Marra, Chief Executive Officer, LandCorp, 12 April 2016, *Transcript of Evidence*, 12 April 2016, p 2.

476 *ibid.*

477 *ibid.*

478 Submission No. 29 from LandCorp, 9 September 2015, p 1.

479 *ibid.*, pp 2–3.

480 *ibid.*, p 2. See also: Mr Frank Marra, Chief Executive Officer, LandCorp, 12 April 2016, *Transcript of Evidence*, 12 April 2016, p 2.

481 Mr Frank Marra, Chief Executive Officer, LandCorp, 12 April 2016, *Transcript of Evidence*, 12 April 2016, pp 2–3.

debugged from that perspective'.⁴⁸² Through the *Cool Earth Project*, LandCorp hopes to determine the viability of this technology for use in Western Australia (WA). If geothermal technology proves viable here, it could be used to significantly lessen household energy use in the future. As such, the *Cool Earth Project* stands as an example of potentially significant innovation that the market would ordinarily fail to deliver.

- 8.8 In relation to innovation in models of financing, LandCorp approaches this on a project-by-project basis, choosing 'the right intervention model' depending on the 'depth of private sector capacity'.⁴⁸³ On this basis, LandCorp:

*undertakes the full range of development activity, from developing our projects 100 per cent on balance sheets ourselves, through to joint ventures, through to collaborative partnership arrangements where we might tip in land and someone else might take on the development fully, through to LandCorp being very hands off and we do what we call a structured sale where we will sell off a parcel of land but with conditions and then allow the private sector to fully operate it.*⁴⁸⁴

- 8.9 Through all of its development activity, LandCorp needs to ensure a 'minimum hurdle rate of return for the capital' invested in a project.⁴⁸⁵ If this 'minimum hurdle', which is lower than would be expected for a private sector investment, is not achievable, LandCorp must seek a community service obligation payment from government to ensure it is met.⁴⁸⁶ Nevertheless, LandCorp operates in a market environment and its 'products are out there from a market-based perspective', which requires research and risk assessment to 'ensure the return profile reflects those risks'.⁴⁸⁷

- 8.10 In addition to meeting the required rate of return for a particular project, LandCorp considers a number of factors, including government's desired policy outcomes such as affordability, and infill or high-density achieved with a level of quality.⁴⁸⁸

- 8.11 These examples each demonstrate that government agencies can be innovative in their service delivery. However, a different view was expressed in evidence to the Inquiry. For example, Dr Stewart Dallas, in discussing state-owned utilities, stated that they 'have been very inward looking/parochial/isolated'.⁴⁸⁹ Dr Dallas suggested that

482 *ibid*, p 3.

483 *ibid*, p 6.

484 *ibid*.

485 *ibid*.

486 *ibid*.

487 *ibid*, p 7. LandCorp's White Gum Valley project is discussed in detail in the *Transcript of Evidence*, 12 April 2016, p 8.

488 Mrs Kerry Anne Fijac, Manager, Business Development and Marketing, LandCorp, 12 April 2016, *Transcript of Evidence*, 12 April 2016, p 7.

489 Submission No. 1 from Dr Stewart Dallas, 6 August 2015, p 2.

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government departments need to ‘support and indeed embed international scale innovation and research’, possibly through an internal mandate or budget for R&D.⁴⁹⁰

8.12 The Small Business Development Corporation (SBDC) also suggested that government ‘could lead by example in some innovation in terms of service delivery’.⁴⁹¹ According to SBDC’s Executive Director, Small Business Services, Ms Jacqueline Finlayson, ‘from a citizen and business point of view, Western Australia has a fair bit of work to do in terms of its delivery of government services in a contemporary and innovative way’.⁴⁹²

8.13 The University of Western Australia (UWA) viewed the state government’s *Science statement* as demonstrating ‘some encouraging progress’ in creating a ‘state-wide approach to scientific research’.⁴⁹³ UWA, however, also viewed the implementation of this strategy, including ‘the creation of a science and innovation culture across government’, as a challenge.⁴⁹⁴

Fostering innovation through government procurement

8.14 Government procurement ‘is increasingly viewed as having important potential to drive innovation’ in that it can:

- *overcome market failures by enlarging the market for certain goods and services, thus ensuring sufficient critical mass to encourage R&D investment [...]*
- *help offset systemic failures by enabling interaction between users and potential suppliers [...]*
- *articulat[e] and signal[ing] unmet needs to the market [... and]*
- *be more effective in generating innovation than R&D subsidies.*⁴⁹⁵

8.15 There are a number of barriers, though, to government ‘acting as an intelligent and informed customer’.⁴⁹⁶ A survey of 800 UK suppliers indicated that the main barriers to government procurement driving innovation include ‘the lack of interaction with procuring organisations, the use of over-specified tenders as opposed to outcome based specifications, low competencies of procurers and a poor management of risk during the procurement process’.⁴⁹⁷ These barriers are particularly acute for smaller

490 *ibid.*

491 Ms Jacqueline Finlayson, Executive Director, Small Business Services, Small Business Development Corporation, *Transcript of Evidence*, 19 April 2016, p 5.

492 *ibid.*

493 Submission No. 22 from University of Western Australia, 28 August 2015, p 11.

494 *ibid.*

495 Uyarra, Elvira et al, ‘Barriers to innovation through public procurement: A supplier perspective’, *Technovation*, vol. 34, 26 April 2014, p 631.

496 *ibid.*

497 *ibid.*

businesses and not-for-profit organisations, who reported issues ‘in relation to contract size, lack of useful feedback and communication opportunities’.⁴⁹⁸

- 8.16 It is important to recognise that government procurement can stifle innovation when government purchases create a guaranteed market. When that happens, businesses have little incentive to innovate, and indeed often focus on achieving regulatory certainty for the sale of their goods and services, instead of being concerned with how to improve them.⁴⁹⁹ Government procurement will generally help to encourage innovation when it creates early demand for new products, requires domestic producers to be highly sophisticated and internationally competitive, and seeks to take advantage of, and further develop, existing competitive advantage.⁵⁰⁰
- 8.17 The Commonwealth Government, as part of its National Innovation and Science Agenda, recognises a role for government procurement policy in fostering innovation in Australia, arguing that government can be an ‘exemplar’.⁵⁰¹ According to the *National innovation and science agenda report*, the Commonwealth Government is ‘committed to changing the way government delivers to Australians by trialling good ideas, sharing information, looking for innovative suppliers and changing our policies when they are not working’.⁵⁰²
- 8.18 According to the Commonwealth’s Digital Transformation Office, ‘a major barrier holding back innovation in the way government delivers services is procurement’.⁵⁰³ Rather than take the easier path of ‘continu[ing] with the ways things have been done’, the Commonwealth intends to ‘embrace new technological opportunities’ and make ‘government digital by default and opening up procurement and data to encourage innovation in Australian business’.⁵⁰⁴ The aim is to provide ‘accessible and seamless’ services, with government making ‘it easier for innovative businesses to partner with government’.⁵⁰⁵ To this end, the Commonwealth is establishing a new digital marketplace as ‘an online directory of digital and ICT services from which government agencies will procure to improve competition and promote innovation across

498 *ibid.*

499 *ibid.*, pp 644–645.

500 *ibid.*, p 645.

501 Australian Government, *National innovation and science agenda report*, Commonwealth of Australia, Canberra, 2015, p 14.

502 *ibid.*

503 Shelter, Paul, Digital Transformation Office, *Making it easier for startups and SMEs to help government deliver digital services*, Australian Government, 15 December 2015, p 1. Available at: <https://www.dto.gov.au/blog/making-it-easier-for-startups-and-sme-to-help-government/>. Accessed on 9 May 2016.

504 Australian Government, *National innovation and science agenda report*, Commonwealth of Australia, Canberra, 2015, p 14.

505 Shelter, Paul, Digital Transformation Office, *Making it easier for startups and SMEs to help government deliver digital services*, Australian Government, 15 December 2015, p 1.

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government'.⁵⁰⁶ This will make 'government more accessible to startups and innovative small and medium businesses by breaking down barriers to technology procurement'.⁵⁰⁷

8.19 The Commonwealth Government is also piloting 'a new approach to government procurement through the Business Research and Innovation Initiative' (BRII) which will 'challenge small to medium enterprises to deliver innovative solutions for government, rather than tendering for an existing product'.⁵⁰⁸ Under this initiative, the Commonwealth will nominate five policy and services delivery challenges and invite proposals from business to address those challenges. Grants of up to \$100,000 will be provided to the winners to allow them to test their ideas over a three to six month development period.⁵⁰⁹ An additional grant of up to \$1 million over 18 months may be available to the most successful ideas to assist in developing a prototype or proof of concept.⁵¹⁰

8.20 Other state governments have also recognised the potential for public procurement to stimulate innovation. For example, as part of its aim to be a 'leader in promoting innovation', the New South Wales Government considers using its 'procurement system to promote innovation [... as] an important policy objective'.⁵¹¹ According to a 2012 NSW Government discussion paper, 'this includes seeking new products, processes or services, or delivering services in new ways [as well as ...] procuring goods and services in new ways that promote innovation and creativity'.⁵¹² The NSW Government found inspiration in the *JobsOhio* model where money is invested through

506 Hon Malcolm Turnbull, MP, Prime Minister of Australia, *Driving innovation through procurement, cyber security and open data*, Media Statement, 7 December 2015. Available at: <https://www.pm.gov.au/media/2015-12-07/driving-innovation-through-procurement-cyber-security-and-open-data>. Accessed on 9 May 2016.

507 Australian Government, *National innovation and science agenda report*, Commonwealth of Australia, Canberra, 2015, p 15. The Committee notes that the Public Accounts Committee of the Legislative Assembly is currently inquiring into 'the procurement and contract management framework applicable to the delivery of Information and Communications Technology (ICT) projects across the public sector'.

508 Australian Government, *National innovation and science agenda report*, Commonwealth of Australia, Canberra, 2015, p 15.

509 Australian Government, *Business research and innovation initiative*, nd, np. Available at: <http://www.innovation.gov.au/page/business-research-and-innovation-initiative>. Accessed on 10 May 2016.

510 *ibid*.

511 Department of Finance & Services, *NSW Government procurement discussion paper*, NSW Government, Sydney, January 2012, p 24. Available at: <http://www.siba.com.au/getattachment/Advocacy/Advocacy-Requests/NSW-Government-Procurement-Review/NSW-Government-Procurement-Discussion-Paper.pdf.aspx>. Accessed on 9 May 2016.

512 *ibid*.

a not-for-profit corporation into programs that aim to incentivise job creation by innovative businesses.⁵¹³

- 8.21 As fostering innovation through government procurement was not an issue generally raised in submissions to the Inquiry, it is difficult to get a sense of how alert the Western Australian Government is in relation to this potential. The Department of Commerce, though, submitted that ‘government can use its purchasing budget to encourage innovation rather than only purchasing items off the shelf’ and suggested that the government ‘can work with key purchasing agencies to support local business innovation’.⁵¹⁴ As the agency responsible for the Buy Local, Building Local Industry, and Intellectual Property policies, the Department advised it ‘can work with key purchasing agencies to support local business innovation’.⁵¹⁵
- 8.22 Hon Dr Mal Bryce AO also sees a role for government procurement in assisting local companies develop, grow, and create jobs. Dr Bryce suggested that government could contract fledgling innovative local companies at critical stages in their development to provide them with opportunities that may not arise through the ordinary operation of the market. Procurement policies would need to ensure that local companies demonstrate they are competitive and that contracts include deliverables.⁵¹⁶
- 8.23 This approach would require a shift in culture for government and the public service as there are risks associated with preferring small, local companies to large or high-profile public companies. It would also require government to inform the public of its new approach and explain the risks and benefits. For Dr Bryce, the critical question for government is whether it wants to take a risk and support local companies in the long-term interests of the state and the future employment opportunities that generate.⁵¹⁷
- 8.24 Dr Bryce’s view was echoed by the SBDC in discussing a UK initiative called the Small Business Research Initiative (SBRI).
- 8.25 The SBRI, established in April 2009, is a mechanism connecting public sector agencies facing ‘intractable challenges for which no solution exists today or the current solutions are substantially inadequate’ with new ideas and suppliers. Innovate UK argues that there are benefits both to government and to businesses. These include:
- public sector access to ‘new ideas and technologies that would not be available to them through normal channels’;
 - solutions tailored to meet the agency’s particular needs;
 - improved public sector efficiency and effectiveness;

513 Mr Simon Smith, Department Secretary, NSW Department of Industry, *Briefing*, 2 November 2016.

514 Submission No. 28 from Department of Commerce, 9 September 2015, p 14.

515 *ibid*

516 Hon Dr Mal Bryce AO, former Deputy Premier of Western Australia, *Briefing*, 13 May 2016.

517 *ibid*.

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- faster adoption of new technology;
- managed risk through ‘a phased development programme running a portfolio of the most promising projects’; and
- businesses having access to finance to develop their idea.⁵¹⁸

8.26 The SBRI is based on a competition for a particular posed challenge, such as energy storage technology, improved experience for people with mental health illnesses, strengthening the security of maritime operations, future digital systems, patient responses to stratified medicine, defence and security micro and nano materials.⁵¹⁹ The competition process is as follows:

- *Government department or other public body identifies specific challenge*
- *This is turned into an open competition for new technologies and ideas*
- *Interested companies submit an application*
- *All submitted ideas are assessed for impact on the challenge and technical and commercial feasibility*
- *Development contracts (typically £50k to £100k) to assess the feasibility of the idea are awarded to the most promising proposals*
- *First feasibility phase (generally 2–6 months)*
- *Second assessment stage—not all projects will progress to phase two*
- *Second phase contract awarded—usually to develop prototype or demonstrator—for up to two years (typically up to £1m); this is the principal period for research and development aimed at producing a well-defined prototype*
- *Successful company is free to further develop and exploit their product or service, offer it to other customers and take it to market where it is open to competitive procurement.*⁵²⁰

8.27 Since April 2009, more than 40 public sector bodies have benefited from participating in the SBRI.⁵²¹

8.28 The SBDC acknowledged that the SBRI allows the UK public sector ‘to rapidly respond to socio-economic challenges through accessing technological and innovative solutions

518 Innovate UK, *SBRI for government departments and public bodies*, nd, np. Available at: <https://sbri.innovateuk.org/sbri-for-government-departments-public-bodies>. Accessed on 18 April 2016; and Innovate UK, *About SBRI*, nd, np. Available at: <https://sbri.innovateuk.org/about-sbri>. Accessed on 18 April 2015.

519 A full list of SBRI competitions is available at: <https://sbri.innovateuk.org/previous-sbri-competition-briefs>.

520 Innovate UK, *SBRI for government departments and public bodies. Process*, nd, np. Available at: <https://sbri.innovateuk.org/process>. Accessed on 18 April 2016.

521 *ibid.*

cultivated by the private sector’ and can be seen as ‘a form of public-private partnership facilitated through the procurement of “innovation” by government’.⁵²²

8.29 However, the SBDC also pointed to a number of significant differences between the UK and WA. First is the size and scale of the market economies, including population and company numbers. The UK has the ‘benefit of scale and the critical mass of a large diversified economy with ready access to much larger European markets and technologies’.⁵²³

8.30 Second is the differences in the cultural and regulatory environment in which businesses operate. The SBDC pointed to ‘fundamental differences in relation to cultural norms, legal frameworks, education standards, taxation arrangements, access to finance and start-up/venture capital, industrial relations systems, [and] entrepreneurial spirit’, among other things.⁵²⁴

8.31 Third is the need for a ‘significant shift’ required in the Western Australian public sector to ‘foster and facilitate new and innovative ways of doing things’.⁵²⁵ The SBDC provided two examples of ‘major problems and bureaucratic resistance’ faced by businesses having to fit their innovations into existing regulations:

- an attempt to introduce ‘a new, “safer” light pole (which did not meet Australian standards, even though no such standards actually existed!)’; and
- ‘an alternative form of assisted patient transfer service (which did not fit into any Transport licensing category and which threatened incumbent ambulance services)’.⁵²⁶

8.32 A further issue to consider is that an SBRI-type initiative may duplicate federal government programs such as the previously mentioned BRIL, which is scheduled to launch in July 2016.⁵²⁷

8.33 The BRIL was intended to provide government with access to new thinking and technology not available through traditional procurement practices, and to provide SMEs with critical early financial support to improve their chance of success.

Finding 25

There is a role for the Western Australian Government through the procurement process in fostering local innovation.

522 Submission No. 46 from Small Business Development Corporation, 6 May 2016, p 1.

523 *ibid.*

524 *ibid.*, p 2.

525 *ibid.*, p 2.

526 *ibid.*

527 *ibid.* The future of this initiative is not certain at the time of this report due to the July 2016 federal election.

Finding 26

Fostering innovation through the Western Australian Government's procurement process may involve a degree of risk. While this will require careful management by the government it should not be a deterrent.

Recommendation 14

The Western Australian Government develops an innovation-specific local procurement policy.

Implementing state policy and initiatives to encourage innovation

8.34 In the state government's 2016–2017 budget papers, many agencies and authorities mention innovation in a variety of ways: innovation is variously included as an agency focus area, an enabler of service provision, something to be encouraged, and a challenge to industries which will require regulatory change. While many government policies might be construed as encouraging innovation, a number of specific policies and initiatives were brought to the Committee's attention as being directly aimed at fostering innovation.

A Science Statement for Western Australia

8.35 In April 2015 the Office of Science released *A science statement for Western Australia. Growing Western Australia* (the *Science statement*). According to the *Science statement*, which is 'driven by the need for a more strategic approach to scientific research' in WA, if the state 'is to build on its comparative advantages, a set of priorities for research investment must be defined'.⁵²⁸ The *Science statement* sets out five science priorities based on areas in which the state enjoys a comparative advantage, as well as research and industry capability. Setting these priority areas of mining and energy, medicine and health, agriculture and food, biodiversity and marine science, and radio astronomy aims to 'enable research efforts across the State to be aligned at a State and national level, making better use of available resources'.⁵²⁹

8.36 Focusing on these priority areas in scientific research aims to help achieve several positive outcomes for WA, including 'fostering a culture of science in Western Australia through Education and Engagement initiatives; developing Western Australia's emerging capability in Data intensive science; building on the State's Water science expertise; and strengthening partnerships for Effective Collaboration'.⁵³⁰

528 Office of Science, Department of Premier and Cabinet, *A science statement for Western Australia. Growing Western Australia*, Government of Western Australia, Perth, April 2015, p 6.

529 *ibid*, p 6 and p 7.

530 *ibid*, p 18.

8.37 Alongside the *Science statement*, the Office of Science has recently established its WA Science Capability Directory to provide ‘relevant contact information for key stakeholders’ identified by the state government from across its five science priority areas as well as big data and STEM education.⁵³¹

8.38 A sample entry from the WA Science Capability Directory is provided in Figure 8.1.

Figure 8.1: Sample entry in the WA Science Capability Directory⁵³²

Name	Australian Export Grains Innovation Centre (AEGIC)
Brief	AEGIC provides national leadership and enables collaboration and capacity-building in Australia’s export grain industry with the end goal of returning enhanced value to growers.
Contact	Mr Richard Simonaitis
Role	CEO
Phone	08 6168 9900
Website	www.aegic.org.au

8.39 The development of the WA Science Capability Directory is a positive development. It is, though, essential that the Office of Science maintains this directory to ensure it provides useful and up to date information.

8.40 While the *Science statement* is generally seen as an important first step, industry is now keen to see the ongoing implementation of the opportunities listed in the statement, together with a long-term plan for taking advantage of STEM-related opportunities.⁵³³ It is vital that the government has an implementation strategy and plan, and provides the necessary support to drive its science and innovation agenda.

Finding 27

Western Australia’s Science Statement is a positive development but the government needs to develop an implementation strategy and a process to review and update this strategy.

State government innovation services

8.41 Western Australian Government services directly aimed at assisting innovators to develop their ideas and grow their businesses are largely delivered through the Department of Commerce and the SBDC.

531 Office of Science, Department of Premier and Cabinet, *WA science capability directory*, nd, np. Available at: <https://www.dpc.wa.gov.au/science/Documents/WA%20Science%20Capability%20Directory%20March%202016.pdf>. Accessed on 13 May 2016.

532 *ibid.*

533 Mr Emmanuel Hondros, Manager, People Strategies, Chamber of Minerals and Energy of Western Australia, *Transcript of Evidence*, 19 April 2016, p 2.

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8.42 The Department of Commerce's Industry and Innovation Division aims to be a 'strategic catalyst for industry and innovation', with key focus areas being industrial development, innovation services and local industry participation.⁵³⁴

8.43 As part of this role, until recently the Department has been responsible for a number of initiatives, including the Innovation Centre of Western Australia (ICWA), the Innovator of the Year program and the Innovation Vouchers Program (IVP). These are discussed in more detail below.

8.44 As at March 2016, the Industry and Innovation Division of the Department of Commerce has 17.47 FTEs, which represents a significant reduction in size since June 2011 when it had 73.9 FTEs. In 2013, 14 staff were transferred from the Department to the Office of Science, and as at June 2014 the Industry and Innovation Division had 30 FTEs.⁵³⁵ Three of the Departments Industry and Innovation Division staff are currently on a six-month secondment to the Office of the Government Chief Information Officer to assist the smooth transfer of the Innovator of the Year Awards and the administration of ICWA to that Office.⁵³⁶

8.45 The SBDC is a statutory authority established in 1984 'to deliver and facilitate relevant, practical support to small businesses and to foster the development of policy conducive to the growth of a thriving sector'.⁵³⁷ Mr David Eaton, Small Business Commissioner and CEO of the SBDC, summarised the SBDC's role as being to:

- *provide basic business information, advice and skill development to small business operators, with a particular focus on start-ups;*
- *assist [... small business operators] to navigate government regulation;*
- *advocate and work with government agencies, particularly in reducing the burden of regulation;*
- *provide access to justice through our dispute resolution and mediation services; and*
- *where appropriate, [act as a] conduit from business basics through to expert assistance that may be provided by other organisations.*⁵³⁸

534 Department of Commerce, *Industry and innovation. What we do*, nd, np. Available at: <http://www.commerce.wa.gov.au/industry-and-innovation/what-we-do-1>. Accessed on 13 May 2016.

535 Submission No. 28d from Department of Commerce, 2 June 2016, p 3. Note: these numbers do not include a corporate overhead FTE allocation.

536 *ibid*, p 1.

537 Small Business Development Corporation, *Business in WA. About SBDC. Services*, nd, np. Available at: <https://www.smallbusiness.wa.gov.au/business-in-wa/about-sbdc/services/>. Accessed on 17 May 2016.

538 Mr David Eaton, Small Business Commissioner and Chief Executive Officer, Small Business Corporation, *Transcript of Evidence*, 19 April 2016, p 2.

8.46 The SBDC is most commonly approached by small businesses that are either seeking to start up or are in crisis.⁵³⁹ Mr Eaton explained that financial literacy and digital literacy are foundation skills for entrepreneurship and innovation, and that while some businesses might be very optimistic and excited about their ideas, they may not have this basic business acumen to ‘understand the competitive challenge’ they face or understand their business model.⁵⁴⁰

8.47 Given the SBDC’s limited resources, its ‘core focus’ is on assisting:

*start-ups initially to understand and navigate the regulatory regime that is at its core. Nobody else really does that in a way that can give them that insight into all tiers of government and what they have got to start. Then we evolve into ... basic business skilling.*⁵⁴¹

8.48 Importantly, the SBDC argued that government support does not necessarily mean financial support.⁵⁴² For example, in discussing government support for Spacecubed, Mr Eaton advised that one role of the SBDC that is ‘hidden to most people is a non-funding way of supporting these sorts of industry or business-led ventures’.⁵⁴³ The SBDC offers ‘advice and support’, and plays a connecting and facilitating role.⁵⁴⁴ According to SBDC, ‘a fairly significant part’ of its role is to provide ‘a service that connects people to [... examples of other businesses] and that expertise can shine some light on options so that business owners can make informed decisions that are not going to risk their business when taking the next step’.⁵⁴⁵

8.49 The SBDC also advised that it was a founding partner with the Curtin Centre for Entrepreneurship in a program called Ignition, which was imported from the University of Cambridge’s Centre for Entrepreneurial Learning (CfEL).⁵⁴⁶ Ignition is a five and a half day intensive program, run annually, and made up of ‘a blend of practical teaching sessions, expert clinics, mentor sessions and experienced advice and support from leading entrepreneurs and innovators’.⁵⁴⁷

539 *ibid*, p 4 and p 6.

540 *ibid*, p 4 and p 6.

541 *ibid*, p 3.

542 Mrs Caragh Waller, Manager, Business Information and Programs, Small Business Development Corporation, *Transcript of Evidence*, 19 April 2016, p 6.

543 Mr David Eaton, Small Business Commissioner and Chief Executive Officer, Small Business Development Corporation, *Transcript of Evidence*, 19 April 2016, p 6.

544 *ibid*.

545 Ms Jacqueline Finlayson, Executive Director, Small Business Services, Small Business Development Corporation, *Transcript of Evidence*, 19 April 2016, p 7.

546 Curtin University, Centre for Entrepreneurship, *Curtin growth ignition*, nd, np. Available at: <http://business.curtin.edu.au/schools-and-departments/centre-for-entrepreneurship/courses-and-programs/curtin-growth-ignition/>. Accessed on 17 May 2016.

547 *ibid*.

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8.50 According to the SBDC's Manager, Business Information and Programs, Mrs Caragh Waller, Ignite 'has a great history of success in the UK', and is basically:

*for surrounding innovators with like-minded people, as well as people who potentially may fund their innovation—angel investors et cetera, federal government programs that may be able to help them link them up to those other tiers of government that perhaps they are not aware of. It also brings together academia, so MBA students support individually each of the participants on the program and government as well. We come as a state government agency to support them and make all the resources of the state government available to this individual.*⁵⁴⁸

8.51 Comparing the aims of the SBDC with those of ICWA shows possible overlap in the services provided by these bodies.

Innovation Centre of Western Australia

8.52 ICWA is a facility located at Technology Park Bentley that aims to:

- *Enable innovators to take their ideas from concept to a viable business through education, expert advice and provision of networking opportunities.*
- *Create a robust and sustainable innovation and commercialisation infrastructure in WA [...].*
- *Provide leadership and a focal point for innovation and commercialisation by providing a physical, easily accessible location for innovation in WA and through the creation of collaborative relationships across the innovation ecosystem, including tertiary institutions, industry, investors, government and professional service provider.*⁵⁴⁹

8.53 ICWA also has a Business Incubator to provide services to start-up businesses to help them grow. The ICWA Business Incubator offers:

- competitive rental;
- ongoing support from ICWA's commercialisation advisors and innovation mentors, with commercialisation advice in the form of one-on-one advisory sessions;
- access to ICWA's network of specialist and technical advisors, and industry contacts; and

548 Mrs Caragh Waller, Manager, Business Information and Programs, Small Business Development Corporation, *Transcript of Evidence*, 19 April 2016, pp 3–4.

549 Department of Commerce, *Innovation gateway. About*, nd, np. Available at: <http://innovation.wa.gov.au/about-us/>. Accessed on 13 May 2016. See also: <http://innovation.wa.gov.au/about-us/our-services/>.

- a collaborative environment where innovators can support one another.⁵⁵⁰

- 8.54 Through its various partners, ICWA offers free technical and specialist advisory consultations in a number of areas, including: intellectual property protection; marketing and branding; R&D taxation; strategic planning and business analytics; product development strategies, with a focus on hardware applications; business advisory and legal services; and access to federal government programs.⁵⁵¹
- 8.55 While this suggests some overlap between ICWA and SBDC services, the SBDC assured the Committee that ICWA ‘has a range of services’ that the SBDC does not provide.⁵⁵² The SBDC focusses on providing assistance for the first aspects of a business—the start-up—and businesses are then transferred to ICWA for technical development, as well as IP and commercialisation advice.⁵⁵³
- 8.56 During site visits to Technology Park Bentley, the Committee received many positive comments in relation to the services provided by ICWA.⁵⁵⁴ Furthermore, Mr Peter Kasprzak, CEO of Innovate Australia, advised that he has ‘very warm feelings towards the innovation centre because [... he] was there 10 years ago and there was an entrepreneurs club and then an inventors’ association where we had meetings over there. It is a great facility’.⁵⁵⁵
- 8.57 The Department of Commerce advised that it had funded ICWA ‘for some years’ but that ‘those models need a rethink’.⁵⁵⁶ The Department has engaged a consultant to consider the ‘mentoring and incubator support’ being provided and ‘whether that is the best use of money in terms of the current sort of facade and mode of delivery that is provided’.⁵⁵⁷
- 8.58 At the time of this report, the future of ICWA is unclear. In March 2016, responsibility for ICWA was transferred to the Office of the Government Chief Information Officer.⁵⁵⁸

550 Department of Commerce, *Innovation. ICWA business incubator*, nd, np. Available at: <http://innovation.wa.gov.au/icwa-business-incubator/>. Accessed on 13 May 2016.

551 Department of Commerce, *Innovation. About us. ICWA technical and specialist advisors*, nd, np. Available at: <http://innovation.wa.gov.au/about-us/our-services/icwa-technical-and-specialist-advisors/>. Accessed on 13 May 2016.

552 Ms Jacqueline Finlayson, Executive Director, Small Business Services, Small Business Development Corporation, *Transcript of Evidence*, 19 April 2016, p 7.

553 *ibid.*

554 On 23 September 2015, the Committee visited ICWA, Motium, AnaeCo and Gray Surgical.

555 Mr Peter Kasprzak, Chief Executive Officer, Innovate Australia, *Transcript of Evidence*, 11 February 2016, p 5.

556 Ms Anne Driscoll, Acting Director General, Department of Commerce, *Transcript of Evidence*, 16 March 2016, p 10. The other incubator funded by the Department is in Henderson.

557 *ibid.*

558 Submission No. 28d from Department of Commerce, 2 June 2016, p 1.

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8.59 Regardless of whether ICWA is continued in its current form or whether an alternative model is developed, it is important that the SBDC and the Department of Commerce do not duplicate their services, and that areas of responsibility for each body are clearly delineated.

Finding 28

While ICWA is well regarded by the innovation community its future is unclear.

Recommendation 15

The Western Australian Government ensures that any model developed for the delivery of innovation-related services does not result in a duplication of services.

Innovation Vouchers Program

8.60 The Innovation Vouchers Program (IVP) aims to ‘assist SMEs to overcome some of the barriers that exist on the path to commercialisation’ by providing financial assistance of up to \$20,000 ‘to access professional skills, services or knowledge to enable them to advance their innovation or commercialisation activity in Western Australia’.⁵⁵⁹ Successful applicants ‘need to provide a net cash co-investment of matched funds at a rate no less than 20:80 of applicant to State Government funding’.⁵⁶⁰ That is, for a \$20,000 grant, the applicant needs to contribute \$5,000.

8.61 The services, skills and knowledge on which the vouchers can be spent include:

- *research and development (eg technical development, compliance testing, proof of concept, product testing, validation, laboratory verification and certification);*
- *product development (eg engineering design work, prototyping, innovation design);*
- *technology transfer and intellectual property (eg protection of intellectual property, legal advice and licensing); and*
- *commercialisation support services (eg innovation management and consulting, commercialisation strategies and commercialisation feasibility studies).*⁵⁶¹

8.62 The IVP website notes that the program is currently closed.⁵⁶² The program is dependent on an annual allocation of funding and the current funding is exhausted. It is not clear whether innovation vouchers will be part of the state government’s

559 Department of Commerce, *The innovation vouchers program*, nd, np. Available at: <http://innovation.wa.gov.au/programs/innovation-vouchers-program-2015/>. Accessed on 18 May 2016.

560 *ibid.*

561 *ibid.*

562 *ibid.*

\$20 million innovation budget, although part of the budget is for ‘scholarships, incentives, grants and awards to drive entrepreneurship and job creation’.⁵⁶³

8.63 The Committee notes that the *2016–2017 Budget paper no. 2* shows the following Industry and Innovation Grant expenditure by the Department of Commerce:

- 2014–2015 actual spend of \$1,309,000
- 2015–2016 estimated actual spend of \$1,137,000
- Forward estimates for 2017–2018 to 2019–2020 of \$1,137,000 per year.⁵⁶⁴

8.64 RIIT’s Mr Zane Prickett sees the IVP as a positive initiative, suggesting that the Committee would ‘be surprised at the long-term results of those’, particularly as the grants were ‘very small’.⁵⁶⁵ Mr Prickett argued that more of these types of initiatives would support people ‘to really start to grab their ideas and get enough runway to get at least a well-developed prototype in, so you can test that money, and they can get off’ and start the commercialisation process.⁵⁶⁶

8.65 Some, though, suggested that the IVP grant is too small. For example, the Chamber of Commerce and Industry of Western Australia (Inc) (CCIWA) recognised that the IVP aims to assist SMEs ‘overcome some of the barriers to commercialization’.⁵⁶⁷ However, CCIWA also contrasted IVP grants with Germany’s Central Innovation Programme, which ‘promote[s] market-driven, technology-based R&D within German SMEs’, by offering ‘funding of up to €2 million of grant funding for a wider variety of R&D projects than the WA program’.⁵⁶⁸

8.66 In discussing the lack of funding for SMEs to build prototypes, Ms Sheryl Frame of StartupWA acknowledged the IVP, but argued that it ‘did not go nearly far enough’.⁵⁶⁹ Curtin University submitted that ‘it is important that the scale of the grants is sufficient to make a meaningful impact and shift behaviour’ and that it is ‘questionable’ whether the current IVP ‘is leading to meaningful outcomes and whether the funding could perhaps be better applied elsewhere’.⁵⁷⁰

563 Hon Colin Barnett, MLA, (Premier of Western Australia), *Our state budget 2016-17: Securing our economic future—\$20m commitment to drive WA’s innovation future*, Media Statement, Government of Western Australia, Perth, 14 May 2016.

564 Department of Treasury, *2016–17 budget statements (Budget paper No. 2 Volume 1)*, Government of Western Australia, Perth, May 2016, p 519.

565 Mr Zane Prickett, Director, Resource Innovation and Information Technology, *Transcript of Evidence*, 11 February 2016, p 8.

566 *ibid.*

567 Submission No. 34 from Chamber of Commerce and Industry of Western Australia (Inc), 18 September 2015, p 10.

568 *ibid.*

569 Ms Sheryl Frame, Director, StartupWA, *Transcript of Evidence*, 11 February 2016, p 2.

570 Submission No. 20 from Curtin University, 31 August 2015, p 3.

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- 8.67 Concern was also expressed in relation to the government process of evaluating IVP applications. Ms Frame, for example, stated 'I think it probably cost you more in time in adjudicating applications you had than the results you are getting out of it'.⁵⁷¹ Mr Strharsky of RIIT stated that the government 'has to have some way of evaluating the applications that come in, and if you think about it, that process of evaluating those applications is exactly the process that we run in our accelerator for choosing entrants'.⁵⁷²
- 8.68 In effect, this means that government is duplicating the work of the private sector and, as Mr Strharsky argued, 'we are paying twice in Perth for understanding which opportunities make the most sense to fund at that stage'.⁵⁷³ Mr Strharsky suggested that the government could partner with the private sector entity 'that is delivering that service already and that is probably better placed to know'.⁵⁷⁴
- 8.69 Submissions pointed to other jurisdictions that also had innovation voucher programs. As well as Germany's Central Innovation Programme, submissions referred to \$15,000 Tech Vouchers available in New South Wales, South Australia's \$50,000 Tech Voucher Program and Innovate UK's £5,000 Innovation Vouchers.⁵⁷⁵ A brief outline of Innovate UK's Innovation Voucher initiative is provided below.

571 Ms Sheryl Frame, Director, StartupWA, *Transcript of Evidence*, 11 February 2016, p 2.

572 Mr Justin Strharsky, Director, Resource Innovation and Information Technology, *Transcript of Evidence*, 11 February 2016, p 8.

573 *ibid.*

574 *ibid.*

575 Submission No. 11 from StartupWA, 20 August 2015, p 11.

Innovate UK—Innovation Vouchers

Innovate UK offers Innovation Vouchers of up to £5,000 to help start-ups and SMEs obtain external expert help in the form of knowledge or technology transfer.⁵⁷⁶ Innovation vouchers are intended to ‘stimulate a company to explore bringing new knowledge into the business, enhancing its ability to develop innovative products, processes and services and explore new markets’.⁵⁷⁷

Vouchers are awarded based upon three key criteria:

- assistance should be for an idea that is a business challenge requiring specialist help;
- it should be the first time that the business has worked with the knowledge provider; and
- the idea should be applicable to one of Innovate UKs three priority sectors.⁵⁷⁸

Eligible applicants can choose experts from universities and further education colleges; research and technology institutes; technical consultancies and Catapult centres; design advisers; and intellectual property advisers.⁵⁷⁹

According to Innovate UK, it ‘is to invest up to £6m in Innovation Vouchers to help stimulate and promote innovation in sectors where fewer businesses are currently investing in innovation and we want to encourage more of them to start’.⁵⁸⁰

Innovation Vouchers are awarded four times a year—in January, April, July and October—with themes for each round announced on the Innovation Vouchers web site. Themes have included areas such as agrifood, built environment, cyber security, energy, waste and water, and high value manufacturing.⁵⁸¹

576 Innovate UK, *Overview*, nd, np. Available at: <https://vouchers.innovateuk.org>. Accessed on 18 May 2016; and *Innovation vouchers*, nd, np. Available at: <https://interact.innovateuk.org/-/innovation-vouchers>. Accessed on 18 May 2016.

577 Innovate UK, *Innovation vouchers*, nd, np.

578 *ibid.*

579 Innovate UK, *Overview*, nd, np.

580 Innovate UK, *Innovation vouchers*, nd, np.

581 Innovate UK, *Innovation vouchers listing*, nd, np. Available at: <https://vouchers.innovateuk.org/innovation-vouchers-listing>. Accessed on 18 May 2016.

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Innovator of the year

8.70 The WA Innovator of the Year program began in 2006 to support innovators and entrepreneurs in WA, and is run by the Department of Commerce.

8.71 The program aims to:

- *promote and acknowledge the success of Western Australian innovators;*
- *encourage co-support from industry for promotional activities;*
- *activate and strengthen industry-government research collaborations; and*
- *engage communities throughout Western Australian regions in innovation.*⁵⁸²

8.72 The 2016 program offers five distinct awards:

- Mitsubishi Corporation WA Innovator of the Year—Overall Winner—\$75,000
- Mitsubishi Corporation Emerging Innovation Category (pre-revenue)—\$25,000
- Mitsubishi Corporation Growth Category (post-revenue)—\$25,000
- Woodside Oil and Gas Encouragement Award—\$10,000
- Perth Convention Bureau 2016 WA Innovator of the Year Travel Award—\$5,000.⁵⁸³

8.73 Professor Lyn Beazley AO FTSE, Chair of the WA Innovator of the Year Advisory Committee, stated that:

*creative thinkers can take advantage of the program's mentoring, networking opportunities and financial assistance to help them commercialise their ideas, and in turn, create long lasting benefits for our economy and community. The prestige of the awards means that the recognition afforded to winners helps promote their innovation to the world and achieve their goals.*⁵⁸⁴

8.74 Curtin University also sees the WA Innovator of the Year as a positive initiative, stating that it 'is an example of a program that celebrates and raises the profile of successful innovators'.⁵⁸⁵

582 Department of Commerce, *WA Innovator of the year. About the program*, nd, np. Available at: <https://www.commerce.wa.gov.au/industry-and-innovation/about-program>. Accessed on 18 May 2016.

583 Department of Commerce, *WA Innovator of the year. Awards*, nd, np. <https://www.commerce.wa.gov.au/industry-and-innovation/awards>. Accessed on 18 May 2016.

584 Department of Commerce, *WA Innovator of the year. Message from the Chair of the Advisory Committee*, nd, np. <https://www.commerce.wa.gov.au/industry-and-innovation/message-chair-advisory-committee>. Accessed on 18 May 2016.

585 Submission No. 20 from Curtin University, 31 August 2015, p 2.

- 8.75 In March 2016, responsibility for the WA Innovator of the Year program was transferred from the Department of Commerce to the Office of the Government Chief Information Officer.⁵⁸⁶
- 8.76 The Committee is also aware of other government initiatives aimed at celebrating innovation in WA. For example, the Office of Science administers the Premier's Science Awards, the WA Science Hall of Fame and the Governor's School STEM Awards.⁵⁸⁷ The Department of Commerce also assists SMEs through the Industry Facilitation and Support Program, and by contributing a small amount to the medical research commercialisation fund and offering internships for medical researchers to develop their skills.⁵⁸⁸

Finding 29

There are several portfolios and appointments with various responsibilities for encouraging and supporting innovation in Western Australia. It is not clear at this time which agency has the lead responsibility.

Western Australian Government policy and regulation should encourage innovation, not stifle it

- 8.77 Evidence to this Inquiry suggests that government regulation can be a barrier to innovation. This occurs in two main ways. First, is what is perceived as 'red tape' and 'duplicative regulation'.⁵⁸⁹ For CCIWA, 'balancing and managing all the regulatory burden' is a problem for SMEs as it is an area 'that do[es] not generate any economic value for them and for their customers and for the people they employ'.⁵⁹⁰
- 8.78 The CCIWA also argued that while the 'removal of duplicative regulation is important ... monitoring how regulation is being applied by government agencies' is more important.⁵⁹¹ Regulation is necessary to ensure there is a 'well-functioning system', but inconsistent application of regulations or a focus on government 'acting as the role of policeman rather than monitoring and supporting' makes it more difficult for businesses to operate within the existing regulatory regime.⁵⁹²

586 Submission No. 28d from Department of Commerce, 2 June 2016, p 1.

587 Office of Science, *Award programs*, nd, np. Available at: <https://www.dpc.wa.gov.au/science/AwardPrograms/Pages/default.aspx>. Accessed on 23 May 2016.

588 Mr John O'Hare and Mr Michael Dickson, Department of Commerce, *Transcript of Evidence*, 16 March 2016, p 4 and p 6.

589 Mr Dale Leggett, Director of Policy, Chamber of Commerce and Industry of Western Australia (Inc), *Transcript of Evidence*, 17 February 2016, pp 5–6.

590 *ibid*, p 3.

591 *ibid*.

592 *ibid*.

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- 8.79 BHP Billiton also noted the importance of ‘regulatory certainty and political stability to stimulate business confidence’ and argued that removing the ‘compliance burden and non-competitive regulation [...] cultivate a business climate that rewards innovation’.⁵⁹³ BHP Billiton cited Australia’s intellectual property regime as an example of an area where the government needs to ‘strike[s] an appropriate balance between providing sufficient protection to reward and encourage creativity without stifling the diffusion of ideas’.⁵⁹⁴ The issue of IP is discussed in Chapter 5.
- 8.80 This is closely related to the second way in which government regulation may stifle innovation, namely in not being able to respond to new ideas in a timely manner. Using technological developments in agriculture as an example, CCIWA questioned whether Western Australian legislation is ‘adequate to keep pace’ with such developments and allow them to be used on farms ‘without excessive levels of red tape or delay’.⁵⁹⁵
- 8.81 According to TIAC, government ‘regulations often capture and endorse the “here and now”, and therefore sometimes stifle better solutions developed through future innovation and research’.⁵⁹⁶ For TIAC, the state government has ‘the responsibility to ensure that regulatory settings are contemporary, effective and efficient, and that potential barriers to the introduction of new technologies are minimised’.⁵⁹⁷
- 8.82 The Department of Commerce recognised the ‘increasing challenges’ for government ‘in terms of technology, globalisation, regulatory reach and appropriateness of regulation in the new emerging economies’.⁵⁹⁸ According to the Department:
- government needs to be changing laws to assist innovation, particularly to areas where there are limited partnerships and the bio-discovery laws, but also addressing other regulatory barriers that present themselves to us, be it in the arena of transport or building regulation. As new technologies present we have to rethink the way in which our laws are structured.*⁵⁹⁹
- 8.83 The proposed amendments to the *Limited Partnerships Act 1909 (WA)*, as discussed in Chapter 5, provide an example of government legislation that needs to change to keep pace with, and not hinder, innovation. It is also important that new legislation is formulated with an eye on what the future might hold.

593 Submission No. 16 from BHP Billiton Iron Ore Pty Ltd, 28 August 2015, p 5.

594 *ibid.*

595 Submission No. 34 from Chamber of Commerce and Industry of Western Australia (Inc), 24 September 2015, p 3.

596 Submission No. 21 from Technology and Industry Advisory Council, 2 September 2015, p 18.

597 *ibid.*, p 2.

598 Ms Anne Driscoll, Acting Director General, Department of Commerce, *Transcript of Evidence*, 16 March 2016, p 2.

599 *ibid.*

8.84 TIAC argued that some of the regulatory constraints ‘could be minimised if regulations are adjusted to manage, rather than avoid, risk, and to provide for a blanket concept of equal or better outcomes based on new technologies overriding any prescriptive requirements’.⁶⁰⁰

8.85 There are other regulatory mechanisms the state government can use to foster an environment that will necessarily encourage SME engagement. These include:

- *Us[ing] of standards to drive innovation adoption. One example was the modernisation of standards related to light bulbs and light bulb energy efficiency.*
- *Unlock[ing] areas of strength through efficient and supportive legislation in areas such as biodiscovery and aquaculture.*⁶⁰¹

8.86 Noting that ‘legislation should not unduly increase risks or cost’, TIAC proposed that state regulations ‘should be less punishing on technology commercialisation failure’.⁶⁰² A failed attempt at commercialisation or technology adoption does not necessarily mean that the business has been poorly managed—it may simply mean that the idea was ahead of its time. TIAC also argued that regulations ‘should be considered for their impact on commercialisation of innovative solutions, legislation should not unduly increase risks or cost’.⁶⁰³

8.87 A major challenge for government is to strike the right balance in regulation, amid sometimes conflicting arguments presented by business in relation to government’s role. On the one hand, government is often told to ‘leave us alone. Let us get on with it’, while on the other, businesses and innovators frequently expect government to ‘take a leading role’.⁶⁰⁴

8.88 For the Department of Commerce, the government’s role in addressing these contradictory messages from the business community in relation to government involvement is to think in terms of ‘leading versus interference’.⁶⁰⁵ Noting that SMEs are often time-poor, complying with government requirements can often be a challenge for growing companies employing four or five people. Part of the solution to this problem is to develop ‘processes and systems that actually reduce impact on cash

600 Submission No. 21 from Technology and Industry Advisory Council, 2 September 2015, p 18.

601 Submission No. 28 from Department of Commerce, 9 September 2015, p 11.

602 *ibid*, p 18.

603 *ibid*, p 18.

604 Ms Anne Driscoll, Acting Director General, Department of Commerce, *Transcript of Evidence*, 16 March 2016, p 2.

605 Mr Michael Dickson, Industry and Innovation, Department of Commerce, *Transcript of Evidence*, 16 March 2016, p 5.

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flow and reduce impact on time'.⁶⁰⁶ Importantly, this means that government is 'not picking winners'; rather it is 'making it easier for the winners to surface'.⁶⁰⁷

Government does not need to duplicate the work of the market

8.89 Thus far, this report has insisted that efforts by government to foster innovation should not duplicate those of the private sector. Rather, government needs to direct its policies and resources to determining and filling gaps in the innovation ecosystem that represent areas of market failure.

8.90 This is perhaps best demonstrated by a case study of LandCorp's solar PV and battery trial at the Gen Y Demonstration Housing Project in White Gum Valley. This project provides an example of what government can do, particularly from a governance perspective.⁶⁰⁸

606 *ibid.*

607 *ibid.*

608 Information on LandCorp's solar PV and battery trial can be found at: Mr Frank Marra, Chief Executive Officer, LandCorp, 12 April 2016, *Transcript of Evidence*, 12 April 2016, p 8; LandCorp, *Solar PV and battery trial, Fact Sheet*, Government of Western Australia, Perth, nd. Available at: <http://www.landcorp.com.au/Documents/Corporate/Innovation%20WGV/Innovation-WGV-Factsheet-PV-Battery-September2015.pdf>. Accessed on 23 May 2016; and LandCorp, *Shared solar power on trial in Australian first*, Government of Western Australia, Perth, 9 September 2015. Available at: <http://www.landcorp.com.au/innovation/wgv/Latest/Shared-solar-power-on-trial-in-Australian-first/>. Accessed on 23 May 2016.

Chapter 9

Government Leadership is Essential

9.1 A strong innovation ecosystem is based on ‘creative thinking, collaboration, initiative, openness, a positive approach to failure and high trust’.⁶⁰⁹ The foundation of an innovative society, that is, is a culture of innovation which permeates every element of the ecosystem. Developing and maintaining a culture of innovation in Western Australia (WA) requires strong leadership from the state government.

Successful innovation requires strong leadership

9.2 The connection between innovation and leadership is well recognised in business. For example, Rio Tinto Iron Ore submitted that:

*innovation success starts with leadership and strategy in which innovation is prioritised as an important component of the business strategy. This requires strong and progressive senior executive leadership to maintain focus on innovation over time, as well as a corporate appetite for change and a tolerance for experimentation and some risk.*⁶¹⁰

9.3 This statement applies equally to government. Optimising innovation success in WA begins with state government leadership through which innovation is prioritised as an important component of government strategy and policy. It requires strong and progressive government and public sector leadership to maintain a long-term focus on innovation and a tolerance for experimentation and risk.

The Western Australian government must lead the way

9.4 Organisations often look to government for support in terms of what public funds might be available or what concessions might be made to reduce their costs.⁶¹¹ However, as TIAC argued, while government needs to be mindful of such matters,

609 Reillon, Vincent, *Understanding innovation*, Briefing, European Parliamentary Research Service, European Parliament, February 2016, p 6. A culture of innovation is defined in Chapter 3.

610 Submission No. 26 from Rio Tinto Iron Ore, 7 September 2015, p 4.

611 Mr Alan Bansemer, Chair, Technology and Industry Advisory Council, *Transcript of Evidence*, 11 February 2016, p 4.

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fostering innovation is ‘much more complicated and support comes in a very broad way’.⁶¹²

9.5 Government must support innovation by:

- funding research and development;
- providing, managing and growing innovation infrastructure;
- growing STEM-awareness and uptake;
- ensuring a skilled and work-ready future workforce;
- delivering policies that directly foster innovation; and
- ensuring regulation is supportive of innovation and consistently applied.

Just as critically, the Western Australian government must provide what Professor Peter Klinken described as ‘the emotional environments’ that ‘encourage innovation, creativity, entrepreneurship, risk-taking and fewer impediments to business development’.⁶¹³

Leadership through raising the profile of innovation

9.6 In this context, a critical way for government to show leadership is by providing ‘supportive commentary that says this is an area that we value’.⁶¹⁴ For the University of Western Australia (UWA), the ‘most important thing government can do’ is to provide ‘leadership within the innovation system’ so that a clear message on the importance of innovation is ‘sent from the top’.⁶¹⁵

9.7 Both Professor Klinken and UWA’s Mr Timothy Shanahan referred to the increased status of innovation in Australia since Hon Malcolm Turnbull became Prime Minister. For Professor Klinken, ‘the whole word “innovation” now is a buzzword. You cannot go anywhere without hearing it’; as a consequence, Professor Klinken has ‘sensed a positive lift that [...] he cannot recall for many, many decades’.⁶¹⁶ The Prime Minister’s emphasis on innovation, ‘with relatively modest resources [...] has changed the whole national conversation’.⁶¹⁷

9.8 The Western Australian government should work to reinforce this change at a state level. It falls to government to raise the public profile of the importance of innovation

612 *ibid.*

613 Submission No. 14 from Professor Peter Klinken, Chief Scientist of Western Australia, Office of Science, 28 August 2015, p 7 and p 4.

614 Professor Peter Klinken, Chief Scientist, Office of Science, Department of the Premier and Cabinet, *Transcript of Evidence*, 11 February 2016, p 3.

615 Mr Timothy Shanahan, Principle Adviser, University of Western Australia, *Transcript of Evidence*, 12 February 2016, p 3.

616 Professor Peter Klinken, Chief Scientist, Office of Science, Department of the Premier and Cabinet, *Transcript of Evidence*, 11 February 2016, p 3.

617 Mr Timothy Shanahan, Principle Adviser, University of Western Australia, *Transcript of Evidence*, 12 February 2016, p 3.

and to create an enhanced level of excitement about the possibilities that flow from a culture of innovation.

9.9 The existence and role of the WA’s Minister for Science, the Office of Science in the Department of Premier and Cabinet, and the Chief Scientist of Western Australia are all important building blocks in pursuing this outcome. The Committee also acknowledges the strong signal sent by the publication in April 2015 of *A science statement for Western Australia. Growing Western Australia* (the *Science statement*). Furthermore, the Premier’s May 2016 appointment of a Minister for Innovation is a positive step in WA’s journey to becoming a state of innovation.

9.10 The positive cultural impact of the leadership provided through this portfolio would be strengthened through combining the science and innovation portfolios, creating a department and Minister for Science and Innovation. This combined portfolio would undertake a number of functions, including:

- being the repository for information on the science and innovation work being undertaken in WA;
- being the point at which innovation initiatives are consolidated;
- acting as a facilitator for private sector initiatives;
- emphasising the importance of science and innovation in WA;
- ensuring that Cabinet decisions are taken with an eye on the future of science and technology; and
- articulating the importance of scientific research to the community.

Finding 30

The appointment of a Western Australian Minister for Innovation is a positive development.

Recommendation 16

The Western Australian Government combine the science and innovation portfolios to form a department and Minister for Science and innovation.

Leadership through facilitating connections

9.11 This Inquiry has made it clear that there is an enormous amount of innovation occurring in WA every day. Unfortunately, a lot of this innovative effort is not generally well known within and across industry sectors, or by the general public. This is a serious gap in the innovation ecosystem. Government leadership is required to know what innovation is occurring in the state and ‘bring[ing] together the people who have parts

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of the puzzle'.⁶¹⁸ In addition, drawing attention to innovation that is already occurring is a important way to inspire others to pursue a similar course.

- 9.12 As the Technology and Industry Advisory Council (TIAC) highlighted, the Western Australian Government has an important role to play in this process:

*in being able to create, as part of a wider ecosystem, the conversation around innovation, because [... innovation] is like oxygen, and to be able to pump more oxygen into the system means that it will be somebody's job, probably from the public purse, to track how we are performing on an innovation ratio, and other people will then respond to that and be able to measure themselves as, "How do we measure against the innovation ratio?"*⁶¹⁹

- 9.13 For TIAC, 'the government can offer leadership, and that leadership is about connection. Now, governments can actually connect in ways that individual companies and individuals cannot'.⁶²⁰ Furthermore, 'for innovation to become part of a sort of state conversation', government leadership needs to be collaborative rather than a 'hey, follow me' approach.⁶²¹ As TIAC stated, government leadership 'needs to be much more collaborative along the lines of "We're in this together; let's open up"'.⁶²²

Looking to other jurisdictions

- 9.14 Western Australia is not the only state to experience structural changes in its economy and to recognise the need to be innovative in meeting economic and social needs. In light of this the Committee examined initiatives developed in other Australian and overseas jurisdictions to help address these needs.
- 9.15 The following provides a brief overview of government initiatives in South Australia, Victoria, New South Wales and Queensland, as well as the Catapult Centres in the UK, Israel's Industrial R&D Cooperation Programs.

Catapult Centres—UK

- 9.16 In October 2010, the UK Government announced that it would invest over £200 million over four years to establish a network of Technology and Innovation Centres to be

618 Mr Alan Bansemer, Chair, Technology and Industry Advisory Council, *Transcript of Evidence*, 11 February 2016, p 2.

619 Mr Andy Farrant, Member, Technology and Industry Advisory Council, *Transcript of Evidence*, 11 February 2016, pp 2–3.

620 Mr Alan Bansemer, Chair, Technology and Industry Advisory Council, *Transcript of Evidence*, 11 February 2016, p 4.

621 Mr Andy Farrant, Member, Technology and Industry Advisory Council, *Transcript of Evidence*, 11 February 2016, p 4.

622 *ibid.*

known as Catapult Centres.⁶²³ ‘Catapult’ was chosen to ‘represent a transforming force; not merely a set of technical facilities labelled with an acronym, but a dynamic and exciting programme ... unique, memorable and internationally recognisable’.⁶²⁴ A 2014 review of the progress made by the Catapult Centres recommended that the UK government ‘commit to expand the network in a measured way adding up to one or two centres a year’, creating a network of approximately 30 Catapults by 2030.⁶²⁵

9.17 After the initial commitment of £200 million over four years to establish the first seven Catapults, the UK Government provided an additional £239 million to ‘grow the capabilities of the first seven Catapults and to establish two more’.⁶²⁶

9.18 A catapult centre is a ‘physical centre with substantial investment to establish world-leading capability and global impact, in pre-commercial development’.⁶²⁷ Each Catapult, which specialises in a different area of technology, is a not-for-profit organisation established to:

- *provide businesses with access to world-leading technology and expertise*
- *reach into the knowledge base for world-leading science and engineering*
- *be able to undertake collaborative applied research projects with business*
- *be able to undertake contract research for business*
- *be strongly business-focused with a highly professional delivery ethos*
- *create a critical mass of activity between business and the knowledge base*
- *provide skills development at all levels.*⁶²⁸

623 Technology Strategy Board, *Technology and innovation centres: A prospectus. Maximising the commercial impact of UK R & D*, January 2011, p 4.

624 Technology Strategy Board, *Catapult update. Shaping the network of centres*, March 2012, p 6. This decision was largely based on the recommendations of Dr Hermann Hauser in his review of the UK’s Technology and Innovation Centres. See: Hauser, Hermann, *The current and future role of technology and innovation centres in the UK*, prepared for Lord Mandelson, Secretary of State, Department for Business Innovation and Skills, March 2010.

625 Hauser, Hermann, *Review of the Catapult network. Recommendations on the future shape, scope and ambition of the programme*, prepared for The Rt Hon Dr Vince Cable MP and the Rt Hon Greg Clark MP, 2014, p 4 and p 5.

626 *ibid*, p 7 and p 9.

627 Technology Strategy Board, *Technology and innovation centres: A prospectus. Maximising the commercial impact of UK R & D*, January 2011, p 5. A catapult centre may be based across a small number of sites where there is a clear rationale for doing so.

628 *ibid*, p 5; and Catapult, *About us*, nd, np. Available at: <https://www.catapult.org.uk/about-us-text>. Accessed on 7 August 2015.

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9.19 Each Catapult was established by the UK Government's innovation agency, Innovate UK, to bridge the gap between UK businesses wanting to grow and bring new products and services to market (but without the necessary resources, expertise, equipment or contacts), and the UK's research communities.⁶²⁹ In doing so, Catapults:

- *reduce the risk of innovation*
- *accelerate the pace of business development*
- *create sustainable jobs and growth*
- *develop the UK's skills and knowledge base and its global competitiveness.*⁶³⁰

9.20 There are currently eleven Catapult centres:⁶³¹

- Cell and Gene Therapy
- Digital
- Energy Systems
- Transport Systems
- Future Cities
- Medicines Discovery
- High Value Manufacturing
- Offshore Renewable Energy
- Precision Medicine
- Satellite Applications
- Compound Semiconductor applications

9.21 Established Catapult Centres are expected to generate their funding in equal measure from three distinct sources:

- competitively won business-funded R&D contracts;
- competitively won collaborative R&D projects, jointly funded by the public and private sectors; and
- 'core public funding for long-term investment in infrastructure, expertise and skills development'.⁶³²

9.22 The Catapult Centres initiative has a strong reputation, and was suggested as something the government might usefully introduce in WA. Catapult Centres are seen as a means of:

- providing access to infrastructure, within and across different topic areas,⁶³³
- bridging the gap between industry and universities,⁶³⁴
- developing clusters of co-located researchers and business experts;⁶³⁵ and
- making research accessible and, thus, supporting knowledge transfer.⁶³⁶

629 Catapult, *About us*, nd, np.

630 *ibid.*

631 *ibid.*

632 Technology Strategy Board, *Technology and innovation centres: A prospectus. Maximising the commercial impact of UK R & D*, January 2011, p 5.

633 Dr Darren Gibson, Manager, Collaboration and Innovation, Edith Cowan University, *Transcript of Evidence*, 12 February 2016, p 3.

634 Submission No. 14 from Professor Peter Klinken, Chief Scientist of Western Australia, Office of Science, 28 August 2015, p 5; and Submission No. 10 from Edith Cowan University, 28 August 2015, p 4.

635 Submission No. 10 from Edith Cowan University, 28 August 2015, pp 4–5.

9.23 Furthermore, Edith Cowan University (ECU) recommended that the Western Australian Government develop its own Catapult model, ‘with a significant level of investment over a sustained period of time, to reduce some of the risks associated with innovation, to create a skilled workforce and to develop a knowledge base’.⁶³⁷ For ECU, seed funding to establish ‘catapult centres’ in WA would come from government, industry and universities, with a coordination office required to bring different entities together, maintain their collective focus and drive their growth. ECU sees government as the ‘catalyst for this development by providing the co-working space that includes scientific labs, key infrastructure etc’.⁶³⁸

9.24 Catapult Centres are not a panacea for developing and diversifying all areas of the state’s economy, with the 2014 UK review identifying several areas for improvement. Nevertheless, Catapult Centres, as a key element in the WA innovation ecosystem, could provide an important means of addressing specific market failures.⁶³⁹

Industrial R&D Cooperation Programs—Israel

9.25 Given its distance from global markets, the State of Israel decided to ‘aggressively expand opportunities for Israel’s industry to engage in mutually beneficial international collaboration’.⁶⁴⁰ This task falls to the executive agency of the Office of the Chief Scientist (the OCS), namely MATIMOP, the Israeli Industry Center for R&D. The OCS recognises that developing ‘innovative new commercial technologies, products and services is a high risk expensive proposition, often exceeding the capacity and capabilities of individual firms and even countries’.⁶⁴¹

9.26 In light of this, MATIMOP ‘generates and implements international cooperative industrial R&D programs between Israeli and foreign enterprises’.⁶⁴² As well as enhancing relations between countries, cooperative R&D projects provide a number of benefits to participating companies, including:

- risk sharing—through the use of government grants and working with companies with complementary capabilities and skills;
- reducing time to market—through shorter development cycles; and

636 Submission No. 22 from University of Western Australia, 28 August 2015, p 12.

637 Submission No. 10 from Edith Cowan University, 28 August 2015, p 5.

638 *ibid.*

639 Hauser, Hermann, *Review of the Catapult network. Recommendations on the future shape, scope and ambition of the programme*, prepared for The Rt Hon Dr Vince Cable MP and the Rt Hon Greg Clark MP, 2014, p 11.

640 Israeli Industry Center for R&D, *About MATIMOP*, nd, np. Available at: http://www.matimop.org.il/about_matimop.html. Accessed on 5 June 2016.

641 *ibid.*

642 *ibid.*

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- developing strategic relationships and partnerships—through improved access to R&D infrastructure and to funding schemes.⁶⁴³

9.27 These Industrial R&D Cooperation Programs are implemented through a Memorandum of Understanding (MOU) between Israel and the government of partner countries. The MOU outlines the objectives of the bilateral industrial R&D activities between participating entities from each State, including ‘partnering activities, seminars and events, and most significantly a **funding framework for cooperative (joint) R&D projects**’.⁶⁴⁴ These cooperative R&D projects must be ‘highly innovative’ and either aim ‘to lead to a new, innovative hi-tech product or process with clear commercial potential, or ... based on adapting an existing product or process to the local market’.⁶⁴⁵

9.28 In Australia, the governments of both Victoria and New South Wales have entered into cooperative agreements with Israel. The Victoria-Israel Science Innovation and Technology Scheme (VISITS), which began in 2013, provides opportunities for collaboration between Victorian and Israeli private sector companies, particularly within the priority areas of food and fibre; professional services; new energy; defence, transport and construction; medical devices and pharmaceuticals; and international education.⁶⁴⁶

9.29 For Victorian companies, potential VISITS funding includes:

- *Up to \$2,000 in reimbursement for accommodation and travel expenses for attendance of trade missions, conferences, meetings or other events in Israel—Victoria Israel Trade and International Partnering program (VISTRIP)*
- *Up to \$50,000 in assistance—Victoria-Israel Feasibility and Proof of Concept program (VISFPC)*
- *Up to \$250,000 in funding support—Victoria-Israel Science and Technology Research and Development Fund (VISTECH).*⁶⁴⁷

9.30 Similarly, in April 2016 the New South Wales Government signed a joint industrial R&D agreement with Israel to allow companies from NSW and Israel to ‘co-develop and commercialize innovative products’.⁶⁴⁸ As well as the general R&D agreement, there

643 *ibid*

644 Israeli Industry Center for R&D, Office of the Chief Scientist, *Industrial R&D cooperation programs. Steps for getting started*, nd, np. Emphasis in original.

645 *ibid*.

646 Business Victoria, *Victoria-Israel science and technology research and development fund (VISTECH)*, nd, np. Available at: <http://www.business.vic.gov.au/support-for-your-business/grants-and-assistance/the-victoria-israel-science-innovation-and-technology-scheme-visits>. Accessed on 7 June 2016.

647 Business Victoria, *Victoria-Israel science and technology research and development fund (VISTECH)*, nd, np.

648 Israel Trade Commission, *New South Wales signs technological R&D cooperation agreement with Israel*, Sydney, 11 April 2016, p 1.

are a number of new agreements specifically relating to the agriculture and medical research sectors. There is, for example, an MOU between the University of Sydney and the Agricultural Research Organisation of Israel which is expected to ‘help dairy, poultry and aquaculture in NSW, chiefly by drawing on Israeli expertise through teaching, training and research activities’.⁶⁴⁹

- 9.31 Participating companies will receive support from both the NSW and Israeli governments. Funding will be available across all industry areas, with particular emphasis placed on cyber-security, water management and agricultural technology.⁶⁵⁰ The amount of funding provided by the NSW government is not clear.⁶⁵¹
- 9.32 It is important to recognise that the governments of Israel and New South Wales both actively pursued these opportunities. According to Israeli Trade Commissioner in Australia, Mr Ethy Levy, the combination of Australia’s research and technology with Israeli commercialisation expertise could ‘open great opportunities for Israeli and Australian start up’s in global and especially Asian markets’.⁶⁵² New South Wales Premier, the Hon Mike Baird MP, wants ‘to make NSW the “start-up state”’ and believes that the cooperative R&D agreement has ‘helped this goal by engaging and establishing formal partnerships between our businesses, universities, researchers, and their counterparts in Israel’.⁶⁵³

Recommendation 17

The Western Australian Government forms an Industrial R&D Cooperation agreement with Israel.

South Australia

- 9.33 The South Australian Government aims ‘to drive economic transformation and wealth’ with a range of functions, services and support provided primarily by the Department of State Development (DSDSA).⁶⁵⁴ To do this, on 1 July 2014 the government re-established the DSDSA, bringing together the former Department for Manufacturing, Innovation, Trade, Resources and Energy, and the Department of Further Education, Employment, Science and Technology, forming a single Department. This strategy was based on the view that the best way to stimulate innovation is to ensure strong links

649 Jeffay, Nathan, ‘Baird’s big deals’, *Australian Jewish News*, 14 April 2016, p 1. Available at: <http://www.jewishnews.net.au/bairds-big-deals/53319>. Accessed on 7 June 2016.

650 Israel Trade Commission, *New South Wales signs technological R&D cooperation agreement with Israel*, Sydney, 11 April 2016, p 1.

651 Jeffay, Nathan, ‘Baird’s big deals’, *Australian Jewish News*, 14 April 2016, p 1.

652 Israel Trade Commission, *New South Wales signs technological R&D cooperation agreement with Israel*, Sydney, 11 April 2016, p 1.

653 Jeffay, Nathan, ‘Baird’s big deals’, *Australian Jewish News*, 14 April 2016, p 1.

654 Government of South Australia, *The new Department of State Development*, 27 June 2014. Available at: <http://newsletter.skills.sa.gov.au/home/artmid/3348/articleid/95/the-new-department-of-state-development>. Accessed on 14 June 2016.

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between government, industry and research institutions to encourage collaboration.⁶⁵⁵ As a result, DSDSA serves six separate Ministers, including the Premier, and has wide-ranging responsibilities for resources and energy, manufacturing, innovation, investment, trade, skills development, employment and science.⁶⁵⁶ For its Chief Executive, Dr Don Russell, DSDSA exists to 'deliver on the government's objectives for the economy'.⁶⁵⁷

9.34 In parallel with this restructure, the South Australian Government developed a set of ten economic priorities to ensure that public money would be primarily invested in key strategic areas. DSDSA was given lead responsibility for the following six of these priorities:

- *Economic Priority 1—Unlocking the full potential of South Australia's resources, energy and renewable assets*
- *Economic Priority 3—A globally recognised leader in health research, ageing and related services and products*
- *Economic Priority 4—The Knowledge State – attracting a diverse student body and commercialising our research*
- *Economic Priority 6—Growth through innovation*
- *Economic Priority 9—Promoting South Australia's international connections and engagement*
- *Economic Priority 10—South Australia's small businesses have access to capital and global markets.*⁶⁵⁸

9.35 The transformation of DSDSA was based around similar overseas models, which are streamlined to attract corporate investment. A key element of the South Australian strategy is to ensure that good use is made of any and all available Commonwealth programs, with state money regarded as an important catalyst for attracting larger allocations of Commonwealth funding. The view taken in South Australia is that state governments are uniquely positioned to offer insight into how Commonwealth objectives—supported by Commonwealth funding—can be achieved, and that a sensible state government would align its own objectives with those of the

655 Dr Don Russell, Chief Executive, South Australian Department of Strategic Development, *Briefing*, 28 October 2015.

656 Government of South Australia, Department of State Development, *Department of State Development functional chart*, 27 April 2016. Available at: <http://www.statedevelopment.sa.gov.au/upload/org-chart/dsd-org-chart.pdf?t=1465872822239>. Accessed on 13 June 2016.

657 Dr Don Russell, Chief Executive, South Australian Department of Strategic Development, *Briefing*, 28 October 2015.

658 South Australian Department of State Development, *Annual report 2014-15*, 30 September 2015, p 7.

Commonwealth.⁶⁵⁹ A further critical aspect of the South Australian strategy is establishing and promoting close links between the South Australian Government and the South Australia universities.⁶⁶⁰

9.36 To address the paucity of available risk capital in South Australia, the South Australian Government implemented a \$50 million *Unlocking Capital for Jobs Program*, which aims ‘to make it easier for business to secure commercially viable loans’.⁶⁶¹ According to Dr Russell, cash flow issues have often been a problem for growing businesses in South Australia, a problem exacerbated by Australia offering fewer tax breaks than are available in overseas jurisdictions to help businesses overcome the commercialisation valley of death. With the *Unlocking Capital for Jobs Program*, the government will ‘make it easier for business to secure commercially viable loans where firms would otherwise not have the balance sheet strength to access finance’.⁶⁶² Dr Russell advised that the government will guarantee 20 per cent of the collateral of a qualifying small business and, where such a guarantee is provided, the government will take an equity share in the business and charge interest.⁶⁶³ DSDSA also works to identify innovative companies in South Australia, engaging with them to find out directly whether, and how, government can help, particularly in relation to growing export opportunities.

Victoria

9.37 On 1 January 2015, the Victorian Government established the Department of Economic Development, Jobs, Transport and Resources (DEDJTR) as the ‘lead agency for creating the conditions to sustainably develop the Victorian economy and grow employment’.⁶⁶⁴ Consisting of five ‘service delivery’ groups and three ‘enabling’ groups, DEDJTR has nine Ministers across 13 portfolios, and works ‘to increase jobs, investment, exports and opportunities; stimulate innovation, competitiveness, and confidence; and support sustainability’.⁶⁶⁵

659 Dr Don Russell, Chief Executive, South Australian Department of Strategic Development, *Briefing*, 28 October 2015.

660 *ibid.*

661 South Australian Department of State Development, *Annual report 2014-15*, 30 September 2015, p 3.

662 Government of South Australia, Department of State Development, *Unlocking capital for jobs*, 2016. Available at: <http://www.statedevelopment.sa.gov.au/industry/manufacturing/manufacturing-programs-and-initiatives/unlocking-capital-for-jobs>. Accessed on 13 July 2016.

663 Dr Don Russell, Chief Executive, South Australian Department of Strategic Development, *Briefing*, 28 October 2015.

664 Victorian Government Directory, *Department of Economic Development, Jobs, Transport and Resources*. Available at: http://www.vic.gov.au/contactsandservices/directory/?ea0_lfz149_120.&organizationalUnit&196d4fa1-57d7-4b1d-b05f-ddb51e03ee9c. Accessed on 14 July 2016.

665 Victorian Department of Economic Development, Jobs, Transport and Resources, *Organisation structure*, 5 January 2016. Available at: <http://economicdevelopment.vic.gov.au/about-us/organisation-structure>. Accessed on 14 July 2016.

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- 9.38 According to its Lead Deputy Secretary, Mr Justin Hanney, the establishment of the DEDJRT represented the realisation of an ambitious decision by the Victorian Government to bring all of the arms of government that interact with industry together under the administration of a single department.⁶⁶⁶ A key driver in this decision was the desire to stimulate employment opportunities in Victoria, particularly in light of the imminent closure of the domestic automobile manufacturing industry. The establishment of the Department represented an acknowledgement that, while government cannot by itself create jobs, it can create an environment conducive to the creation of employment opportunities.⁶⁶⁷ In support of this goal, the Victorian Government has committed \$508 million to the *Premier's Jobs and Investment Fund*.⁶⁶⁸
- 9.39 A further key part of the Victorian Government's strategy is a commitment to identified 'future industries', which are classified into six sectors: medical technologies and pharmaceuticals; new energy technologies; food and fibre, transport; defence and construction technologies; international education; and professional services. In analysing those six sectors, the Victorian Government realised that while they represent about 40 per cent of the Victorian state economy, they contribute about 80 per cent of trade. Based on this research, DEDJTR commissioned an in-depth and comprehensive analysis of the entire state economy, which identified 11 critical economic sectors. Ultimately DEDJTR was structured with those 11 sectors as its 'clients' and a five-year strategy for stimulating growth in each sector was implemented.⁶⁶⁹ In addition, having identified the few essential enablers of growth and development that sit across all sectors—such as innovation and information technology—DEDJTR aims to provide appropriate infrastructure to ensure that workers are equipped with adequate skills, and that firms understand, and have access to, international trade.
- 9.40 Information about Victoria's food and fibre sector provides an example of the Department's analysis, which revealed that there are about 38,000 businesses in that sector in Victoria. Of those, about 29,000 are farming businesses, 90 per cent of which are SMEs; that is, the food and fibre sector is characterised by small business. Furthermore, only about 800 of the 38,000 businesses export their product. Consequently, the DEDJTR regards the emerging Asian market as a major source of opportunity for Victorian food and fibre businesses, and is working with these businesses to help them take advantage of this opportunity. Furthermore, engaging

666 Mr Justin Hanney, Lead Deputy Secretary, Victorian Department of Economic Development, Jobs, Transport and Resources, *Briefing*, 29 October 2015.

667 *ibid.*

668 Premier of Victoria, *Premier's jobs and investment panel to drive economic growth and job creation in Victoria*, 3 August 2015. Available at: <http://www.premier.vic.gov.au/premiers-jobs-and-investment-panel-to-drive-economic-growth-and-job-creation-in-victoria/>. Accessed on 15 July 2016.

669 Mr Justin Hanney, Lead Deputy Secretary, Victorian Department of Economic Development, Jobs, Transport and Resources, *Briefing*, 29 October 2015.

with these businesses helps DEDJTR to provide useful input into the process of developing government policy by ensuring that policies cater for the real needs of local businesses.

- 9.41 As a result of its analysis, DEDJTR has developed a ‘map’ of the Victorian economy which shows it how many firms operate in various spaces, as well as how many people they each employ, and what their growth capacity might be. The focus of DEDJTR is to help firms with growth capacity by providing market intelligence and export assistance.⁶⁷⁰
- 9.42 A further area of focus for DEDJTR is to help link the capabilities of the numerous research institutions in Victoria—including both universities and cooperative research centres—with industry.⁶⁷¹ This is also an area of focus of Victoria’s Lead Scientist, Dr Leonie Walsh, again from within DEDJTR.⁶⁷² Furthermore, in an attempt to address the lack of available risk capital in Victoria, DEDJTR has made available \$60 million from the *Premier’s Jobs and Investment Fund* as seed capital for start-ups.⁶⁷³

New South Wales

- 9.43 Following the 2015 NSW election, the Department of Industry (DINSW) was significantly restructured: it was first given responsibility for vocational education, and job creation was made DINSW’s primary objective.⁶⁷⁴ Given that innovation is an important and recognised means of job creation, DINSW is focussed on driving innovation in New South Wales. Through this approach DINSW has shifted its focus away from working to support firms towards ensuring that the state offers an attractive business environment to firms, one that is conducive to business. As industry hubs are among the most valuable of all government programs, DINSW was also restructured around five specific knowledge hubs: Energy Innovation, Financial Services, Digital Creative, Medical Technology and Transport & Logistics.⁶⁷⁵
- 9.44 A key focus of DINSW has been to encourage the clustering of like-minded firms with the strategic use of government land. That is, rather than divesting government assets simply to yield the largest dollar amount, DINSW aims to have government land allocated to achieve particular purposes, such as allowing land in strategic areas in

670 *ibid.*

671 *ibid.*

672 Dr Leonie Walsh, Victorian Lead Scientist, *Briefing*, 29 October 2015.

673 Swan, David, ‘Victorian government builds \$60m start-up launch pad’, *The Australian Business Review*, 27 November 2015. Available at:

<http://www.theaustralian.com.au/business/technology/victorian-government-builds-60m-startup-launch-pad/news-story/5c767f6409a6b334b43a52d63083c127>. Accessed on 14 July 2016.

674 Mr Simon Smith, Secretary, New South Wales Department of Industry, *Briefing*, 2 November 2015.

675 *ibid.*

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Sydney to be developed as new hotels. Similarly, DINSW uses regulatory settings to encourage businesses in NSW to be innovative, particularly by creating obligations for industry to trial innovation.⁶⁷⁶

- 9.45 Importantly, DINSW is the parent department of other key NSW Government departments, including the Department of Primary Industries, and the Resources and Energy Division. As a result, DINSW reports to four separate Ministers and has a workforce of around 30,000 staff. Based on the view that some of the most innovative ideas flow from the ground up, structure of DINSW was adopted to encourage innovation from within government. This structure also facilitates the cross-pollination of ideas and technologies from one industry sector to another. Furthermore, it allows the NSW Government to take a 'one stop shop' approach to regulating, thus meeting the needs of industry. Economic growth is the fundamental objective of DINSW as a whole and fuelling export growth is the primary focus in helping to achieve this outcome.⁶⁷⁷
- 9.46 One of the key policy initiatives administered by DINSW is the *Jobs for NSW* program, 'a private sector-led' initiative that 'aims to make the NSW economy as competitive as possible and therefore help create new jobs across the state [that] will help deliver on the NSW Government's election commitment to create 150,000 new jobs in the four years to March 2019'.⁶⁷⁸ Under September 2015 state legislation, the NSW initiative is comprised of a \$190 million fund, which is to be invested over a four-year period by 'a board that includes some of the best business and entrepreneurial brains in Australia' into job creation projects across the state.⁶⁷⁹ Businesses are encouraged to work together in submitting funding applications and proposals are assessed on the basis of their potential for jobs growth.
- 9.47 The *Jobs for NSW* program is complemented by targeted payroll tax rebates, grants for small businesses that hire new employees, and a \$25 million *Jobs of Tomorrow Scholarship Fund*, which provides 25,000 for 'students undertaking qualifications for technology and growth jobs'.⁶⁸⁰
- 9.48 A further key policy initiative is the *Innovate NSW* program, which consists of a series of grants, vouchers and other funding, all of which is aimed at assisting NSW-based

676 *ibid.*

677 *ibid.*

678 New South Wales Department of Industry, *Jobs for NSW*. Available at: <http://www.industry.nsw.gov.au/invest-in-nsw/why-sydney-and-nsw/jobs-for-nsw>. Accessed on 15 June 2016.

679 New South Wales Department of Industry, *Jobs for NSW fact sheet*, 26 November 2015. Available at: http://www.industry.nsw.gov.au/_data/assets/pdf_file/0007/79738/Factsheet-About-Jobs-for-NSW.pdf. Accessed on 15 June 2016.

680 New South Wales Department of Industry, *Jobs for NSW*.

technology SMEs to pursue innovative solutions to problems faced by government and the business community across the state.⁶⁸¹

Advance Queensland

- 9.49 In July 2015 the Queensland Government announced a suite of programs, supported by \$180 million public investment over four years, aimed at promoting innovation, education, skill and business development across the state.⁶⁸² Branded as the *Advance Queensland* initiative, this investment was designed ‘to position Queensland as an attractive investment destination with a strong innovation and entrepreneurial culture’.⁶⁸³
- 9.50 *Advance Queensland* was designed to build upon existing strengths within the Queensland economy, many of which—especially in relation to R&D and innovation—were established under the preceding Smart State strategy.⁶⁸⁴ Devised in the late 1990s, the Smart State strategy was a whole-of-government initiative developed to alleviate Queensland’s vulnerability to economic fluctuation associated with primary industry production.⁶⁸⁵ The Smart State strategy exemplifies government leadership in stimulating a culture of innovation during the early 2000s and, at its core, represents a government effort to create an environment that would attract and develop high-technology industries.⁶⁸⁶
- 9.51 Through Smart State, the Queensland Government funded universities, government departments and research institutions across Queensland to create specialist research infrastructure and develop specialised R&D skills.⁶⁸⁷ In addition to helping Queensland establish a strong reputation as a world-leading high-technology economy—particularly in the field biotechnology—this infrastructure provided a strong platform for initiating *Advance Queensland*.⁶⁸⁸ Smart State set the preconditions for the success of programs such as *Advance Queensland* over a fifteen year period.

681 New South Wales Department of Industry, *Innovate NSW*. Available at: <http://www.industry.nsw.gov.au/business-and-industry-in-nsw/innovation-and-research/innovate-nsw>. Accessed on 15 June 2016.

682 Queensland Government, *Why Advance Queensland*, 6 April 2016. Available at: <http://advance.qld.gov.au/why-aq.aspx>. Accessed on 8 June 2016.

683 Queensland Department of Science, Information Technology and Innovation, *Briefing*, 5 November 2015.

684 Professor Peter Gray and Mr Bob McCarthy AM, Directors, Australian Institute of Bioengineering & Nanotechnology, *Briefing*, 4 November 2015.

685 *ibid.*

686 *ibid.*

687 Queensland Department of Science, Information Technology and Innovation, *Briefing*, 5 November 2015.

688 Professor Peter Gray and Mr Bob McCarthy AM, Directors, Australian Institute of Bioengineering & Nanotechnology, *Briefing*, 4 November 2015.

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9.52 *Advance Queensland* was formulated to:

- *ensure young Queenslanders have the skills for future demand, [including] STEM, computer coding, robotics*
- *work with the private sector, to have more startups and provide support for businesses to innovate and grow*
- *collaborate with industry and universities to translate great ideas and research into products and services*
- *support graduates, new businesses and scientists to think and network globally.*⁶⁸⁹

9.53 In pursuit of these aims, *Advance Queensland* has three key programs—a \$50 million ‘Best and Brightest Fund’, a \$46 million ‘Future Jobs Strategy’ and a \$76 million ‘Business Investment Attraction’ package.⁶⁹⁰

9.54 With the aim of developing, attracting and retaining world-class talent, the Best and Brightest Fund offers \$33 million in fellowships and scholarships to encourage scientists and researchers from around the world to move to Queensland for their research.⁶⁹¹ The terms of these fellowships and scholarships are attractive and largely represent a continuation of similar policies under the Smart State strategy, which were instrumental in attracting some of the world’s leading scientists to—and, in many cases, back to—Queensland for their research.⁶⁹² For early career researchers, fellowships valued at up to \$180,000 over three years are offered; mid-career researchers are offered fellowships valued at up to \$300,000 over three years.⁶⁹³

9.55 In addition, a further \$8 million from the Best and Brightest Fund is available for ‘Knowledge Transfer Partnerships’, which help SMEs in Queensland by providing funding to cover up to two-thirds of the cost of hiring a university graduate to work on an innovative project.⁶⁹⁴ Critically, applications for Knowledge Transfer Partnerships must be made by SMEs in conjunction with one of eight participating Queensland universities, thus making collaboration between businesses and universities a prerequisite.

689 Queensland Department of Science, Information Technology and Innovation, *Briefing*, 5 November 2015.

690 *ibid.*

691 *ibid.*

692 Dr Sue Hooper, Director Health and Medical Research, Health and Medical Research Unit, Queensland Health, *Briefing*, 4 November 2015.

693 Queensland Government, *Research fellowships*, 6 April 2016. Available at: <http://advance.qld.gov.au/uni-researchers/research-fellowships.aspx>. Accessed on 8 June 2016. Early career researchers have up to five years post-PhD research experience, and mid-career researchers have between five and ten years such experience.

694 Queensland Government, *Knowledge transfer partnerships program*, 6 April 2016. Available at: <http://advance.qld.gov.au/small-business/knowledge-transfer-partnerships.aspx>. Accessed on 8 June 2016.

- 9.56 Under the Future Jobs Strategy, the Queensland Government has made available a total of \$28 million for individual grants of up to \$1.5 million to Queensland-based research institutions and businesses to collaborate on research projects that address the state's science and research priorities, as determined by the state government in consultation with Queensland's Chief Scientist.⁶⁹⁵ An additional \$20 million has also been earmarked for 'Innovation challenges', through which industry is offered financial incentive to collaborate and solve problems identified by government departments.⁶⁹⁶
- 9.57 The \$76 million Business Investment Attraction package is comprised of three specific elements: a \$24 million 'Startup Queensland' program; a \$12 million 'Commercialisation' program; and a \$40 million 'Business Development Fund'.⁶⁹⁷ The Startup Queensland program aims to support start-ups and SMEs in Queensland to bring ideas to market, particularly by supporting 'incubators and accelerator programs to scale up and provide innovation advisory and skills development services for start-ups'.⁶⁹⁸ In addition, both the Commercialisation program and the Business Development fund make seed capital available to help businesses reach proof-of-concept in their ideas and reach marketable scale respectively.⁶⁹⁹
- 9.58 Critically, in addition to *Advance Queensland's* specific funds and skill-development programs, most of its programs are administered by a single department, the Department of Science, Information Technology and Innovation. This singularity of focus ensures that the strategy's objectives are realised, while also providing people in Queensland with a single portal to access all relevant information about programs and funding packages available to help their ideas and businesses grow.⁷⁰⁰
- 9.59 *Advance Queensland*, like the Smart State strategy before it, represents a long-term plan for the state's economic development. While an assessment of *Advance Queensland's* outcomes requires more time, the initiative has two important values at its core: an investment in Queensland's human capital and a belief that future success is a matter of planning, rather than fate. For this reason, *Advance Queensland* demonstrates why government must take the lead in creating a culture of innovation—the return on investment is long-term and very difficult to measure, and it represents investment in the state's future that is unlikely to come from the private sector.

695 Queensland Government, *Innovation partnerships*, 6 April 2016. Available at: <http://advance.qld.gov.au/investors/innovation-partnerships.aspx>. Accessed on 8 June 2016.

696 Queensland Department of Science, Information Technology and Innovation, *Briefing*, 5 November 2015.

697 *ibid.*

698 Redrup, Yolanda, 'Queensland's \$76 million start-up pitch impresses tech entrepreneurs', *The Australian Financial Review*, 15 July 2015. Available at: <http://www.afr.com/technology/queenslands-76-million-startup-pitch-impresses-tech-entrepreneurs-20150714-gichgj>. Accessed on 8 June 2016.

699 Queensland Department of Science, Information Technology and Innovation, *Briefing*, 5 November 2015.

700 *ibid.*

Chapter 9

9.60 What these initiatives have in common is the leadership shown by their respective governments in identifying gaps in their innovation ecosystems, being proactive in working to fill those gaps and in daring to take risks in the process. If WA is to become a state of innovation, the Western Australian Government also needs to take the lead, perhaps by implementing appropriate elements from innovation models in other jurisdictions, but also by devising and implementing its own initiatives to spark important innovation outcomes like research, entrepreneurial endeavour and collaboration.

Finding 31

Governments in other jurisdictions provide leadership through developing various programs and initiatives that:

- address contemporary problems through creating an environment that encourages and facilitates the development of high-technology potential future industries;
- Leverage existing intellectual and physical infrastructure;
- Recognise and proactively seek collaborative opportunities beyond their own borders; and
- Recognise the imperative to invest in human capital.

Recommendation 18

That the Western Australian Government:

- identifies the state's existing intellectual and physical infrastructure, and the potential opportunities these present, given the state's geographic location and resources;
- develops programs and initiatives that facilitate bringing that infrastructure and potential opportunities together to generate future comparative advantage through developing new technologies; and
- ensures that its policies and initiatives emphasise the need to collaborate with other Australian states and Territories as well as overseas jurisdictions.

Government leadership needs to be long-term and bi-partisan

9.61 If WA is to become known as 'the state of innovation' and innovation is to be more than just another buzzword, the state government must take a long-term view and a bi-partisan approach. In arguing for a role for a Western Australian Government, TIAC's Mr Andy Farrant was clear that leadership is 'not about the current government, it is not about past governments; it is about *the* government'.⁷⁰¹

701 Mr Andy Farrant, Member, Technology and Industry Advisory Council, *Transcript of Evidence*, 11 February 2016, p 2. Emphasis added.

- 9.62 Innovate Australia argued that the Western Australian Government has to ‘to look at the long-term vision; you cannot just be, “Let’s fix it in this quarter”, [...] just produce something’.⁷⁰² Developing WA as a state of innovation requires a long-term approach, one that will benefit future generations of Western Australians. Innovate Australia’s goal is for WA ‘to become the state of innovation and the goal for Australia to become the number one country for innovation in 15 years’.⁷⁰³
- 9.63 Currently there is a level of confusion around ‘different mechanisms to promote innovation, to set research and development priorities and to ensure that available research funding is directed towards these priorities’.⁷⁰⁴ As Engineers Australia pointed out, there are a number of problems with this approach:
- *Issues that require attention over the medium to long-term are caught up in short-term political cycles.*
 - *Several innovation strategies have been developed by different governments over the past two decades with remarkably similar objectives, reflecting the views of the government of the day, but have achieved little effective progress.*
 - *Programs aiming to promote innovation are typically too small to matter, are prone to rapid change and are too numerous to be comprehended by the people they aim to assist.*
 - *Research and development funding is not targeted to identified priorities and funding directions adopted by different agencies often conflict.*⁷⁰⁵
- 9.64 Engineers Australia called for ‘concerted efforts by both State and Australian governments’ to ensure that innovation policies provide ‘more than quasi business assistance and eloquent bureaucratic solutions’.⁷⁰⁶ Once again, government must provide leadership.
- 9.65 Not only must governments provide supportive legislation and policy, they must make a long-term commitment to fostering innovation through developing and maintaining an innovation culture in WA. It is essential that business has an increased level of confidence that there will be continuity of policy and funding through and across government terms.

702 Mr Peter Kasprzak, Chief Executive Officer, Innovate Australia, *Transcript of Evidence*, 11 February 2016, p 9.

703 *ibid.*

704 Submission No. 7 from Engineers Australia, Western Australian Division, 28 August 2015, p 6.

705 *ibid.*

706 *ibid.*

Concluding remarks

9.66 This Inquiry has focussed on three major sectors of the Western Australian economy. Nevertheless, the Committee's findings and recommendations need to be considered as applying generally to the broad state economy.

9.67 The main areas in which the Western Australian Government has an essential leadership role are:

- developing and maintaining an innovation ecosystem and culture based on collaboration, that is, cultivating a 'Team WA' approach;
- working to understand what gaps there are in the state's innovation ecosystem and developing mechanisms to fill those gaps;
- providing support for SMEs—as major job creators—that face particular challenges in bringing innovative ideas to commercial success;
- educating potential investors about risk, particularly in sectors outside the resources industry;
- promoting stronger links between agents, resources and human capital in the state's innovation ecosystem;
- supporting the investment community to help ecosystem grow by ensuring the state environment is conducive to investment;
- ensuring that government R&D and service provision have specific goals and outcomes, and do not replicate those in the private sector or other government agencies;
- undertaking R&D to solve problems that are shared by the state's business community, but not addressed by the market;
- encouraging the uptake of STEM subjects and ensuring that STEM education at primary, secondary and tertiary levels is appropriate to meet students' future employment and social needs;
- supporting the strategic development and maintenance of physical and intellectual infrastructure;
- ensuring that policies and legislation foster and reward innovation rather than present barriers;
- encouraging and supporting workplace learning initiatives for university students;
- considering ways in which government procurement can be used to assist the commercialisation of innovative products and services developed by SMEs;
- making science and innovation a major portfolio of government; and,
- perhaps most importantly, providing strong leadership to raise the profile of innovation in the state, and encourage all Western Australians to embrace innovation.

Finding 32

Successful innovation requires strong, sustained leadership from current and future Western Australian Governments.

A handwritten signature in blue ink that reads "Ian Blayney". The signature is written in a cursive, flowing style.

MR I.C. BLAYNEY, MLA
CHAIRMAN

Appendix One

Inquiry Terms of Reference

The Economics and Industry Standing Committee will inquire into and report on how technological and service innovation can be encouraged to expand and diversify the Western Australian economy.

The Committee will focus on the following sectors of the Western Australian economy: agriculture and food; mining and energy; and advanced manufacturing.

In particular, the Committee will consider:

- what drives innovation;
- collaboration between government, universities and business;
- how research can lead to the development of new products, services and jobs;
- the challenges associated with financing and commercialising new technologies, products and services; and
- models of development by which technological and service innovation could be encouraged in Western Australia.

Appendix Two

Committee's functions and powers

The functions of the Committee are to review and report to the Assembly on: -

- a) the outcomes and administration of the departments within the Committee's portfolio responsibilities;
- b) annual reports of government departments laid on the Table of the House;
- c) the adequacy of legislation and regulations within its jurisdiction; and
- d) any matters referred to it by the Assembly including a bill, motion, petition, vote or expenditure, other financial matter, report or paper.

At the commencement of each Parliament and as often thereafter as the Speaker considers necessary, the Speaker will determine and table a schedule showing the portfolio responsibilities for each committee. Annual reports of government departments and authorities tabled in the Assembly will stand referred to the relevant committee for any inquiry the committee may make.

Whenever a committee receives or determines for itself fresh or amended terms of reference, the committee will forward them to each standing and select committee of the Assembly and Joint Committee of the Assembly and Council. The Speaker will announce them to the Assembly at the next opportunity and arrange for them to be placed on the notice boards of the Assembly.

Appendix Three

Submissions received

	Name	Position	Organisation
1	Dr S Dallas		
2	Ms H Brayford	Director General	Department of Fisheries
3	Mr D Karr	Principal/CEO	Interspatial Systems
4	Mr N Daws	Director	Fastwave Communications
5	Prof R Kingwell	Chief Economist	Australian Export Grains Innovation Centre
6	Mr R Sellers	Director General	Department of Mines and Petroleum
7	Ms S Kreemer Pickford	General Manager, WA Division	Engineers Australia
8	Mr L Mullins	Managing Director	Stochastic Simulation
9	Mr J Strharsky	Director	RIIT Unearthed
10	Prof S Chapman	Vice-Chancellor	Edith Cowan University
11	Mr B McCulloch	Director	StartupWA
12	Mr K Bills	CEO	WA:ERA
13	Dr Ruth Shean	Director General	Department of Training and Workforce Development
14	Prof P Klinken	Chief Scientist of Western Australia	Office of Science, Department of Premier and Cabinet
15	Mr M Woffenden	Chief Executive Officer	Minerals Research Institute of Western Australia
16	Mr J Matthys	Vice President Corporate Affairs	BHP Billiton Iron Ore Pty Ltd Western Australia
17	Ms M Hammat	Secretary	UnionsWA
18	Prof A Taggart	A/Vice Chancellor	Murdoch University
19	MJ and DL Dickson		
20	Prof D Terry AO	Vice-Chancellor	Curtin University
21	Mr A Bansemer	Chairman	Technology and Industry Advisory Council

Appendix Three

	Name	Position	Organisation
22	Mr D Harrison	Director, Government and Corporate Communications	University of Western Australia
23	Mr I Callahan		
24	Mr M Pivac		
25	Ms L Harvey	Acting Chief Executive Officer	Australian Research Council
26	Mr C Richards	General Manager, Communications & External Relations	Rio Tinto Iron Ore
27	Ms N Roocke	Deputy Chief Executive	Chamber of Minerals and Energy of Western Australia
28	Ms A Driscoll	Acting Director General	Department of Commerce
29	Ms K Fijac	Acting Chief Executive Officer	LandCorp
30	Mr S Hicks	Stakeholder Relations	Neometals
31	Mr J Pearson	General Manager External and Government Relations	Shell Australia
32	Mr S Gregory	Senior Vice President Strategy Science and Technology	Woodside Energy
33	Mr R Delane	Director General	Department of Agriculture and Food
34	Mr D Leggett	Director Policy	Chamber of Commerce and Industry of Western Australia (Inc)
35	Ms E Douglas	Chief Executive Officer	Knowledge Society
36	Dr G Laughlin	Principal Policy Adviser	Australian National Data Service
37	Mr S Ellis	Chief Operating Officer, Western Region	APPEA
38	Mr G Harman	PGPA Operations Manager	Chevron Australia
39	Mr I Halliday	Managing Director, Dairy Australia	Australian Dairy Industry
40	Dr N Ayers	iPREPWA Coordinator	iPREPWA

	Name	Position	Organisation
41	Ms C Robertson	AIIA WA Chair	Australian Information Industry Association
42	Emeritus Prof L Abbott	Chair, WA Division	Ag Institute Australia
43	Ms B Peake	Government and Industry Relations Manager	CBH Group
44	Prof Ross Kingwell	Chief Economist	Australian Export Grain Innovation Centre
45	Mr Peter Kasprzak	Chief Executive Officer	Innovate Australia
46	Mr David Eaton	Small Business Commissioner	Small Business Development Corporation

Appendix Four

Hearings

Date	Name	Position	Organisation
11 Feb 2016	Prof Peter Klinken	Chief Scientist	Office of Science
11 Feb 2016	Mr Peter Kasprzak	Chief Executive Officer	Innovate Australia
	Dr Adam Osseiran	Director	
	Ms Carol Wallbank	Director	
11 Feb 2016	Mr Alan Bansemer	Chair	Technology and Industry Advisory Council
	Mr Andy Farrant	Member	
	Prof Shaun Collin	Member	
11 Feb 2016	Mr Mark Shelton	Director	StartupWA
	Ms Sheryl Frame	Director	
11 Feb 2016	Mr Zane Prickett	Director	Resource Innovation and Information Technology
	Mr Justin Strharsky	Director	
11 Feb 2016	Mr Peter Clarke		Innovation Consulting Australia
11 Feb 2016	Prof Joseph Luca	Dean, Graduate Research School	Edith Cowan University
	Dr Natasha Ayers	iPREPWA Coordinator	
12 Feb 2016	Dr Darren Gibson	Manager, Collaboration and Innovation	Edith Cowan University
12 Feb 2016	Prof Christopher Hutchison	Director of Research and Development	Murdoch University
	Prof Steve Wilton	Medical Researcher/ Foundation Chair in Molecular Therapies	
	Prof Richard Harper	Leader of Agricultural Sciences	

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Date	Name	Position	Organisation
12 Feb 2016	Prof Graeme Wright	Deputy Vice-Chancellor, Research	Curtin University
	Mr Rohan McDougall	Director, IP Commercialisation	
12 Feb 2016	Mr David Harrison	Director, Government and Corporate Communications	University of Western Australia
	Mr Mark Stickells	Director, Energy and Minerals institute	
	Mr Timothy Shanahan	Principal Adviser	
17 Feb 2016	Prof Ross Kingwell	Chief Economist	Australian Export Grain Innovation Centre
17 Feb 2016	Mr Lindsay O'Sullivan	Chief Operating Officer	Chamber of Commerce and Industry of Western Australia (Inc)
	Mr Dale Leggett	Director of Policy	
	Mr Luke Hoare	Principal Policy Adviser	
24 Feb 2016	Dr Mark Sweetingham	Executive Director, Grains Research and Development	Department of Agriculture and Food
24 Feb 2016	Mr Owen Whittle	Assistant Secretary	UnionsWA
	Dr Tim Dymond	Organising and Strategic Research Officer	
16 March 2016	Ms Anne Driscoll	Acting Director General	Department of Commerce
	Mr John O'Hare	Acting Director, Industry and Innovation	
	Mr Michael Dickson	Manager, Strategic Projects; Labour Relations, Industry and Innovation	
	Ms Kristin Berger	A/Executive Director, Labour Relations, Industry and Innovation	

Date	Name	Position	Organisation
16 March 2016	Dr Claus Otto	Technology Manager	Shell Australia
	Mr John Dagostino	Government Relations Adviser	
16 March 2016	Mr Shaun Gregory	Senior Vice President and Chief Technology Officer	Woodside Energy
	Mr Brian Haggerty	Vic President, Innovation Capability	
23 March 2016	Dr Alan Bye	Vice President, Technology	BHP Billiton Iron Ore Pty Ltd
	Mr Julius Matthys	Vice President, Corporate Affairs Western Australia	
23 March 2016	Mr Andrew Harding	Product Group Executive, Iron Ore	Rio Tinto Iron Ore
	Mr Michael Gollschewski	Managing Director, Pilbara Mines	
	Mr Clayton Walker	Managing Director, Ports, Rail and Core Services	
6 April 2016	Mr Mark Titley	Global Technology Centre Manager	Chevron Australia
	Mr Peter Fairclough	General manager, Policy, Government and Public Affairs	
6 April 2016	Mr Simon Walker	Executive Director Policy Planning and Innovation	Department of Training and Workforce Development
	Mr Gary Fitzgerald	Director State Workforce Planning	
6 April 2016	Mr Mark Webb	Acting Director General	Department of Agriculture and Food
	Dr Bruce Mullan	Director, Sheep Industry Development	
	Ms Catherine Lyons	Acting Director, Strategy and Governance	

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Date	Name	Position	Organisation
7 April 2016	Mr Ken Fitzpatrick	Chair	National Energy Resources Australia
	Ms Miranda Taylor	Chief Executive Officer	
12 April 2016	Mr Frank Marra	Chief Executive Officer	LandCorp
	Mr John Clifton	Manager, Strategy and Innovation	
	Ms Kerry Anne Fijac	Manager, Business Development and Marketing	
19 April 2016	Mr David Eaton	Small Business Commissioner	Small Business Development Commission
	Ms Jacqueline Finlayson	Executive Director, Small Business Services	
	Mr Martin Hasselbacher	Director, Policy and Advocacy	
	Mrs Caragh Waller	Manager, Business Information and Programs	
19 April 2016	Dr Alex Wonhas	Executive Director, Energy, Environment and Resources	CSIRO
19 April 2016	Mr Emmanuel Hondros	Manager, People Strategies	Chamber of Minerals and Energy of Western Australia
	Mr Stedman Ellis	Chief Operating Officer, Western Region	APPEA
	Mr Adam Welch	Senior Policy Advisor	
18 May 2016	Prof Andris Stelbovics	Pro Vice-Chancellor	Curtin University
	Prof Brian Evans	Director Oil & Gas Initiatives, Faculty of Science & Engineering	

Appendix Five

Site visits and briefings

Date	Name	Position	Organisation
12 May 2015	Ms Elena Douglas	CEO	Knowledge Society
13 May 2015	Mr Erich Hofmann	Managing Director	Hofmann Engineering
	Mr Jarrod Hofmann	Product Manager HPGRs	
20 May 2015	Mr John O’Hare	Acting Director, Industry and Innovation	Department of Commerce
	Mr Stephen Grocott		
20 May 2015	Prof Peter Klinken	Chief Scientist of Western Australia	Office of Science, Department of Premier and Cabinet
20 May 2015	Mr Charlie Thorn	Director, Research & Development	Curtin University
26 May 2015	Mr Peter Metcalfe	Director External Affairs—Upstream	BP Australia
	Mr Des Gillen	Managing Director, Kwinana Refinery	
26 May 2015	Mr Shane Addis	Managing Director	ERGT Australia
	Mr Ryan Cotterell	Business Development Manager	
	Mr Mick Macfarlane	Consultant	
	Mr Dennis Dyce	Project Manager	
26 May 2015	Mr Stuart McLagan	Communications Manager	GE Oil & Gas
29 Sept 2015	Mr Neil Stringfellow	Executive Director	Pawsey Supercomputing Centre
29 Sept 2015	Dr Steve Harvey	Science Director & Deputy Director	Mineral Resources Flagship CSIRO
29 Sept 2015	Mr Kym Bills	CEO	WA:ERA

Appendix Five

Date	Name	Position	Organisation
29 Sept 2015	Prof Graeme Wright	Deputy Vice Chancellor	Curtin University
	Prof Craig Buckley	Deputy Director	Fuels and Energy Technology Institute, Curtin University
	Dr Richard Gunawan	Research Fellow	
	Mr Tim Walton	Director, Energy Research Initiatives	Office of Research and Development, Curtin University
8 Oct 2015	Prof Hugh Durrant-Whyte	Chair	New South Wales Innovation and Productivity Council
15 Oct 2015	Dr Janakan Krishnarajah	CEO/Medical Director	Linear Clinical Research Limited
	Mr John Fitzgerald	Chief Operating Officer	Harry Perkins Institute of Medical Research
28 Oct 2015	Mr Stuart Whiley	Interim CEO	ASC
	Mr Mark Lamarre	Interim CEO Shipbuilding	
	Mr Paul Gay	General Manager Collins Class Submarines	
	Mr Jim Burnside	Future Submarine Manager	

Date	Name	Position	Organisation
28 Oct 2015	Dr Don Russell	Chief Executive	South Australian Department of State Development
	Mr Paul Goiak	Director Industry Participation, Industry & Innovation	
	Mr Barry Goldstein	Executive Director, Energy Resources Division	
	Mr Vince Duffy	Executive Director, Energy Markets and Programs Division	
	Dr Andrew Dunbar	Director, Office of Science, Technology and Research	
	Mr Rob Esvelt-Allen	Principal Economist	
	Mr Paul Heithersay	Deputy Chief Executive	
	Mr Adam Reid	Deputy Executive Director, Industry & Innovation	
	Dr Leanna Read	Chief Scientist of South Australia	
29 Oct 2015	Mr Stuart Elliott	Managing Director	Planet Innovation
	Mr Roger Langsdon	Marketing Manager	
29 Oct 2015	Dr Anita Hill	Executive Director, Future Industries	Manufacturing Flagship, CSIRO
	Mr Ben Aldham	Executive Officer	
	Mr Jonathan Law	Flagship Director, Mineral Resources	
	Dr Martin Keogh		
	Dr Keith McLean	Manufacturing Flagship Director	
	Ms Alexandra Kingsbury	Research Manager	
	Dr Kristina Konstas	Research Scientist	
Dr Anastasios Polyzos	Senior Research Scientist		

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Date	Name	Position	Organisation
29 Oct 2015	Dr Leonie Walsh	Lead Scientist	Victorian Office of the Lead Scientist
29 Oct 2015	Mr Justin Hanney	Lead Deputy Secretary	Victorian Department of Economic Development, Jobs, Transport and Resources
	Mr Tim Ada	Executive Director, Sector Development	
	Dr Michael Green	Executive Director, Future Industries Project	
30 Oct 2015	Mrs Jane Urquhart	Acting Head of Division, Science & Commercialisation Policy	Commonwealth Department of Industry, Innovation and Science
	Mr Peter Chesworth	Head of Division, Sectoral Growth Policy	
	Mr Abrie Swanepoel	Senior Economist, Industry Economics & Analysis Division	
30 Oct 2015	Dr Lachlan Blackhall	Co-founder and Chief Technology Officer	Reposit Power
	Mr Dean Spaccavento	Co-founder	
30 Oct 2015	Dr Patrick Hone	Executive Director	Fisheries Research and Development Corporation
	Mr John Wilson	Business Development Manager	

Date	Name	Position	Organisation
2 Nov 2015	Mr Simon Smith	Secretary	New South Wales Department of Industry
	Mr Scott Hansen	Director General, Department of Primary Industries	
	Mr Jonathan Gregory	Executive Director, Department of Primary Industries Business Operations	
	Mr Michael Bullen	Deputy Director General, Department of Primary Industries Agriculture	
	Ms Kylie Hargreaves	Deputy Secretary, Resources and Energy	
	Ms Clare Sykes	Senior Project Officer, METS, Resources and Energy	
2 Nov 2015	Mr Paul Shetler	Chief Executive Officer	Commonwealth Digital Transformation Office
2 Nov 2015	Mr Yasser El-Ansary	Chief Executive	Australian Private Equity & Venture Capital Association
2 Nov 2015	Ms Sri Wahidah Masturi	Business Development Manager	The Old Clare Hotel
3 Nov 2015	Prof Roy Green	Dean, UTS Business School	University of Technology Sydney
3 Nov 2015	Mr Richard Kell, AM	Chair	The Warren Centre for Advanced Engineering
	Mr Ashley Brinson	Executive Director	
	Ms Alexandra Harrington	Chief Operating Officer	
3 Nov 2015	Prof Mary O'Kane	NSW Chief Scientist & Engineer	Office of the New South Wales Chief Scientist & Engineer

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Date	Name	Position	Organisation
4 Nov 2015	Prof Peter Gray	Director	Australian Institute for Bioengineering and Nanotechnology, University of Queensland
	Mr Bob McCarthy AM	Adjunct Professor	
4 Nov 2015	Mr Andrew Sanderson	General Manager	TAE
	Mr Greg Mason	Manager Innovation & Strategic Projects	
	Mr Greg Twiner	Business Development Manager & Contracting Manager	
4 Nov 2015	Dr Sue Hooper	Director Health and Medical Research	Health and Medical Research Unit, Queensland Health
5 Nov 2015	Mr Paul Russell	Acting Chief Strategic Policy and Innovation Officer	Queensland Department of Science, Information Technology and Innovation
	Mr Leslie Hodgson	Director, Digital Economy	
	Mr Mal Lane	Manager, Industry Development	
	Mr Alan Murgatroyd	Principal Project Officer, Innovation Policy and Programs	
	Dr Christine Williams	Assistant Director-General, Science Division	
	Mr Andrew Dungan	Director, Industry Development	
	Ms Kylie Hickling	Director, Commercialisation	
	Ms Clare Hoey	Manager, Innovation Policy and Programs	
5 Nov 2015	Dr Geoff Garrett AO	Queensland Chief Scientist	Office of the Chief Scientist, QLD

Date	Name	Position	Organisation
5 Nov 2015	Dr Mark Jacobs	Executive Director Science Delivery, EcoSciences Precinct	Department of Science, Information Technology and Innovation, QLD
	Ms Sonya Winnington-Martin	Science Infrastructure and Operations	
	Mr David Wainwright	Director, Air Quality Sciences, Science Division	
	Ms Christina Jones	Remote Sensing Centre	
	Ms Lauren O'Brien	Soil and Land Resources Division	
18 Nov 2015	Mr Matt Taylor MLA	Member for Bateman	Legislative Assembly Parliament of Western Australia
27 Nov 2015	Mr Doron Ben-Meir	Executive Director of Research, Innovation & Commercialisation	University of Melbourne
12 April 2016	Dr Matt Lamont	Managing Director	DownUnder GeoSolutions
18 April 2016	Mr Brodie McCulloch	Managing Director	Spacecubed
18 April 2016	Mr John Fitzgerald	Chief Operating Officer	Harry Perkins Institute of Medical Research
18 April 2016	Mr Julius Matthys	Vice-President, Corporate Affairs Western Australia	BHP Billiton Iron Ore Pty Ltd
	Ms Cecelia Haddad	Manager Supply Chain Scheduling	
	Mr Gary Warden	Vice President Technology	
	Mr Rob Carruthers	Manager Government Relations	
	Ms Natalee Connor	Government Relations Specialist	

Appendix Five

Date	Name	Position	Organisation
18 April 2016	Mr Michael Gollshewski	Managing Director, Pilbara Mines	Rio Tinto Iron Ore
	Mr John Lehfeldt	Manager, Production Systems	
28 April 2016	Mr Archie MacPherson	Chief Executive	WMG HVM Catapult, University of Warwick, United Kingdom
	Dr Mark Swift	International Manufacturing Centre	
29 April 2016	Prof David W Hopkins	Professor of Soil Science; Dean of the School of Agriculture, Food & Environment	Royal Agricultural University, United Kingdom
2 May 2016	Prof Shmuel Wolf	Dean; Professor of Plant Physiology, Faculty of Agriculture, Food and Environment	The Hebrew University of Jerusalem
	Prof Benny Chefetz	Vice Dean for Research	
	Prof Ram Reifen	Director, Research Centre for Nutrigenomics and Functional Foods	
	Dr Zvi Peleg	Faculty member, Institute of Plant Sciences and Genetics in Agriculture	
	Mr Yaacov Michlin	President & CEO, Yissum	
2 May 2016	Mr Avi Luvton	Executive Director, Business Development —Asia Pacific	MATIMOP—Israeli Industry Center for R&D
	Ms Hadas Kroitoru	Program Manager	
3 May 2016	Ms Daphna Nissenbaum	CEO & Co-Founder	TIPA Sustainable Packaging, Israel
3 May 2016	Mr Gideon Soesman	Co-Founder & Managing Partner	Greensoil Investments, Israel

Date	Name	Position	Organisation
3 May 2016	Mr Amir Veresh	CP Investor Relations & Admin	Massivit 3D, Israel
3 May 2016	Mr Roni Zehavi	Chief Executive Officer	CyberSpark, Israel
4 May 2016	Dr Anat Bonshtien	Technology & Regulation Manager, Fuel Choices Initiative	Office of the Prime Minister, Israel
4 May 2016	Dr Yochi Hagay	Chief Executive Officer	BioHarvest, Israel
4 May 2016	Mr Hanan Bazak	Director	Ministry of Agriculture & Rural Development, Israel
	Ms Anat Lowengart-Aycicegi	Division Head; Agro-Ecology and Field Crops Division	
4 May 2016	Dr Arie Regev	Director, Foreign Relations Department Deputy Director, Foreign Trade Center	Ministry of Agriculture & Rural Development
	Mr Jacob Mualem Marom	Director; 'Kidum' R&D Application; Agricultural Research Organization	Ministry of Agriculture
	Mr Gil Shalev	Chief Executive Officer	EQUInom, Israel
4 May 2016	Mr Paul Israel	Executive Director	Israel-Australia, New Zealand & Oceania Chamber of Commerce
13 May 2016	Hon Dr Mal Bryce AO	Former Deputy Premier of Western Australia	

Appendix Six

Glossary

ABS	Australian Bureau of Statistics
ACEPT	Australian Centre for Energy Process Training
AIBN	Australian Institute for Bioengineering and Nanotechnology
AiG	Australian Industry Group
AMC	Australian Marine Complex
AMC-CUF	Australian Marine Complex-Common User Facility
AMRC	Australian Minerals Research Centre
APPEA	Australian Petroleum Production and Exploration Association
ARC	Australian Research Council
ARRC	Australian Resources Research Centre
ATAR	Australian Tertiary Admission Rank
AVCAL	Australian Private Equity & Venture Capital Association
AWARE	Advancing Western Australia Research Education
BRII	Business Research and Innovation Initiative
CCIWA	Chamber of Commerce and Industry of Western Australia (Inc)
CEDA	Committee for Economic Development of Australia
CfEL	Centre for Entrepreneurial Learning, Cambridge University
COAG	Council of Australian Governments
CSIRO	Commonwealth Scientific and Industrial Research Organisation
Cth	Commonwealth of Australia
CUF	Common User Facility
DAFWA	Department of Agriculture and Food
DEDJTR	Department of Economic Development, Jobs, Transport and Resources, Victoria
DINSW	Department of Industry, New South Wales
DSDSA	Department of State Development, South Australia
DTWD	Department of Training and Workforce Development
ECU	Edith Cowan University

Appendix Six

ESWA	Earth Science Western Australia
FLNG	Floating liquefied natural gas
GDP	Gross domestic product
GII	Global Innovation Index
GRDC	Grains Research and Development Corporation
ICWA	Innovation Centre of WA
IP	Intellectual property
iPREPWA	Industry and PhD Research Engagement Program
IVP	Innovation Vouchers Program
LNG	Liquefied natural gas
MOU	Memorandum of Understanding
MRIWA	Minerals Research Institute of Western Australia
NERA	National Energy Resources Australia (the Australian Energy Resources Growth Centre)
NGL	National Geosequestration Laboratory
NIS Agenda	National Innovation and Science Agenda
NRSP	National Resource Sciences Precinct
OCS	Office of the Chief Scientist, Israel
OECD	Organisation for Economic Cooperation and Development
PPP\$ GDP	Purchasing power parity gross domestic product
R&D	Research and Development
RIIT	Resource Innovation and Information Technology
RTO	Registered training organisation
SBDC	Small Business Development Corporation
SBRI	Small Business Research Initiative
SCSA	School Curriculum and Standards Authority of WA
SMEs	Small to medium enterprises
STEM	Science, technology, engineering and mathematics
TIAC	Technology and Industry Advisory Council
UWA	University of Western Australia
VET	Vocational education and training
VISITS	Victoria–Israel Science Innovation and Technology Scheme

WA	Western Australia
WACE	Western Australian Certificate of Education
WA:ERA	Western Australian Energy Research Alliance