

Chapter 3

Activities in the innovation system

Australia is an innovation follower, rather than an innovation leader. Australian businesses tend to adopt a mixed-mode approach to innovation, where different types of innovation are used in complementary ways. Business innovation often involves introducing goods and services already developed by others. Only 5.5 per cent of surveyed businesses reported delivering new-to-market goods and services in 2014–15 and less than one per cent of all innovation active businesses reported innovation expenditure of \$5 million or more.



This chapter examines some of the key activities in the innovation system: innovation, entrepreneurship, and R&D.

Australia ranks relatively highly on general entrepreneurship and innovation measures, but poorly on new-to-market innovation.

Businesses that undertake R&D are almost always innovation-active businesses, and are significantly more likely to be new-to-market innovators.

Australia's gross domestic expenditure on R&D (GERD) to GDP ratio was 2.1 per cent in 2013–14, which is slightly above the OECD average of 2.0 per cent, but significantly lower than the top five OECD performers on this indicator.

Australia fares better on experimental development. In 2013, Australia was ranked 10th out of 29 OECD countries on business expenditure on experimental development as a percentage of GDP. The majority of R&D expenditure is undertaken by large businesses.

The Australian Government supports R&D in a number of ways, both directly and indirectly. The government is expected to spend \$10.1 billion on R&D in 2015–16, including \$3.2 billion through the R&D Tax Incentive.³⁶

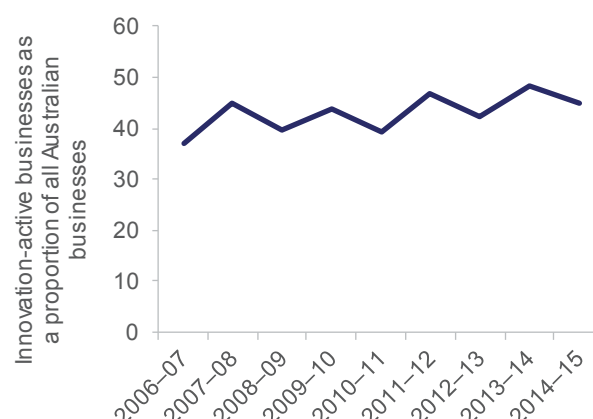
3.1 Trends in entrepreneurship and innovation

Australia's rates of entrepreneurship and attitudes towards entrepreneurship are high relative to other countries, even though the rate of business creation appears to be slowing in Australia and across the OECD. Australia has a range of indicators that measure business R&D, innovation, invention and entrepreneurship performance (Table A2).

Innovation rates are improving slowly

The key measure of 'innovativeness' of the private sector in Australia is the percentage of innovation-active businesses. The latest results show that 45 per cent of all Australian businesses were innovation-active in 2014–15, down from 48 per cent in 2013–14. The proportion of innovation-active businesses has shown a slightly upward trend with yearly fluctuations over the past decade (Figure 3.1).^(f)

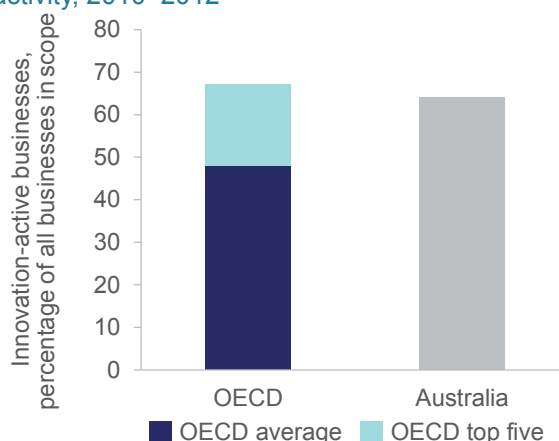
Figure 3.1: Innovation activity in Australia, 2006–15



Source: ABS (various) *Innovation in Australian Business*, cat. no. 8158.0; ABS (various) *Summary of IT Use and Innovation in Australian Business*, cat. no. 8166.0

The most recent international comparisons for the year 2012–13 show that Australia ranks in the top five of 30 OECD countries in terms of the proportion of innovation-active businesses to total businesses (Figure 3.2). Australia's score appears higher in this chart than in Table A2 because the data are matched to other OECD countries (see note in Figure 3.2). This high ranking may reflect relatively high innovation activity by SMEs. Large businesses have a low rank, 18th place. Australia's manufacturing and service sectors are relatively highly ranked.

Figure 3.2: International ranking on innovation-activity, 2010–2012



Notes: OECD comparisons exclude businesses with less than ten employees. Industry core coverage includes ISIC Rev. 4 Sections and Divisions B, C, D, E, G46, H, J, K, M71–72 and 73. Australian data is for 2012–13. The OECD top five are Switzerland, Germany, Luxembourg, Australia and Ireland.

Source: OECD (2015) *Innovation statistics and indicators*, <http://www.oecd.org/innovation/inno/inno-stats.htm>

^(f) We are currently working with the ABS to investigate the source of this sawtooth wave pattern.

Methodology 3.1: Making international comparisons with innovation data

Given we use an internationally agreed definition of innovation, we are able to make comparisons with other countries (mostly in the OECD) that use the same definition. Country scores are typically presented as a percentage of all businesses, or as a percentage of all innovation-active businesses.

The ABS transforms the Business Characteristics Survey unit record data to produce national business innovation and collaboration indicators that match businesses in other OECD countries. OECD specifications include:

Using the same OECD employment size ranges.

SMEs are 10–249 employees, and large businesses are 250+ employees. Excluding the very small businesses typically makes Australia's OECD matched innovation rate higher than it appears in ABS publications because micro-sized businesses are significantly less likely to innovate in any given year.

Using the same International Standard Industrial Classification (ISIC) of All Economic Activities developed by the United Nations.

OECD Industry core coverage usually includes ISIC Rev. 4 Sections and Divisions B, C, D, E, G46, H, J, K, M71–72 and 73. This typically makes Australia's OECD matched innovation rate higher than it appears in ABS publications because sectors like Agriculture are less likely to innovate in any given year.

Due to the considerable time and resources it takes to collect, coordinate and match the data from over 35 countries, the OECD's international comparisons are typically three to five years old when they are released.

Technological vs non-technological innovation

The OECD describes goods, services, and process innovation as predominantly technological innovation, and marketing/organisational innovation as mostly non-technological innovation (Definition 1.3).

Data for Australia and other OECD countries shows that most businesses adopt a mixed-mode approach to innovation, where different types of innovation are used in complementary ways. For example, goods and services innovation is often accompanied by a new marketing method, or the introduction of a new operational process might demand a new way of managing a business' supply chain (organisational innovation).

Table 3.1 provides international comparisons of the different modes of innovation. Australia ranks highly for product or process innovation only, with large businesses ranked 3rd in the OECD and SMEs ranked 8th.

By contrast, for innovation in marketing or organisational methods only, Australia ranks poorly at 30th for large businesses and 31st for SMEs out of 33 OECD countries. In this mode of innovation, there was little variability in Australia's OECD rank between manufacturing (28th) and services (29th).

Australian SMEs ranked first in the OECD (at 43 per cent) for product or process and marketing or organisational innovation. Even though a higher proportion (50 per cent) of large businesses in Australia innovated in this way, they ranked 13th in the OECD.



Table 3.1: Mixed modes of innovation, Australia versus the OECD and OECD top five averages, 2010–2013

	Business size			Economic sector	
	All businesses	SMEs	Large businesses	Manufacturing	Services
	<i>as a percentage of all businesses</i>	<i>as a percentage of all SMEs</i>	<i>as a percentage of all large businesses</i>	<i>as a percentage of all manufacturing businesses</i>	<i>as a percentage of all service businesses</i>
Product and/or process innovative businesses, including abandoned or ongoing innovation activities (regardless of organisational or marketing innovation)					
OECD average	35.7	34.6	64.3	41.0	33.5
OECD top 5 average	54.0	53.0	79.2	59.5	50.8
Australia	55.8	55.4	70.5	53.0	55.9
Organisation or marketing innovative businesses only					
OECD average	13.7	13.7	11.5	11.7	15.3
OECD Top 5 average	21.5	21.7	19.0	20.0	22.8
Australia	6.8	6.8	7.5	5.3	8.4
Product or Process AND Marketing or Organisational innovations only					
OECD average	24.9	23.9	50.4	27.4	23.4
OECD Top 5 average	39.4	38.4	66.6	42.4	38.1
Australia	42.9	42.7	50.7	39.5	42.5

Notes: SMEs are businesses with 10–249 employees. Large businesses have 250+ employees. Manufacturing and service sectors are defined according to ISIC Rev. 4. The All businesses comparison is for firms with ten or more employees and ISIC (Rev. 4) Sections and Divisions B, C, D, E, G46, H, J, K, M71–72 and 73. Australian data is for 2012–13. According to the OECD ‘Products’ includes both goods and services.

Source: OECD (2015), “Mixed modes of innovation”, in *OECD Science, Technology and Industry Scoreboard 2015: Innovation for growth and society*.

3.2 Innovation novelty

At a minimum, an innovation must be new to the business. Higher degrees of novelty can be broadly categorised as **'new-to-market'** (Definition 3.1), where the market is defined as the business and its competitors and can include a geographic region or product line. Within this category, an innovation can be **'new-to-industry'**, **'new-to-country'** or **'new-to-world'** innovation. An innovation is new to world when the business is the first to introduce the innovation for all markets and industries — domestic and international.

Businesses that are the first in their market to develop innovations can represent the technology or innovation frontier. Previous AIS Reports have shown that this degree of novelty can have a big impact on the competitiveness of industry, and may be more important for breaking into new export markets than for increasing export sales.³⁷ New-to-market innovation is significantly and positively associated with export activity, market share and average annual sales.³⁸ This association is strongest for large businesses, which account for the majority of exports.

The average gross operating profit for Australian business is generally higher for innovators, particularly new to market innovators, as shown by Table 3.2.

Table 3.2: Average gross operating profit, by innovation status and degree of novelty, 2014–15.

	Average gross operating profit per business, \$000	Average gross operating profit per employee, \$000
New-to-market innovators	550 (103)	28 (5)
New-to-business innovators	297 (33)	17 (2)
Non-innovators	110 (26)	14 (3)

Notes: Gross operating profit is defined as Total income — (Total operating expenditure + Capital expenditure) according to the ABS. Figures in parentheses are standard errors.

Source: Customised ABS data commissioned by the Department of Industry, Innovation and Science

Definition 3.1: Defining innovation novelty

In order to assess innovation novelty, businesses that introduced an innovation (i.e. innovating businesses) were asked in the Business Characteristics Survey to report whether they thought their new or significantly improved goods, services, processes or methods introduced were new to the world, new to Australia, new to the industry, or new to the business only (these categories are mutually exclusive).

New-to-market innovation is where the innovation is either new to the world, new to Australia or new to the industry.

New to Market =
(New to World + New to Australia + New to Industry)

Innovation that is only new to the business was the most common type across innovating Australian businesses in 2014–15. The percentage of surveyed businesses that reported introducing new goods and services innovations was 19 per cent in 2014–15. Most of these businesses are doing new-to-business innovation, adopting goods and services developed by others. Only 5.5 per cent of surveyed businesses reported delivering new-to-market goods and services in 2014–15.

The rate of new-to-market innovation appears to have declined since the pre-global financial crisis period (Figure 3.3). This may reflect growing aversion to invest in high-risk business ventures or internal innovation projects, or an outright loss of highly innovative businesses across Australia.

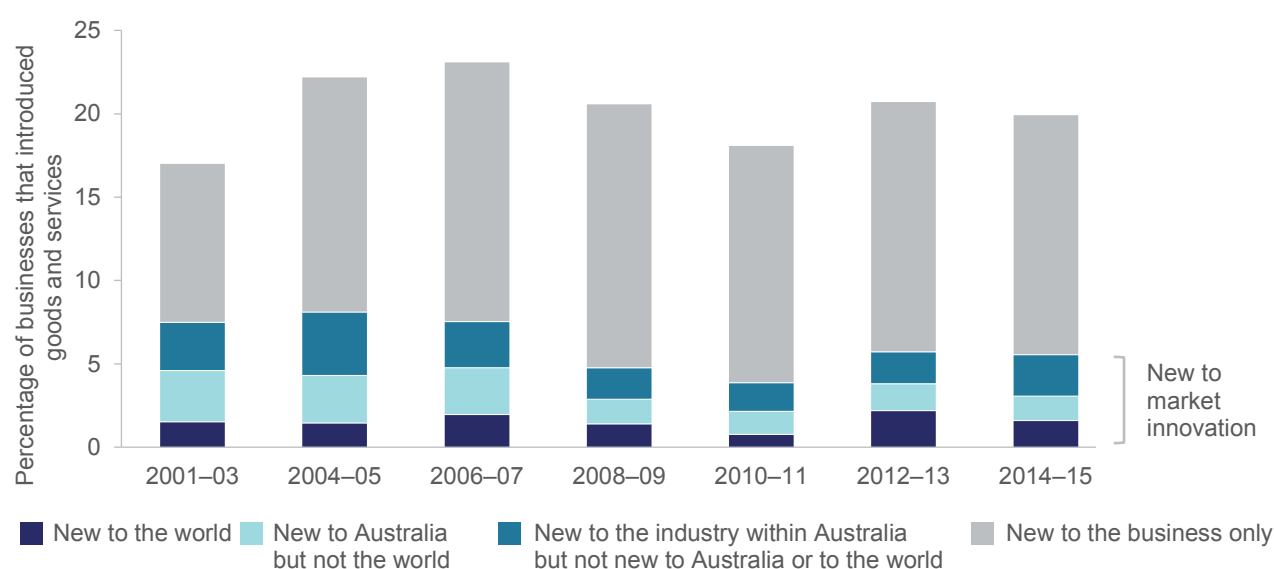
In contrast to the international comparisons on innovation activity (that include all types of novelty), Australian new-to-market innovation is ranked relatively poorly against other countries (Figure 3.4). After matching to OECD definitions of business size and sector, the data suggests that Australia is not an innovation leader but an innovation follower. Compared to 31 other OECD countries, Australia, at nine per cent, ranked 23rd for the year 2012–13.

This ranking largely reflects the activity of SMEs (with 10–249 employees) at nine per cent. Large businesses (with 250+ employees), also at 9 per cent, rank even lower at 29th out of 30 OECD countries.

Although Australia's new-to-market innovation ranks poorly against many of our OECD counterparts,

several of our sectors perform well above the national average on new-to-market innovation. In particular, the *Manufacturing* and *Wholesale Trade* sectors perform well above the national average in both relative and absolute terms.³⁹

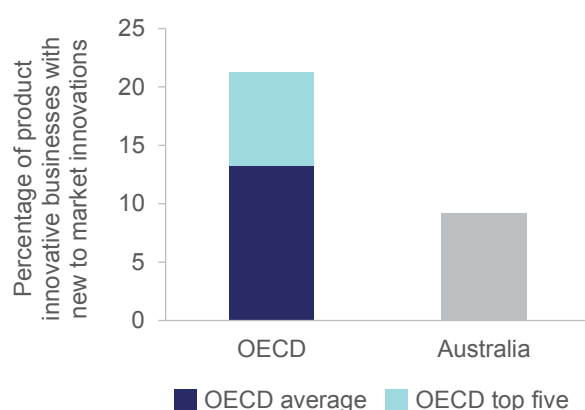
Figure 3.3: Degree of innovation novelty in Australian goods and services innovation, 2001–03 to 2014–15



Notes: New to market innovation is the sum of New to world, New to Australia and New to industry innovation.

Source: ABS (various) *Innovation in Australian business*, cat. no. 8158.0

Figure 3.4: International ranking on new to market innovation, 2010–12



Notes: OECD comparisons exclude businesses with fewer than ten employees. Industry core coverage includes ISIC Rev. 4 Sections and Divisions B, C, D, E, G46, H, J, K, M71–72 and 73. Australian data is for 2012–13. The OECD top five countries are Canada, Belgium, Netherlands, Finland and Austria.

Source: OECD (2015) *Innovation statistics and indicators*, <http://www.oecd.org/innovation/inno/inno-stats>

3.3 A new measure of innovation frequency

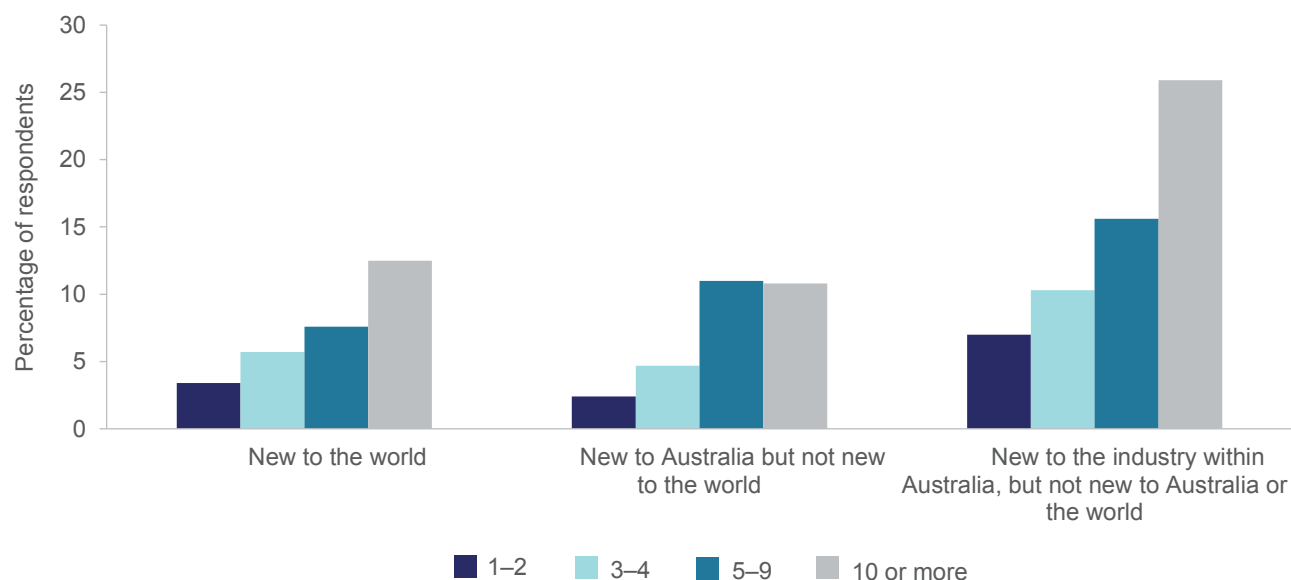
One of the criticisms of the Business Characteristics Survey is that its measure of innovation has historically been a YES/NO response for a particular reference year. This meant that there was no way to tell if one innovative business had introduced several innovations or only one. The new indicators developed with the University of Tasmania and the ABS provide insight to innovation frequency (Chapter 1).

Across all four types of innovation, businesses most commonly reported introducing one to two new goods, services, processes or methods. For example, of those businesses reporting new goods and/or services:

- 66 per cent introduced one to two new goods and/or services during the year ended 30 June 2015
- only 7 per cent introduced 10 or more new goods and/or services.

More frequent innovators are also more likely to be new to market innovators, as shown by Figure 3.5. This is also the case for more persistent innovators (data not shown; Chapter 2).

Figure 3.5: The relationship between innovation frequency and innovation novelty, by number of innovations, 2014–15



Source: Customised ABS data commissioned by the Department of Industry, Innovation and Science



3.4 Improving our measurement of innovation investment

While there is an accounting definition of R&D and intellectual property, there is no such definition of innovation expenditure. For this reason, obtaining accurate estimates of innovation expenditure is difficult. The 2014–15 BCS included a revised question on business innovation expenditure that allows a business to allocate a percentage of total investment towards specific innovation-related activities. This includes estimates of the percentage of expenditure on physical assets for the development of innovation and intangible items (e.g. training and marketing; Definition 3.2).

Two new response options were added to the survey:

1. Reorganisation of existing business models, work practices and decision making processes.
2. Training relevant to the development or introduction of new goods, services, processes or methods.

Definition 3.2: Innovation investment

Investment on innovation comprises all expenditure incurred by businesses on developing or introducing all new or significantly improved goods, services, processes or methods over a financial year period.

The types of activities covered in the survey are:

- acquisition of machinery, equipment or technology (including hardware and software)
- re-organisation of existing business models, work practices and decision-making processes
- training relevant to the development or introduction of new goods, services, processes or methods
- marketing activities undertaken to introduce new goods and/or services to the market
- research and experimental development for the purposes of developing or introducing innovation
- design, planning or testing
- acquisition of licences, rights, patents or other intellectual property
- other labour costs related to the development or introduction of new goods, services, processes or methods
- other activities related to the development or introduction of new goods, services, processes or methods

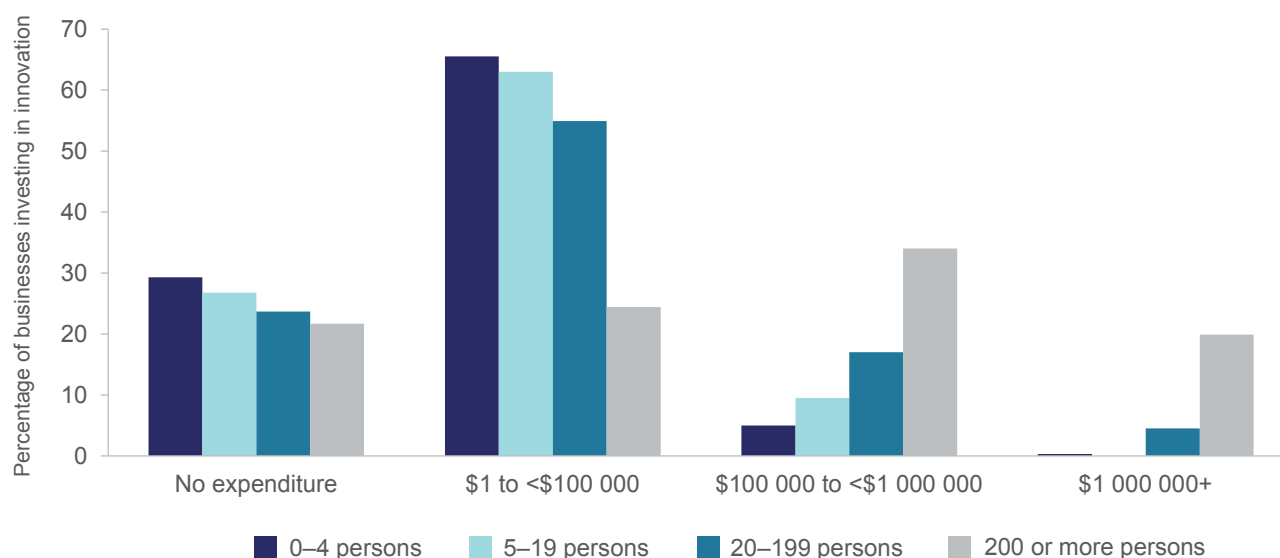


Using these revised definitions, the ABS estimated total expenditure by Australian businesses on innovation-related activities to be between \$26 and \$30 billion in 2014–15.

The proportion of innovation-active businesses that reported no expenditure on innovation was 28 per cent. Nearly half of all businesses (46 per cent) reported innovation expenditure of \$1 to less than \$25,000. Not surprisingly, as business size increased, the likelihood of spending more on innovation also increased (Figure 3.6). The majority of SMEs invested between \$1 and \$100,000 in innovation-related activities. Less than one per cent of all innovation active businesses reported innovation expenditure of \$5 million or more. These were mostly large businesses.

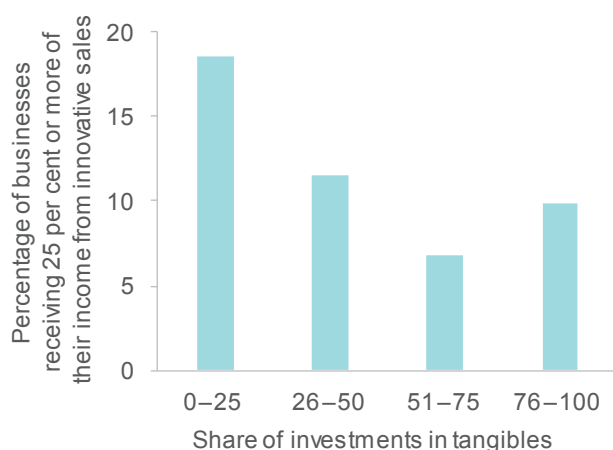
Businesses investing a high proportion of capital in acquiring physical assets including machinery received less income from the sale of new goods and services than those who invested a low proportion of expenditure in machinery. This is illustrated through the U-shaped relationship between the proportion of businesses receiving 25 per cent or more of their income from new goods and services, and acquiring machinery (Figure 3.7). This relationship may result from businesses prioritising investment on physical assets and thereby reducing investment on intangible items such as training, marketing and R&D. These intangible items seem to be high contributors to income from the sale of innovative new goods and services.

Figure 3.6: Percentage of innovation-active businesses investing in innovation, by range of investment and employment size, 2014–15



Source: ABS (2016) *Innovation in Australian Businesses, 2014–15: Innovation Expenditure*, Table 1 cat. no. 8158.0 (data cube: Excel spreadsheet) <http://www.abs.gov.au/ausstats/abs@.nsf/mf/8158.0>

Figure 3.7: Proportion of businesses receiving 25 per cent or more of their income from new goods and services, by investment in machinery, equipment or technology, 2014–15



Notes: 'Tangibles' means machinery, equipment and technology.

Source: Customised ABS data commissioned by the Department of Industry, Innovation and Science

3.5 Research and development in Australia

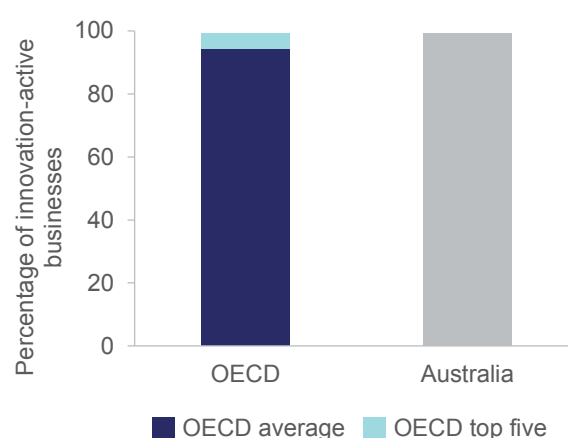
R&D plays a crucial role in the technological development and competitiveness of a country. The benefits of R&D come primarily in the form of skills development, the generation of new knowledge and technologies, and the creation of new goods and services. The literature has shown that R&D-related activities can explain up to 75 per cent of the total factor productivity growth, once externalities are considered.⁴⁰ The private returns to R&D are generally found to be positive, and higher than those for physical capital. International research shows a statistically significant relationship between a business' investment in intellectual property (IP) and its performance. In particular, investment in IP and other forms of intangible capital have been shown to facilitate business growth,⁴¹ and spur productivity improvements.⁴² This suggests that innovative businesses conducting R&D may reap greater rewards than innovative businesses that don't perform R&D.⁽⁹⁾

⁽⁹⁾ Businesses that undertook R&D but did not introduce any innovation are not classified as innovative by the ABS.

The impact of R&D on innovation activity

Businesses that undertake R&D in Australia are almost always innovation-active (Figure 3.8 and Figure 3.9). Across the OECD, 94 per cent of businesses doing R&D are innovation-active, compared to only 35 per cent of businesses that don't perform R&D (on average).

Figure 3.8: Innovation-active businesses, as a percentage of total R&D-active businesses, 2010–12



Notes: OECD comparisons exclude businesses with fewer than ten employees. Industry core coverage includes ISIC Rev. 4 Sections and Divisions B, C, D, E, G46, H, J, K, M71–72 and 73. Australian data is for 2012–13. The OECD top five countries are Japan, Slovakia, Australia, Switzerland and Austria.

Source: OECD (2015) *Innovation statistics and indicators*, <http://www.oecd.org/innovation/inno/inno-stats.htm>



The literature has shown that R&D can explain up to 75 per cent of total factor productivity growth once externalities are considered.



Definition 3.3: R&D and R&D Intensity

R&D comprises creative and systematic work to increase the stock of knowledge — including knowledge of humankind, culture and society — and to devise new applications of available knowledge.

The term R&D includes three types of activity: basic research, applied research and experimental development.

Basic research is experimental or theoretical work undertaken to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view.

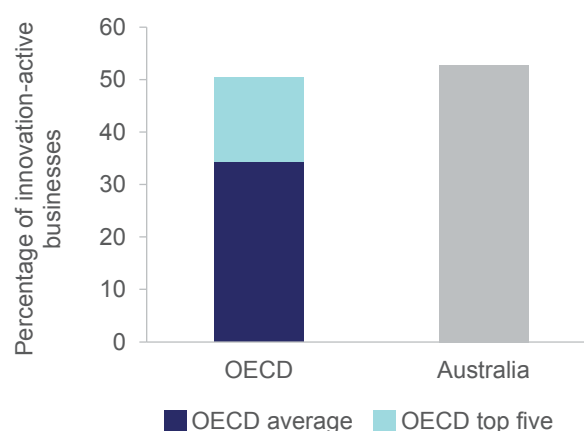
Applied research is original investigation to acquire new knowledge. It is, however, directed primarily towards a specific, practical aim or objective.

Experimental development is systematic work, drawing on knowledge gained from research and practical experience and producing additional knowledge, which is directed to producing new products or processes, or to improving existing products or processes.

R&D intensity is commonly defined as the ratio of R&D expenditure to an output measure, usually gross value added (GVA) or gross output (GO), and occasionally employment. This indicator is commonly used at the level of an economy to measure its relative R&D effort (gross expenditure on research and development (GERD) divided by GDP) or its sector (business expenditure on R&D (BERD) over GDP or a more closely aligned measure of GVA for the industry sector).

Source: Frascati Manual (2015)⁴³; Galindo-Rueda and Verger (2016).⁴⁴

Figure 3.9: Innovation-active businesses, as a percentage of total businesses with no R&D, 2010–12

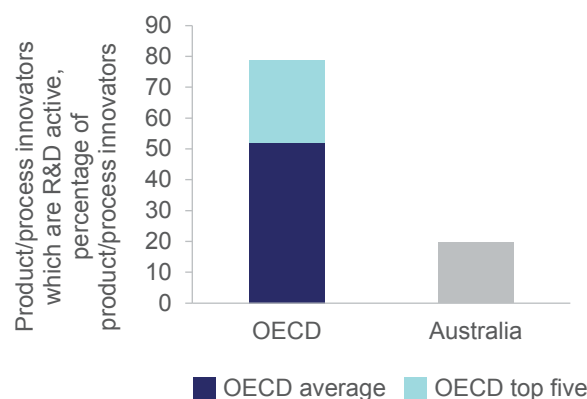


Notes: OECD comparisons exclude businesses with fewer than ten employees. Industry core coverage includes ISIC Rev. 4 Sections and Divisions B, C, D, E, G46, H, J, K, M71–72 and 73. Australian data is for 2012–13. The OECD top five countries are Switzerland, Australia, Germany, Italy and Greece.

Source: OECD (2015) *Innovation statistics and indicators*, www.oecd.org/innovation/inno/inno-stats.htm

R&D-active Australian businesses are three times more likely to introduce new-to-market goods and service innovations (24 per cent) than non-R&D-active businesses (seven per cent). Australia has a relatively low proportion of businesses introducing product or process innovations that are R&D active (Figure 3.10). Australia ranks last on this measure relative to 28 OECD countries.

Figure 3.10: Product/process innovators that are R&D active, 2010–12

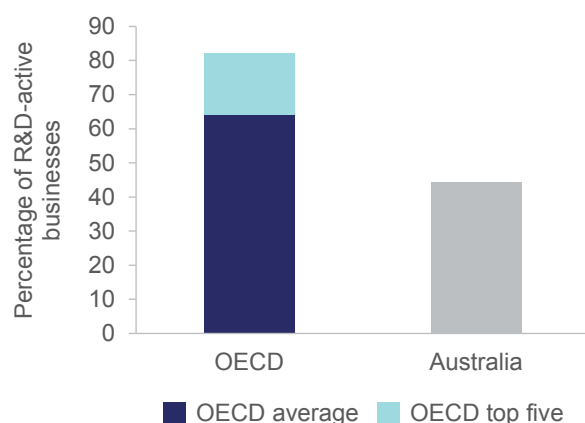


Notes: OECD comparisons exclude businesses with fewer than ten employees. Industry core coverage includes ISIC Rev. 4 Sections and Divisions B, C, D, E, G46, H, J, K, M71–72 and 73. Australian data is from 2012–13. The OECD top five countries are Sweden, Korea, Finland, Netherlands and Norway.

Source: OECD (2015) *Innovation statistics and indicators*, www.oecd.org/innovation/inno/inno-stats.htm

A greater share of R&D-active businesses operate in international markets compared to businesses that don't do R&D (Figure 3.11 and Figure 3.12). This is consistent with the relationship between new-to-market innovation and R&D.

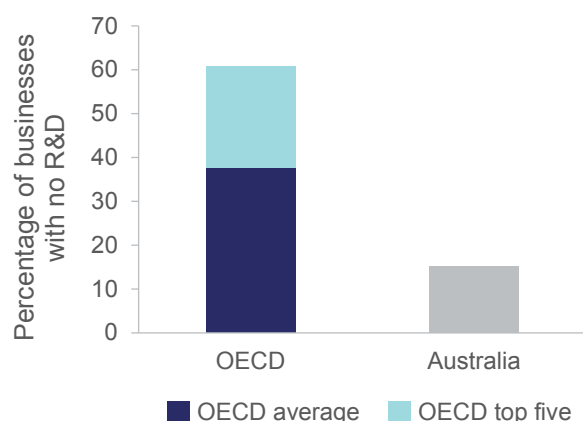
Figure 3.11: R&D-active businesses operating in international markets, 2010–12



Notes: OECD comparisons exclude businesses with fewer than ten employees. Industry core coverage includes ISIC Rev. 4 Sections and Divisions B, C, D, E, G46, H, J, K, M71–72 and 73. Australian data is for 2012–13. The OECD top five are Austria, Latvia, Slovenia, Hungary and Slovakia.

Source: OECD (2015) *Innovation statistics and indicators*, www.oecd.org/innovation/inno/inno-stats.htm

Figure 3.12: Businesses with no R&D operating in international markets, 2010–12



Notes: OECD comparisons exclude businesses with fewer than ten employees. Industry core coverage includes ISIC Rev. 4 Sections and Divisions B, C, D, E, G46, H, J, K, M71–72 and 73. Australian data is for 2012–13. The OECD top five are Latvia, Slovakia, Slovenia, Hungary and the Netherlands.

Source: OECD (2015) *Innovation statistics and indicators*, www.oecd.org/innovation/inno/inno-stats.htm

Trends in R&D activity

Australia's GERD to GDP ratio was 2.11 per cent in 2013–14 (Table A7), which is slightly above the OECD+ average of 2.01 per cent. Australia was ranked 14th out of 36 OECD+ countries in 2013–14, and also behind one non-OECD country (Taiwan) for which data was available. GERD as a percentage of GDP (see Definition 3.3) has been in decline in Australia since 2008–09, after a period of strong growth (Figure 3.13). This decline has been driven by a significant decrease in business R&D as a percentage of GDP over this period (Figure 3.13).

Australia's BERD/GDP ratio increased steadily between 1995 and 2008, from 0.82 to 1.37. The BERD/GDP ratio then declined to 1.19 by 2013 (Table A2). This is considerably lower than the average BERD/GDP ratio of 2.78 for the top five OECD+ countries. In 2013, Australia was ranked 15th out of 35 OECD+ countries by BERD/GDP ratio.

Manufacturing continues to be the largest contributor to R&D in terms of net investment, although the relative proportion has decreased from 36 per cent in 2005–06 to 26 per cent in 2013–14. Despite manufacturing's declining share of economic activity, manufacturing's R&D intensity has increased from 3.5 per cent in 2005–2006 to 4.8 per cent in 2013–14. Since 2011–12, mining investment in R&D has declined from \$4.1 billion to \$2.83 billion in 2013–14. This has been partially offset by a boom in the financial and insurance services sector R&D, where investment tripled between 2005–06 and 2013–14.

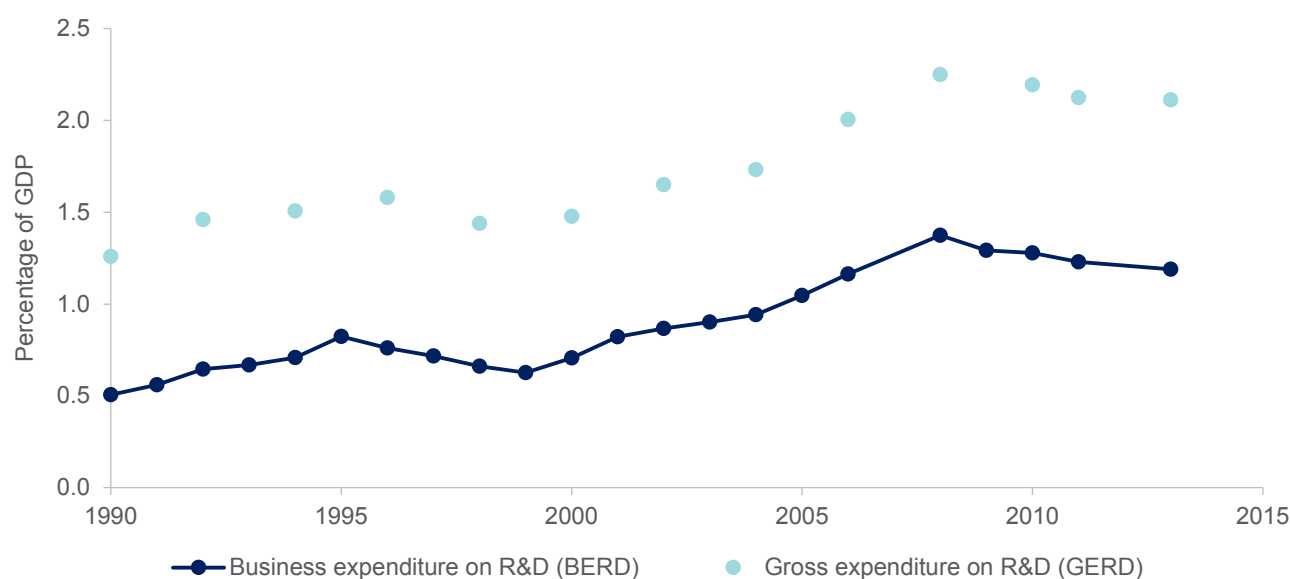
Figure 3.14 shows the major flows of R&D throughout the innovation system. The private sector is the biggest investor in R&D in Australia, and performs mostly applied research and experimental development. A small proportion of the \$19 billion spent on R&D by businesses in 2013–14 went to other sectors for collaborative R&D. For example, the industry sector spent \$430 million on higher education sector R&D, approximately 2.3 per cent of its total investment in R&D.

Investment in R&D

The Australian Government is the second largest source of funds for R&D expenditure. In 2014–15, the industry sector received around \$2.8 billion in tax concessions (Figure 3.14). While the industry sector receives support in the form of tax concessions, the higher education sector and the Australian government research agencies rely on direct government support in the form of grants. In 2014–15, the higher education sector and Australian government research agencies received \$3.4 billion and \$1.9 billion respectively. The higher education sector spent \$10.1 billion on R&D, over half of which came from general university funds.



Figure 3.13: Australia's GERD and BERD intensity, 1990–2013

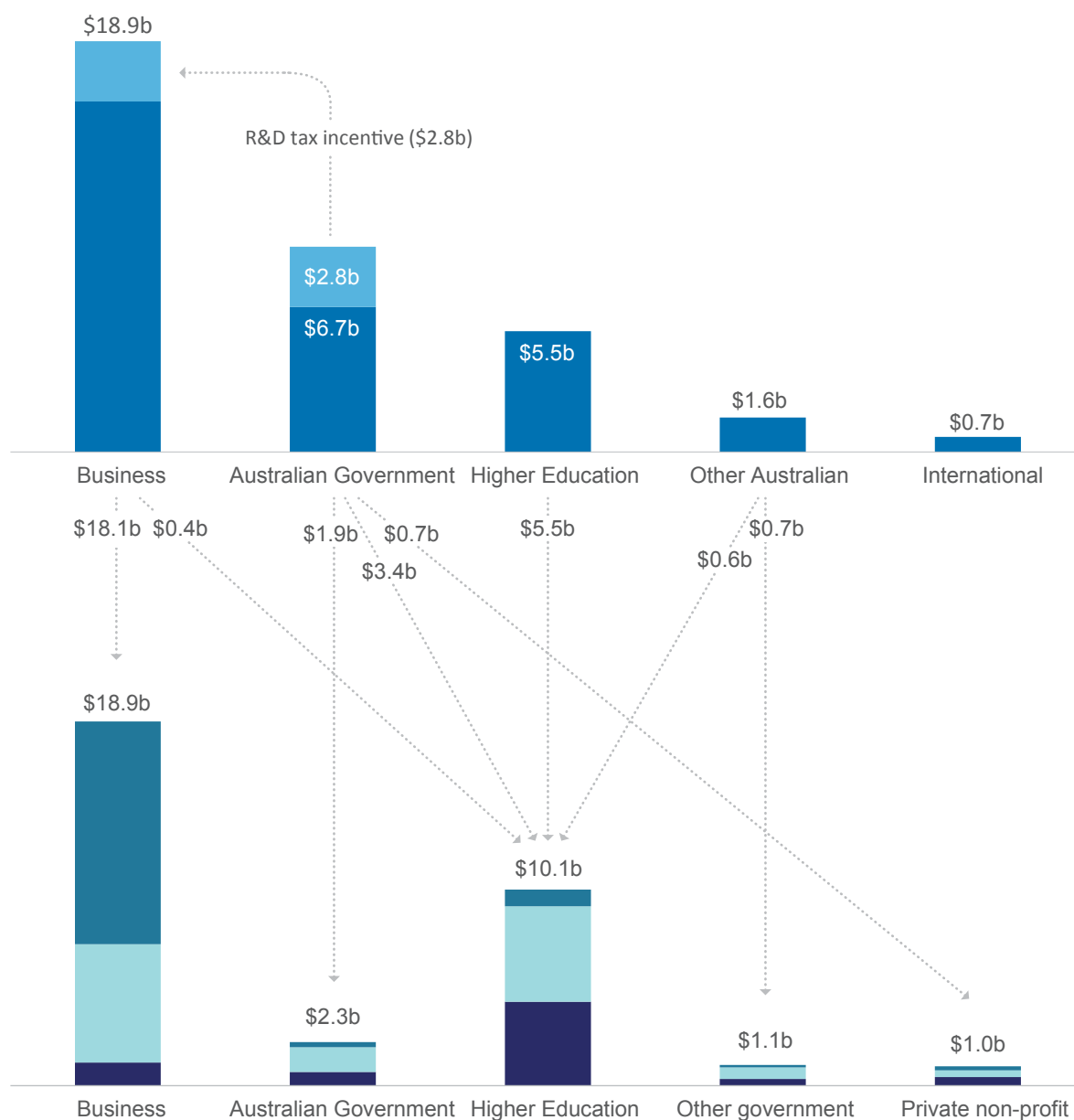


Notes: GERD/GDP is only available for the marked years; the line is a fitted trend.

Source: OECD (2016) Structural Analysis Database, <http://stats.oecd.org/>

Figure 3.14: Major flows of R&D investment, 2013–14, billions

R&D funding sources



R&D performers

■ Basic research ■ Applied research ■ Experimental development

Notes: Flows of less than \$400 million are not included in this figure for visual clarity.

Source: ABS (2015) *Research and Experimental Development, Business, 2013–14*, cat no. 8104.0; ABS (2016) *Government and Private Non-Profit Organisations, 2014–15*, cat no. 8109; ABS (2016) *Higher Education Organisations, 2014*, cat no. 8111.0; Department of Industry, Innovation and Science (2016) *Science, Research and Innovation Budget tables 2016–17*

3.6 Trends in business expenditure on experimental development

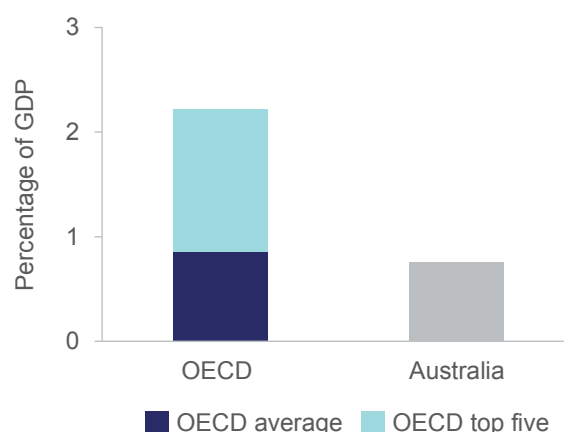
As experimental development is dedicated towards producing new materials, products or processes, it is most closely linked with creating innovation within businesses and across the economy.

Business expenditure on experimental development increased from 0.57 to 0.75 per cent of GDP between 1996 and 2013. Compared to other OECD countries, Australia was ranked 10th in terms of business expenditure on experimental development as a percentage of GDP in 2013.

The Australian industry sector spent \$11.5 billion on experimental development in 2013. Following the Global Financial Crisis of 2008–09, the ratio of business experimental development expenditure to GDP declined marginally. In comparison, the top five OECD countries experienced a significant increase in experimental development expenditure for businesses, increasing from 1.2 to 2.2 per cent of GDP over the same period.

On average, businesses in OECD countries spent 0.85 per cent of GDP on experimental development, compared to 0.76 per cent for Australia (Figure 3.15 and Figure 3.16).

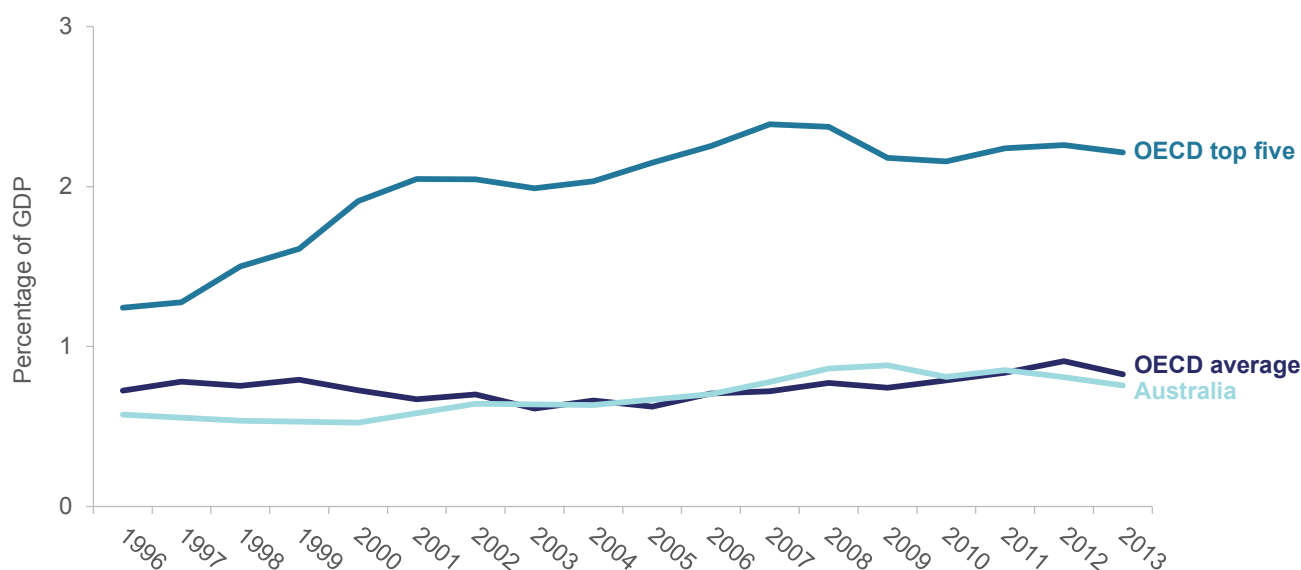
Figure 3.15: Business experimental development as a percentage of GDP, 2013.



Notes: The OECD top five countries are Israel, Korea, Japan, Sweden and Finland.

Source: United Nations Educational, Scientific and Cultural Organization and World Development Indicators from the World Bank.

Figure 3.16: Business expenditure on experimental development as a percentage of GDP, 1996–2013.



Notes: Prior to 2006, data for Australia is only available every two years. Data not available for all OECD countries.

Source: United Nations Educational, Scientific and Cultural Organization and World Development Indicators from the World Bank.

3.7 Innovation activity is clustered in cities

Framework conditions are often national, reflecting the specific path of technological, economic and social development of a country. At a regional level, the innovation system is often described as an ecosystem so as to highlight the interdependency of its components and the evolutionary processes that drive regional development. This ecosystem view is increasingly used to frame policy problems in terms of the health of a regional innovation system, and to identify the gaps by referencing best practices in other regions. We recently introduced the *National Innovation Map* to reveal the geography of innovation in Australia and improve our understanding of the innovation ecosystem.

This map is an online visualisation tool that highlights differences in innovation and entrepreneurial performance between regions at the SA3 level (Definition 3.4).

Research on the geography of innovation activity has highlighted clusters as an important factor contributing to national competitiveness. Close proximity to areas of dense economic activity can induce stronger competition between businesses. This in turn encourages innovation and resource efficiency. Businesses cluster to share resources, including knowledge. Close proximity also reduces transport and communication costs and increases the scope for differentiation and market experimentation in the pursuit of innovation-driven comparative advantage.

Definition 3.4: What is SA3?

Statistical Area level 3 (SA3) is a standardised regional breakup of Australia. There are 333 SA3 spatial units. In aggregate, they cover the whole of Australia without gaps or overlaps. In general, the SA3s are designed to have populations between 30,000 and 130,000 persons, however these boundaries can be varied to contain more significant and meaningful regional areas. As a result, there are a number of SA3s with populations above 130,000 or below 30,000. SA3s do not cross state and territory borders.

Since the *National Innovation Map* was published, the ABS has released an updated Statistical Geography Standard for SA3.

Source: ABS (2010) Australian Statistical Geography Standard. Cat. No. 1270.0

The map uses administrative data to plot patents, trademarks, business entries/exits and business expenditure on R&D (BERD) to provide a picture of the level and location of innovative entrepreneurship in Australia. All indicators of innovation activity have some degree of skewness towards major cities, in part attributable to the location of companies' head offices or the location of offices where the IP or R&D is being registered.

Section 3.5 shows that in most countries, almost 100 per cent of R&D active businesses are also innovative businesses. Together with patent and trademark data, the map gives a strong signal of business innovation by region.

High levels of BERD have occurred in regional areas despite their lower population density (Figure 3.17). This may be partly explained by the mining sector, which during the 2008–12 period had a high share of BERD. However, the latest data for 2013–14 shows that mining R&D is decreasing, with some evidence that regional R&D is also declining.

Patents and trademarks demonstrate the likely arrival of new technologies and products in the marketplace, and are intermediate output measures of innovation activity.

Figure 3.18 shows the distribution of patent applications per 10,000 inhabitants, and confirms the expected hypothesis that patents are concentrated in more populous regions or cities.

The online map also shows entrepreneurship churn (the sum of business entries and exits), which has been positively associated with innovation activity as innovative businesses enter markets and compete with incumbents, forcing out less productive businesses.

Our research using the maps has found that:

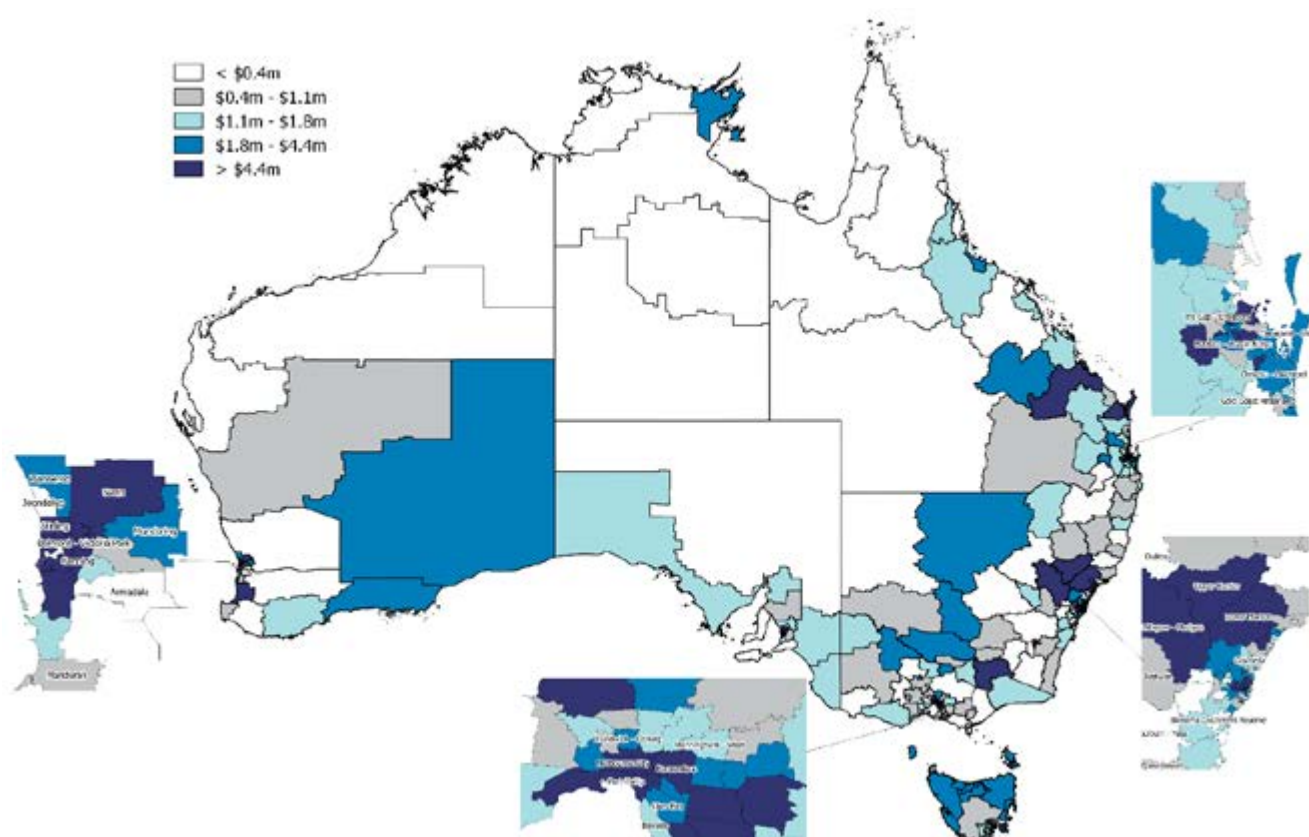
- The presence of industry-facing research organisations like CSIRO or Cooperative Research Centres have a positive influence on regional innovation.
- There are no regions in Australia where high IP generation does not occur in tandem with high entrepreneurship.
- For every one per cent increase in R&D expenditure, a 0.35 per cent increase was observed in patent applicant counts and a 0.40 per cent increase in trademark applicant counts.

Refining the map

Since the initial release of the map, we have continued to work towards improving the measures in it. For example, we have increased our use of geocoding within the dataset, as previously all of the datasets had been matched using postcodes. IP Australia has since released some geocoding information for their patents and trademarks data, which has enabled us to increase the use of geocoding and thus provide greater precision in locating data within their correct SA3.

The National Innovation Map will continue to be updated and improved. You can explore the map [here](#).⁴⁵

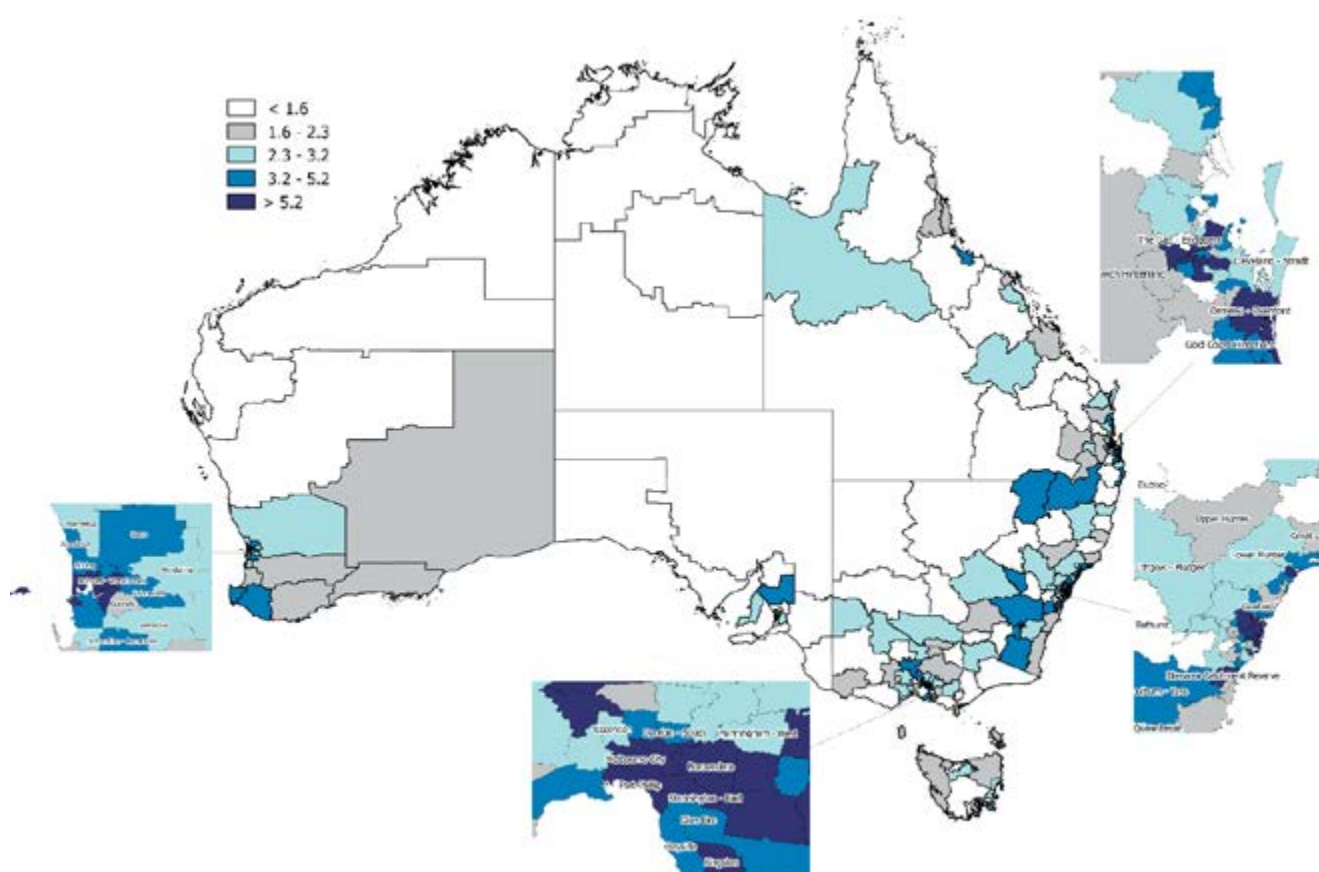
Figure 3.17: Mean annual expenditure in R&D per 10,000 inhabitants by SA3 region, 2008–2014



Notes: Map shows five quintiles with 66–67 SA3 regions each.

Source: Australian Government R&D Tax Incentive (formerly R&D Tax Concession) programme, viewed 22nd June 2015 and Department of Industry, Innovation and Science (2016), *National Innovation Map*, <http://industry.gov.au/Office-of-the-Chief-Economist/Publications/Pages/Nat-Innovation-Map.aspx>

Figure 3.18: Mean patent application counts per 10,000 inhabitants by SA3 region, 2008–2015



Notes: Map shows five quintiles with 65–66 SA3 regions each.

Source: Intellectual Property Government Open Data 2016 (IP Australia) and Department of Industry, Innovation and Science (2016) *National Innovation Map*, <http://industry.gov.au/Office-of-the-Chief-Economist/Publications/Pages/Nat-Innovation-Map.aspx>

Enablis: A case study of an innovative, high-growth firm

John Evans, Enablis CEO



Based in the Sydney CBD, and with a new office opening in Melbourne, Enablis provides data and voice connectivity for highly distributed organisations. Their customers typically have between 10 and 200 or more sites (for example travel agencies and large aged-care providers). As information and communication technologies become central to operations and management, businesses with multiple sites need reliable, secure and efficient data and voice communications. This leads to a strong demand for support ranging from the design to the installation of communications technologies. The constant change in technologies, including VoIP (Voice over Internet Protocol) telephony and the growth in cloud-based services, coupled with the increasing importance of security, is leading more businesses to outsource these services. Enablis offers its target market fully managed communication services across data, voice and security. The CEO and Enablis founder, Jon Evans, comments that 'there is at least a perception among organisations in our target market that the major telecommunications service providers are unable to provide the level of customer support that is needed'. With this market focus, Enablis has achieved strong and consistent growth over the past seven years (Figure 3.19), delivering revenue growth averaging over 35 per cent year-on-year, reaching \$13 million by 2015.

Jon first arrived in Australia as a backpacker, and then returned to the UK to establish the Australian operations for a small IT communications business, Sirocom. While still young, Sirocom was bought out by another UK business, Azzurri. One of Azzurri's major clients was STA Travel, who had many sites in the Australasian region. Azzurri needed a local capability to service this client, and formed an Australian subsidiary. In 2009 Jon bought out the shareholding of this Australian operation and in early 2015 rebranded the business as Enablis.



Jon developed an extensive knowledge of the market by working in sales roles in several IT communications businesses in the UK, and later as a partner-manager for Verizon in Australia.

'Enablis is a "sales-fronted" business with a clear strategy aiming at 30 per cent annual growth', says Jon. 'I have been determined to keep a focus on the value proposition for customers and a build a culture that supports and motivates staff.' With a knowledge of the potential of available technologies, and an understanding of customer needs, Enablis aims to help customers be more efficient in their use of communications. The capability to provide advice that can enable a customer to see opportunities to transform their business model is becoming increasingly important.

Enablis inherited its strategic focus, business model, and to some extent core staff from its one-time owner, Azzurri. Finding this to be a valuable resource they built on this skillset and over time increased focus on their key market. As a keen yacht racer, Jon's analogy of the current situation is 'we have a full spinnaker up, the sky is blue, and there are no clouds on the horizon... the boat is cranking so let's enjoy the ride'. In the business' early days there was a tendency to pursue growth by 'shooting at everything that moved', but the focus on the central value proposition has increased over time, along with the company's reputation in its target market.

Capable and motivated staff are vital for a small, fast-growing business, and while high growth attracts staff, Enablis finds that the local labour market is limited. Jon comments: 'we recruit most of our technology specialists through word of

mouth. Among our 35 employees today we have 19 nationalities. We find that many of these more recent arrivals in Australia have a can-do attitude and are keen to learn and develop'. Fast growth provides increasing opportunities for talented staff, which has contributed to high retention levels. Enablis invests in developing staff and deepening its skillset to support its strategic market focus.

Although Enablis has grown to 35 employees, it retains a flat structure and a strong internal culture. For Jon this is vital for success. 'We have an open culture that avoids internal politics'. Growth brings new challenges for recruitment and the management of incentives, while complexity increases and there is less direct contact between staff and the senior management team. Enablis recently begun drawing on advice from a specialist human resource management consultancy.

Innovation at Enablis has been incremental, and largely involves integrating newly available hardware and software to provide better solutions for clients. 'We must keep an eye on the horizon and see what is out there, but must keep focused on the commercial application and the customer need for that application — that is a key for innovation for us', says Jon. In-house engineering competence and relationships with technology developers provide the capability for the assessment and effective application of new technologies. Enablis' technology-related links are largely with overseas networks and technology providers; there are no significant innovation-related links to local organisations.

As flexibility and agility are important, Jon considers Enablis is small enough to maintain fast decision making, even for major strategic decisions. 'We have robust processes so that doubling in size would not be a problem'.

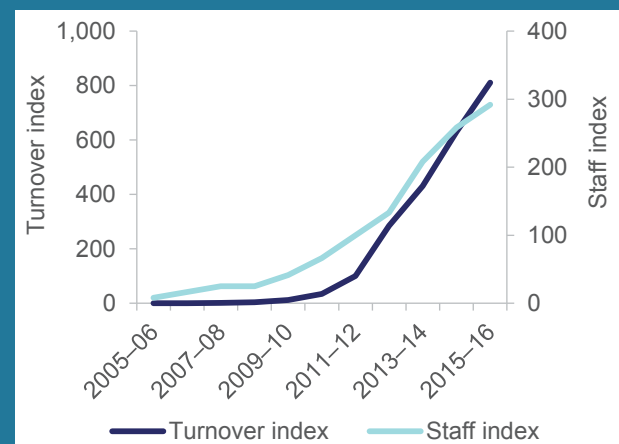
Jon and his senior management team think that the next phase of growth will likely require a step-change in the company. 'We are now clarifying the direction for growth, developing a five-year business plan, reviewing the organisational structure, more clearly defining roles and expectations, and formalising some management processes'.

Any growing market segment is likely to attract new entrants, and technological change can lower the barriers to entry. Jon considers that Enablis' relationship with customers and its reputation in the target market limit the risk of turbulence. The company continues to invest in strengthening capability in newer technology areas, such as the

cloud, through recruitment and possibly in the future through a partnership or acquisition. Continued growth is likely to involve developing new clients — they aim for ten new clients each year — including in other geographical markets such as other Australian cities or New Zealand. Jon commented: 'We have looked at the government market, and while we are confident we have an attractive value proposition for that market, the complex procurement processes have been a disincentive'.

Reflecting on his experience, Jon emphasises 'self-development and continuous learning'. He acknowledges the value of the mentoring he has had from the owner of Sirocom, Simon Rogan, in creating Enablis through a management buyout, and then leading a period of rapid growth. Simon has been an adviser over the life of the business, sits on the Board of Enablis, and usually spends a week in the company every six to 12 months. Jon also found that participating in The Executive Connection (TEC) has been a very valuable source of mentoring, peer-peer learning and support. 'I wouldn't be where I am without the support I have found through TEC'.

Figure 3.19: Enablis' growth, indexed, 2005–06 to 2015–16



Notes: Turnover and staff are indexed from 2005–06. The value in 2011–12 is 100.

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