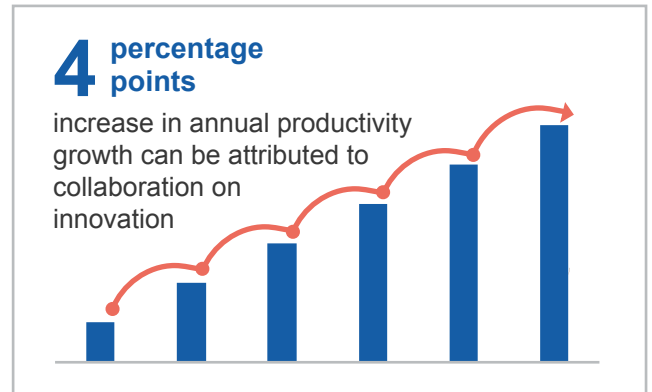
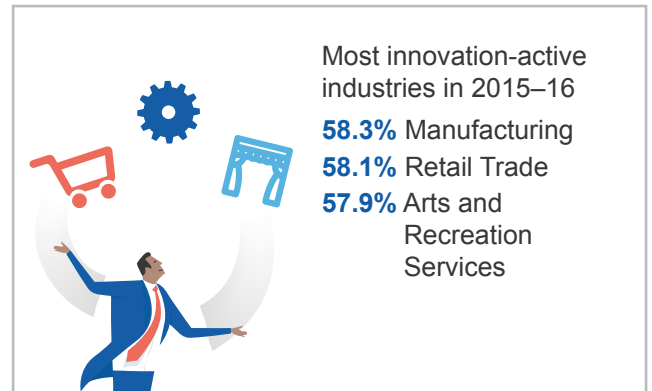
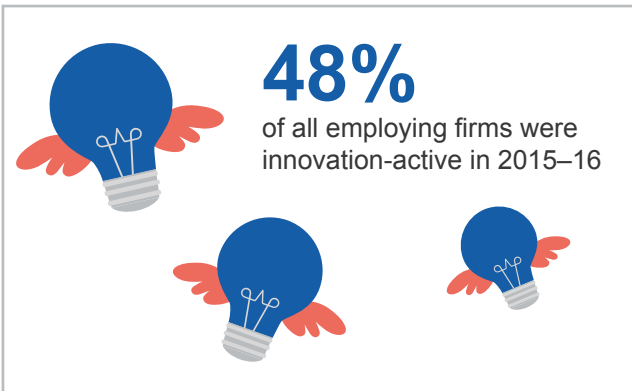




# Chapter 1

This chapter provides a snapshot of Australia's business innovation performance, its distribution by industry, and the main ways in which firms innovate. It focusses on indicators of business collaboration performance and associated measurement issues. Other important indicators explored in this chapter relate to business dynamism and entrepreneurship.

# Australia's innovation system



Sources (left to right): 1) ABS (2017) Summary of IT Use and Innovation in Australian Businesses, cat. no. 8166.0; 2) ABS (2017) Summary of IT Use and Innovation in Australian Businesses, 2015–16 and 2007–08, cat. no. 8166.0; 3) ABS (2016) Data analysis based on the BCS commissioned by Department of Industry Innovation and Science; 4) Palangkaraya A, Spurling T and Webster E (2015) Does innovation make (SME) firms more productive?, Paper presented to Reserve Bank of Australia Annual Conference 2015, Sydney; 5) InCites (2016) Clarivate Analytics database; 6) ABS (2017) Counts of Australian Businesses, including Entries and Exits, Jun 2012 to Jun 2016, cat. no. 8165.0

## KEY POINTS

- Australia has a relatively high proportion of innovation-active firms by international standards. In 2015–16, an estimated 48.7 per cent of all employing firms were innovation-active. These firms are distributed broadly across industries, with the highest proportion found in Manufacturing.
- Australian innovation-active firms overwhelmingly specialise in modifying innovations introduced by other Australian firms but are not particularly strong at introducing new-to-market innovations. In 2015, Australia ranked 23rd of 31 OECD countries for the proportion of firms engaging in new-to-market product innovation.
- Business collaboration on innovation is generally low in Australia. Across a range of collaboration metrics, Australia typically sits in the bottom half of the OECD.
- Australia's level of entrepreneurial activity is amongst the highest in developed economies. Around 14.6 per cent of the Australian adult population (18–64 years) were actively engaged in starting new businesses in 2016, representing 2.2 million early-stage entrepreneurs.

## Why is innovation important?

Innovation delivers substantial benefits to society's well-being and is key to solving some of its most pressing challenges. The benefits of innovation often go well beyond economic benefits, impacting on the quality of day-to-day lives. The living standards of Australians have risen due to innovations including those in healthcare, communication, education, services, infrastructure and environmental sustainability.

The focus of this report is primarily on the economic benefits. Innovation is the most important driver of long-term productivity growth and material living standards. What matters most from an economic perspective is the commercial application and diffusion of ideas; this underwrites long-term competitiveness and growth. According to the OECD, innovation in its various forms accounts for a substantial share of economic growth across its member countries — often around half of total GDP growth over the long-term.<sup>1</sup>

In Australia, the economic benefits of innovation can be observed in part by the disproportionate contribution of innovation-active firms to income and employment growth. The *Australian Innovation System Report* series has shown that innovation-

active firms consistently outperform firms that don't innovate on a range of measures, including productivity and profitability.<sup>2</sup>

## 1.1 Innovation and the national innovation system

Innovation is about the implementation of novel ideas. An idea only becomes innovation when it is put into practice. Innovation refers not only to the introduction of new products, but also new processes, which can increase the productivity of labour or capital, and organisational innovations, which can improve the efficiency or effectiveness of production (Definition 1.1).

Novel ideas can come from anywhere and they can be applied to any field of human endeavour. The business enterprise sector plays a particularly important role, both as a major source of ideas and, above all, in their commercialisation. In pursuing innovation as a business strategy, firms bring together a range of complementary resources and capabilities, some of which may be internal (such as management capability or firm-specific assets) and others external (such as technical expertise or finance).

Governments also play an important role. By investing in education, training, and public research, and also by influencing the innovation activity occurring in other sectors, governments can help create the right conditions for firms to experiment and invest in the development and commercialisation of novel ideas. Some of the ways in which governments can influence innovation in business include establishing robust intellectual property (IP) frameworks, regulatory and tax settings, and financial systems.

### Definition 1.1: Oslo Manual definition of innovation

Innovation is the implementation of a new or significantly improved product (good or service), or process, new marketing method, or a new organisational method in business practices, workplace organisation or external relations.<sup>3</sup>

## Defining the innovation system

There are several alternative analytical approaches to assessing the innovation performance of an economy, each with strengths and weaknesses.<sup>4, 5</sup> The *Australian Innovation System Report* series adopts the innovation system approach (Definition 1.2). Innovation activities, networks and framework conditions work effectively as a system to generate and diffuse innovations that have economic, social and/or environmental value. Ideas adopted from evolutionary economics, economic history and institutional economics have influenced the innovation system worldview.<sup>6, 7, 8</sup>

### Definition 1.2: The innovation system

An innovation system is an open network of organisations that interact with each other and operate within framework conditions that regulate their activities and interactions. There are three components of the innovation system:

- Innovation activities — the discrete activities that lead to discoveries with commercial potential including R&D, entrepreneurial activity, innovation funding (e.g. venture capital), or the generation of skills for innovation.
- Networks — the formal and informal linkages between people and organisations in the innovation system, including communities of practice (such as medical professionals and software developers), joint research arrangements, industry-research collaboration and public procurement of private sector research outputs.
- Framework conditions — the institutional environment and general conditions for innovation activities, networks and collaboration.

These components collectively function to produce and diffuse innovations that have economic, social and/or environmental value.

## Why use the innovation system approach

The innovation system approach:

- is pragmatic and does not rely on any particular theoretical framework
- has a practical focus which appeals to policymakers
- treats innovation as a highly complex economic and social phenomenon, which eludes simple one-size-fits-all measures.

The innovation system approach also recognises that innovation occurs in a particular historical and institutional context. Innovation activity relies on a range of complementary investments in different parts of the system and requires the participation of different actors, including from business, universities, and government.<sup>9</sup> Indeed, across advanced economies, publicly-funded research and government leadership have played a crucial role in the development of transformational technologies and the creation of entirely new markets including in pharmaceuticals, civil aviation, nuclear energy, the internet, nanotechnology, biotechnology and clean energy.<sup>10</sup>

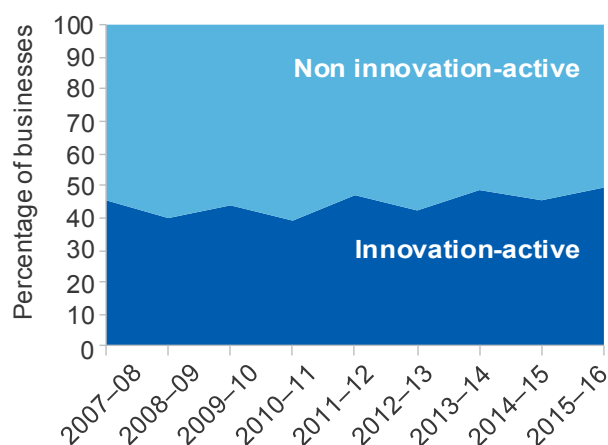
An innovation system approach emphasises the interactions between different parts of the system.<sup>11</sup> The focus on interactions and networks acknowledges people and organisations do not innovate in isolation. Networks are important for coordinating the knowledge and resources required for innovation. Networks facilitate the diffusion of this knowledge to be used throughout the economy.<sup>12</sup> They improve the efficiency with which knowledge is used, because a great deal of knowledge is embedded socially, within people, groups and organisations. Attempting to codify all this widely dispersed tacit knowledge would be neither feasible nor practical.

## 1.2 Australia's innovation activity

### Innovation activity in business

One of the broadest measures of innovation performance in an economy is the proportion of firms that identify as being innovation-active.<sup>(c)</sup> By international standards, Australia has a relatively high proportion of innovation-active firms. In 2015–16, an estimated 48.7 per cent of all Australian employing firms identified as innovation-active, increasing from 44.9 per cent in 2007–08 (Figure 1.1).<sup>(d)</sup> This means nearly half of Australian businesses have attempted to develop or introduce an innovation in the last 12 months.

Figure 1.1: Innovation activity in Australian businesses, 2007–08 to 2015–16



Source: ABS (2017) *Summary of IT Use and Innovation in Australian Businesses*, cat. no. 8166.0

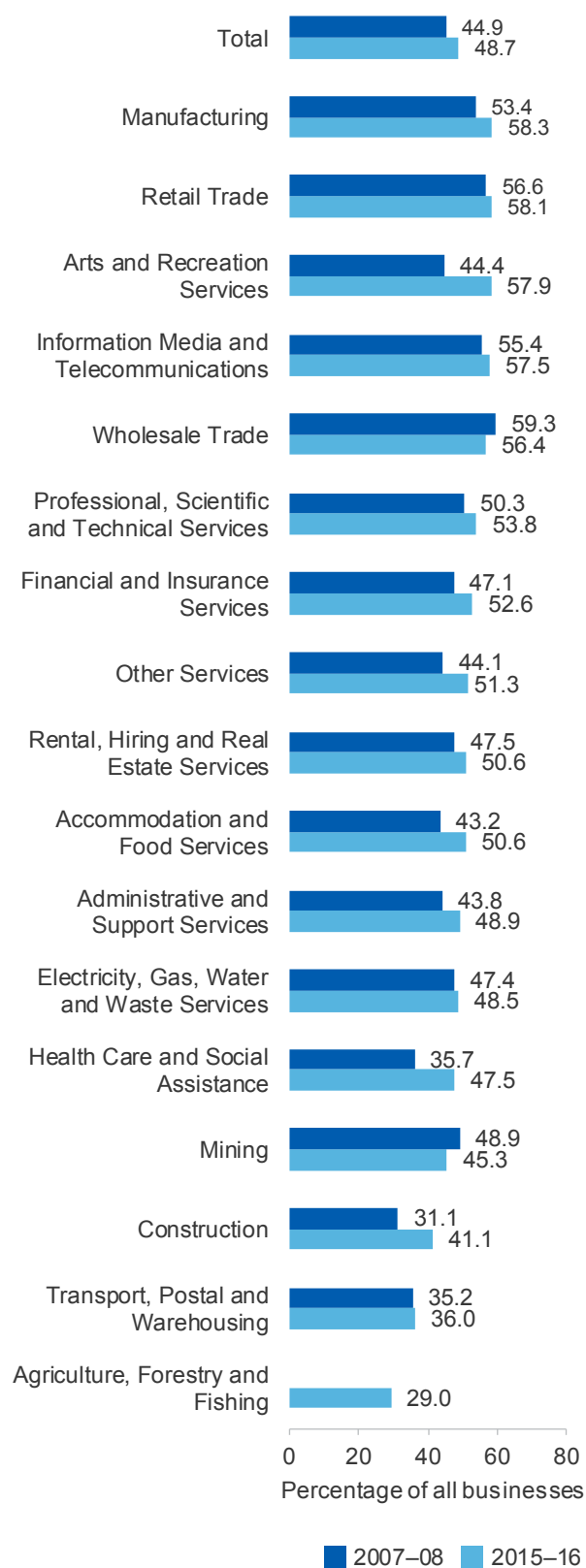
- (c) Innovation-active firms are those that have either introduced a new innovation, are currently developing a new innovation, or have abandoned an innovation within the last 12 months.
- (d) The financial year 2007–08 was chosen for comparison because it was the first year of fully comparable data after the change in ANZSIC classification in 2006.

## Innovation activity by industry

Innovation activity in Australia is distributed broadly across industries, led by Manufacturing. In 2015–16, Manufacturing reported the highest proportion of innovation-active firms in Australia. Since 2007–08, only two industry reported a decrease in the proportion of innovation-active businesses; Mining and Wholesale Trade. The industries with the highest increases in innovation-active firms from 2007–08 to 2015–16 were Arts and Recreation, Health Care and Construction (Figure 1.2).

Innovation activity occurs in businesses of all sizes, although it is generally more common in larger firms. More than three-quarters (77 per cent) of large businesses (200 or more employees) were innovation-active in 2015–16. This is almost double the rate of micro-firms (0–4 employees). Large firms reported the largest increase in innovation-active businesses from 70.8 per cent in 2007–08 to 77 per cent in 2015–16 (Figure 1.3).

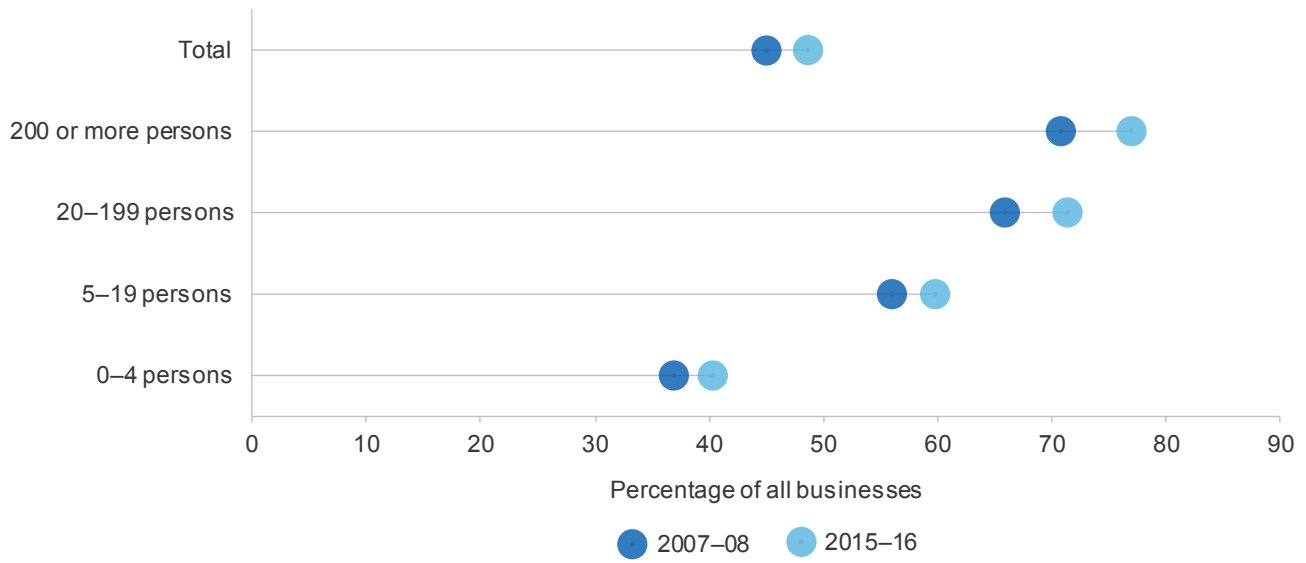
Figure 1.2: Innovation-active businesses, by industry, 2007–08 and 2015–16



Notes: Data for Agriculture, Forestry and Fishing not collected for 2007–08

Source: ABS (2017). *Summary of IT Use and Innovation in Australian Businesses, 2015–16 and 2007–08*, cat. no. 8166.0

Figure 1.3: Innovation-active businesses, by business size, 2007–08 and 2015–16



Source: ABS (2017) *Summary of IT Use and Innovation in Australian Businesses, 2015–16 and 2007–08*, cat. no. 8166.0



## Case Study: Empired

*UTS Business School*



The trend to outsource services has significantly shaped the Australian IT landscape.

“Private and public sector organisations in Australia are increasingly looking to external service providers to provide them with a range of IT services to help meet their business demands,” says Russell Baskerville, current CEO of Empired.

Empired is an IT services company specialising in planning, design, implementation and ongoing management of IT systems for medium and large organisations. Established in Perth in 1999, it has grown from a local talent-management software business into an IT services company with global reach. Such achievement, however, required some significant changes to the company’s business model.

Empired focussed on two areas:

- ‘digital transformation’ is its core business, accounting for about 70 per cent of sales. Empired develops bespoke digital platforms for customers, ranging from infrastructure and applications support, such as data centres, through to services including data analytics, mobile applications, networking and data centre management
- ‘life cycle services’, which covers ongoing support for customer information and communications technology (ICT) systems.

As its priorities and challenges evolved, Empired recognised the need to change its management and human resources strategy to achieve sustainable growth. In hindsight, Russell says he would have acted earlier. These changes occurred in three major phases:

- formation
- introducing professional management
- refreshing senior management.

### Formation

During the formation years, technical specialists and consultants established the firm, building expertise and market credibility. The founders focussed on the technological dimensions of the business. In 2002, Empired undertook its first acquisition (Tusk Technologies) and branched into IT services. Russell Baskerville, current CEO, bought out the founders of Empired in 2005. He had previously founded and led two other IT companies.

### Introducing professional management

In 2006, following a strategic review, IT services became the primary focus. By then, the business had grown to \$4.5 million in turnover, and Empired recognised the need for professional management. Executive talent was recruited and roles within the senior team were redefined. The firm listed on the ASX in 2007.

The rapid growth between 2006 and 2007 was closely linked with the emergent resources sector in Western Australia. This period also saw Empired realise that it lacked clear processes.



“The early informal approaches did not work for addressing significant change as we grew larger,” says Russell.

From 2009 onwards, personnel with IT capabilities and experience in designing and implementing management systems were recruited. By 2011, turnover had reached \$39 million.

### Refreshing senior management

Between 2012 and 2015 Empired grew rapidly, with a turnover of \$170 million and about 1,000 staff. After leading growth for years, some members of the executive team sought change. A new Chief Financial Officer, Chief Operating Officer and Global Sales Manager were recruited, all from Australia or New Zealand, to maintain the firm’s local character.

Today, Empired is one of the largest Microsoft-dedicated partners in the Asia-Pacific region and counts global corporations such as Toyota Motor Corporation and Rio Tinto among its customers. It maintains a subsidiary in New Zealand (Intergen) and has recently opened offices in Singapore and the United States.

### High-performance culture

Empired seeks to attract the best talent and to develop a high-performance culture.

“My approach is to surround myself with talent, hire the best, and pay what is needed to achieve that,” Russell says.

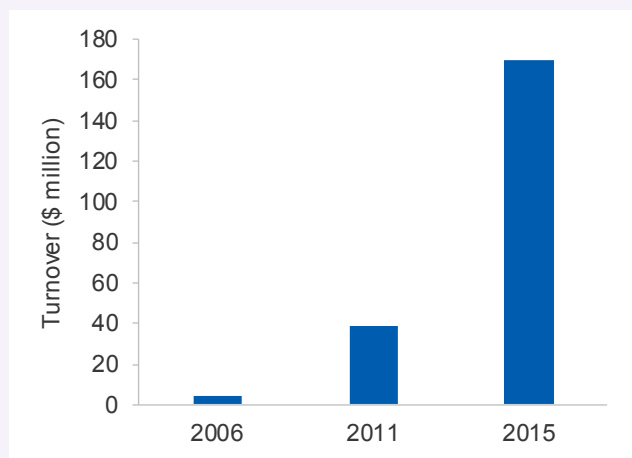
Staff are recruited locally and are often attracted from foreign-owned multinationals in Australia. Empired emphasises the importance of a values-based culture committed to developing talent and expertise among staff and delivering customer solutions. An innovation office identifies opportunities that can be transformed into new products and services. To leverage their strong commercial relationship with Microsoft, Empired also maintains an innovation lab in Seattle, close to where the software giant is based. Staff are given opportunities to rotate between innovative and routine projects to encourage job satisfaction.

Key drivers behind Empired’s growth have been:

- the mining boom
- increasing demand from business and government
- acquisitions
- increasing their range of services.

Significant acquisitions include Conducive (2012), OBS (2013), eSavvy (2014) and Intergen (with 300 staff in New Zealand and operations in the US in 2015).

Figure 1.4: Empired turnover, 2006, 2011 and 2015



Source: Empired Annual Report 2015

### Meeting increased demand

The growth in cloud, mobile and social ICT applications and use, along with the increasing dependence on contracted managed services for system design, installation and support has driven increasing demand for Empired’s services. Changes in the way organisations source IT services have also benefited Empired.

“The structuring of IT outsourcing agreements has been moving away from the traditional large single-supplier contracts to a more selective outsourcing model, where a number of suppliers each deliver specific components based around their core competencies,” says Russell.

As outsourcing service agreements are generally multi-year contracts, the recurring revenues have provided a level of certainty that supports capital investment and recruitment decisions.

Reflecting on over 10 years of leading a fast-growing firm, Russell says he has learned some valuable lessons:

- Confront issues, particularly those that involve conflict, underperformance or changing management in acquisitions. “It is better not to sweat on decisions,” he says. “Consider, decide and act.”
- Assimilate acquisitions quickly. Russell says, “Rapid expansion not only places pressure on operational processes and systems, but changes the fundamental personality of an organisation, as a range of new leaders, management and staff from myriad backgrounds and cultures are brought together into one organisation. Resolve the uncertainty and capture the momentum by integrating acquisitions sooner rather than later.”
- Ensure that the firm is always customer-focussed. “There is always a risk of over-engineering when the majority of employees are technical people.”
- Don’t underestimate how much energy is needed to drive growth, and the impact this has on leadership teams. “It will be essential to bring in new and fresh talent,” he says, “but you also need to back them and give them space to develop their approach.”
- Build the platform of management systems that are needed to manage growth. “I would have done this earlier if I had realised how critical it was.”

## 1.3 How do Australian firms innovate?

### Types of innovation

Australian firms tend to specialise in modifying innovations introduced by other Australian firms. In 2014–15, the overwhelming majority of Australian innovators across all business sizes were domestic modifiers (Figure 1.5), and this has been the case since at least 2008–09.<sup>13</sup> This strategy requires firms to seek out existing innovations, absorb them, and make the required modifications before deploying them commercially. The ability of so many Australian firms to successfully execute this relatively simple strategy is arguably a strength of Australia's innovation system.<sup>14</sup>

However, the excessive focus on domestic modification may adversely affect Australia's international competitiveness, since domestic modification involves a lower degree of novelty than other strategies.<sup>15</sup> In particular, new to market innovation (Definition 1.3) is generally more valuable since it involves a higher degree of novelty, which in turn reflects a higher degree of competence, sophistication and knowledge. In Australia, the estimated proportion of firms undertaking new to market product innovation is relatively low, ranking Australia 23rd of 31 OECD countries in 2015.<sup>16</sup> The challenges of transitioning Australia's food and agribusiness industry from one of predominantly domestic modifying firms to Businesses of Tomorrow which introduce new to world innovations is discussed in the feature article in Section 2.3.

#### Definition 1.3: Output-based innovation models

**New to market international innovators:** These firms have introduced a product (good or service) and/or process innovation that is new to international markets.

**New to market domestic innovators:** These firms have introduced one or more product innovations that are new to domestic markets only.

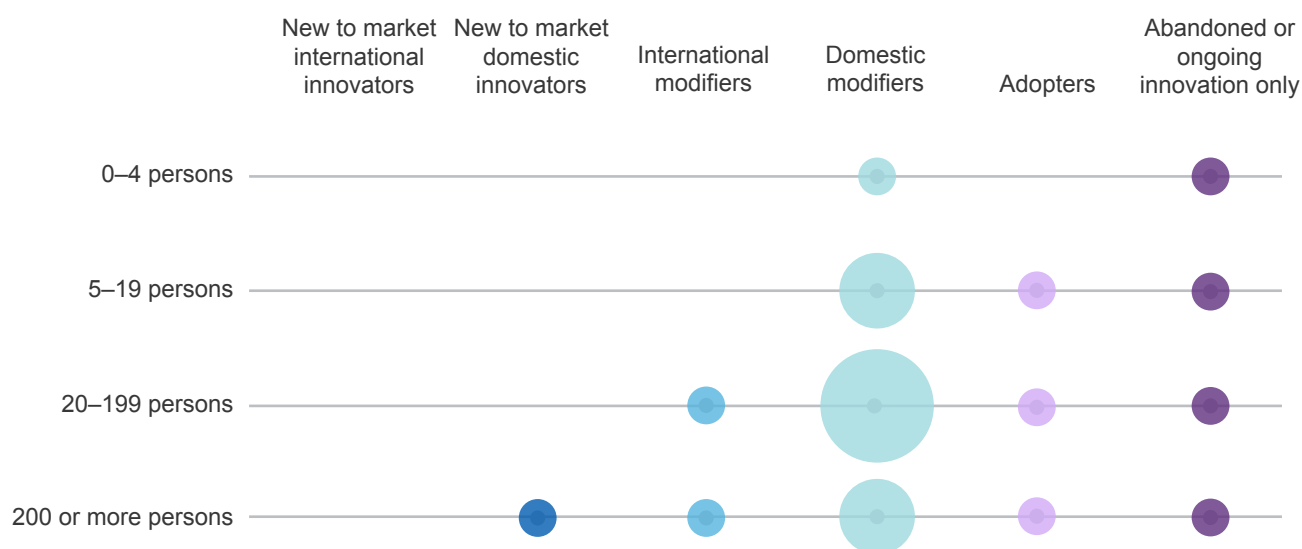
**International modifiers:** These firms have introduced a modification in-house of one or more products or processes already available on international markets.

**Domestic modifiers:** These firms have introduced a modification in-house of one or more products or processes that exist already on domestic markets.

**Adopters:** These firms have adopted one or more products or processes that already exist internationally and domestically. Unlike modifiers, adopters do not develop products in-house, but acquire innovations from others without making modifications to them.

**Abandoned or ongoing innovation:** These businesses have undertaken innovation projects or activities that have either been abandoned or have not yet been finalised.<sup>17</sup>

Figure 1.5: Different types of innovators in Australia, by business size, 2014–15



Notes: Size of the bubble indicates the percentage of businesses engaging in each type of innovation.

Source: ABS (2016) Data analysis based on the BCS commissioned by Department of Industry Innovation and Science

## 1.4 Collaboration and networks

Networks are essential to an innovation system. They provide a practical means for collaboration on innovation (Definition 1.4), which in turn contributes to business performance. A recent firm-level study of 7,000 Australian SMEs found an association between collaboration on innovation and productivity growth: collaboration on innovation increased annual productivity growth by 4.1 percentage points in the firms studied.<sup>18</sup> International studies also show the importance of collaborative R&D on firm performance.<sup>19</sup>

### Definition 1.4: Collaboration

- Collaboration describes arrangements where partners work together for mutual benefit, including sharing some technical and commercial risk. It is not necessary for each participant in a collaboration to benefit commercially.
- This definition of collaboration follows international guidelines developed by the OECD's *Oslo Manual* for the collection and use of data on innovation activities in industry. Pure contracting out of work (outsourcing) is explicitly excluded from the definition of collaboration.
- Collaboration refers not only to commercial relationships between firms in related industries in the business enterprise sector (business-business collaboration), but also the extent to which businesses engage with universities and public research organisations (business-research collaboration), and universities collaborating with other universities and public research organisations (research-research).
- Collaborative arrangements can involve both domestic and international organisations, and they can vary in their degree of formality.

Source: OECD (2006) *Oslo Manual*, 3rd Edition, OECD, Paris; and Authors' note.

## Business collaboration

Notwithstanding a number of measurement challenges (see Methodology box 1.1), indicators from a variety of sources suggest Australia ranks low on most OECD collaboration measures. Using the broadest scope of collaboration activity, which includes collaboration for purposes other than innovation, it is estimated that 86.3 per cent of Australia's innovation-active businesses undertook no collaboration at all in 2015–16 (Table 1.1).

In terms of business-business collaboration on product and process innovation, Australia ranks 25th out of 32 OECD countries, with less than one in four innovative firms collaborating (Table 1.1). The ranking is lower still (26th) in terms of collaboration between innovative firms and their suppliers. In terms of R&D-active firms as a proportion of innovation-active businesses, Australia ranks 27th of 27 OECD+ countries, with around one fifth of firms engaging in collaboration.<sup>(e)</sup> This suggests the majority of R&D activities are in-house, not involving partnership with other organisations.

In 2012–14 (latest internationally comparable data)<sup>(f)</sup>, Australia ranked last of 29 OECD countries for the proportion of SMEs collaborating with universities or other non-commercial research organisations. Large Australian firms performed better, ranking 27th out of 29 OECD countries. The estimated collaboration rates driving these rankings have fluctuated considerably from year to year around a very low base rate. Further evidence suggesting Australian firms are generally disconnected from the largely public university research sector is in the low proportion (3 per cent) of innovation-active businesses reporting higher education institutions as a source of innovative ideas.

Researchers employed in industry are an important channel for establishing collaborative research with their networks of peers. Comparative data from the OECD shows that only 4.7 per 1,000 employees in Australian industry are researchers. On this indicator, Australia ranked 21st out of 36 OECD+ countries in 2013–14, well behind leading countries Israel (21.6 researchers per 1,000 employees), Sweden (13.9) and Denmark (12.9).<sup>20</sup>

Only 7.8 per cent of innovation-active businesses report lack of access to knowledge or technology as a barrier to innovation.<sup>21</sup> This suggests most businesses do not collaborate with research institutions because either they do not perceive it is beneficial to them or they are simply unaware of how such collaboration might improve their business performance — a view supported by the department's BizLab Discovery Project on collaboration (see Box 1.1).

In contrast to the above, Australia performs better than many other OECD countries in industry providing funding to the public research sector. The share of higher education expenditure on R&D (HERD) financed by industry was 5.1 per cent in 2014, and peaked at 6.8 per cent in 2006. Australia ranks 18th out of 36 OECD+ countries on this indicator, ahead of France and the UK but behind Germany and Belgium.

Australia ranks 7th out of 32 OECD countries for the percentage of government expenditure on R&D (GOVERD) financed by industry (Table 1.1). This favourable result may reflect stronger links between business and non-university publicly funded research organisations (PFROs), such as CSIRO. Industry's contribution to GOVERD increased from 7.7 per cent in 2012 to 9.9 per cent in 2014, ranking Australia ahead of the US, where industry finances only 0.4 per cent of GOVERD, but behind Germany and The Netherlands, with 11.2 per cent and 16 per cent respectively. Australia also ranks 9th out of 35 OECD countries for the proportion, 1.23 per cent, of Patent Cooperation Treaty (PCT) applications filed by businesses with a university (whether domestic or foreign).

(e) International comparisons of collaboration measures should be interpreted with caution (see Box 5.3 and *Australian Innovation System Report 2016*, p. 40).

Table 1.1: Business collaboration indicators

Collaboration indicator	Value	Year	Ranking	Number of OECD+ countries
Collaboration on innovation (as a percentage of product and/or process innovative firms)	22.5	2014–15	25	32
Collaboration with suppliers (as a percentage of product and/or process innovative firms)	13.3	2014–15	26	32
R&D-active firms collaborating (as a percentage of innovation-active firms)	19.5	2014–15	27	27
Innovation-active businesses with no collaboration arrangements (per cent)	86.3	2016	–	–
Percentage of HERD financed by industry	5.1	2014	18	36
Percentage of GOVERD financed by industry	9.9	2014	7	32
Innovation ideas sourced from higher education institutions (as a percentage of total)	3	2015	–	–
Percentage of innovation-active SMEs collaborating on innovation with higher education or other non-commercial research institutions	2.7	2014–15	29	29
Percentage of innovation-active large businesses collaborating on innovation with higher education or other non-commercial research institutions	6.2	2014–15	27	29
Business researchers per thousand employed in industry	4.7	2013	21	36
Percentage of PCT applications with a domestic business collaborating with a university (domestic or foreign)	1.2	2000–15	9	35
International co-invention in patents (as a percentage of total patents)	9.7	2013	18	31

Notes: OECD+ includes all 35 member countries of the OECD, as well China, Taiwan and Singapore (where data is available).

Source: OECD (2017), *Science, Technology and Industry Scoreboard 2017*; ABS (2016), *Innovation in Australian Business, 2014–15*, cat. no. 8158.0; OECD (2016) *Main Science and Technology Indicators*; OECD (2017), *OECD Economic Surveys: Australia*; European Patent Office (2016), PATSTAT database.

## Methodology 1.1: The challenges of measuring collaboration

Collaboration measurement is challenging, largely due to the depth of engagement and breadth of the activities described by collaboration.

Difficulties arise from the scope of collaborative activity that is measured — a hierarchy of collaboration activities can be described according to:

- their complexity
- the engagement of the respective parties
- the risks shared.

At the apex, a consortium with multiple partners working on pre-competitive R&D in frontier technologies would be a collaboration of high complexity and high risk. Other collaborations, such as R&D contracts or the placement of a researcher in a business, might involve lower levels of engagement with the research sector.

Another measurement challenge is differences in the international collection of innovation data. Most of the widely referenced figures on Australia's business-research collaboration are based on a comparison with other OECD countries, many of which rely on Eurostat's Community Innovation Survey (CIS).<sup>(g)</sup> Australia's business collaboration data comes from the Business Characteristics Survey (BCS) collected by the ABS. The BCS surveys firms on their innovation and collaboration activity over a single year, but the CIS covers the previous three years.

The shorter reference period for Australia would be expected to produce lower rates of collaboration compared to businesses in countries responding to the CIS. However, when the ABS formerly used a two-year reference period, the proportion of innovating businesses collaborating, was 26 per cent (for 2004 and 2005). This is a considerable

increase on the 15.9 per cent recorded in 2006–07 when the BCS moved to a single year reference period.<sup>22</sup>

The survey population from which estimates are derived is further reduced by other adjustments necessary to make Australia's collaboration data comparable with OECD member countries.<sup>23</sup>

The OECD defines small to medium enterprises (SMEs) as businesses with 10–249 employees. In Australia, SMEs are defined as businesses with fewer than 200 employees. These and other scope adjustments reduce the population from which collaboration is estimated to around 6 per cent of the total starting population. However, they merely place Australian industry on the same measurement basis as other OECD countries in the CIS. They do not distort Australia's collaboration rate, unless Australian collaboration is highly concentrated in the omitted industries or in micro and small firms.

Stratification of the reduced population to estimate business-research collaboration at industry level results in small numbers of businesses and a highly variable annual collaboration rate (Table 1.1), with relative standard errors associated with the estimates often too large to warrant publication. The collaboration rate is not a design variable in the BCS, and it is not practical or cost effective to make it so.

In an effort to improve the quality of estimates of Australian business collaboration on innovation, the Department of Industry, Innovation and Science, in partnership with the ABS, has introduced a new question in the BCS that asks respondents to identify barriers to collaboration. As a result, the 2016–17 data collection will likely enable a more differentiated identification of the specific barriers to collaboration. These results, expected in late 2018, will provide more insight into the business collaboration issue.

(g) The CIS does not use the word "collaborate" in its survey; businesses are asked about their "co-operation" on innovation

## Collaboration in the research sector

Australia's research sector shows a strong collaboration performance on a range of indicators. In the proportion of the world's top 1 per cent of highly cited publications that have an international co-author (Table 1.2), Australia ranked 7th across all disciplines, 5th for Humanities, Arts and Social Science and 8th for Natural Sciences and Engineering among 38 OECD+ countries from 2013–15. During the same period, almost half of the publication output from Australia's top ten universities (ranked by publication output) had an international co-author (43–50 per cent).<sup>24</sup>

Australia's share of the world's top 1 per cent of highly cited publications which included to international collaboration has dramatically increased over the last decades. While this indicator for all disciplines was only 1 per cent in 1995, it has increased to 5.7 per cent in 2015. This applies both to Humanities, Arts and Social Sciences and to Natural Sciences and Engineering.

Analysis by IP Australia on co-filing of patent and trademark applications shows strong collaborative activity between Australia's universities and CSIRO, with a dense web of linkages between these PFROs.<sup>25</sup> When measuring university-to-university collaborative activity, Australia ranks 15th of 35 OECD countries, with 2.5 per cent of PCT applications originating in Australia co-filed by two or more universities.

Table 1.2: Research sector collaboration indicators

Indicator	Value (per cent)	OECD+ Ranking
<b>Share of world's top 1 per cent highly cited publications attributed to international collaboration (2013–15)</b>		
All disciplines	5.7	7
Humanities, Arts and Social Science	5.1	5
Natural Sciences and Engineering	5.9	8

Notes: OECD+ includes all 35 member countries of the OECD, as well China, Taiwan and Singapore (where data is available).

Source: InCites (2017), Clarivate Analytics database.



### Box 1.1: Business research collaboration: the BizLab discovery project

The Department of Industry, Innovation and Science undertook a research project using design thinking to better understand the barriers and drivers for businesses from collaborating with PFROs. Interviews with 30 businesses of varying sizes and sectors were conducted around Australia.

Key findings include:

- Collaboration is integral to commercial success. For many businesses interviewed, fee for service and student internships were the primary form of collaboration with PFROs.
- Some businesses are not aware of the availability or benefits of government support. Others have difficulty finding research partners, managing projects and translating research outcomes.
- PFROs are not always responsive to business needs and many lack business acumen.

The department will explore the following design questions in the next phase of the project:

- How can government improve marketing of programmes and raise awareness?
- How can government better connect businesses and PFROs?
- What approaches could be taken to build SME innovation and management capability?
- How can government support more businesses to collaborate on shared problems?

## 1.5 Business dynamism

Business dynamism refers to the rate at which firms continually enter or exit the market, expand or contract, and reallocate resources between firms. An economy with high business dynamism tends to be more productive, adaptable and capable of sustained economic growth. The role of new HGFs in encouraging business dynamism and innovation is discussed in the feature article *New firms, innovation and economic change: let us count the ways*.

Entrepreneurs play a key role in this process. In a highly dynamic economy, innovators and entrepreneurs are constantly commercialising new ideas and business models, keeping incumbents alert.<sup>26</sup>

Business dynamism is a key driver of resource reallocation and productivity growth. OECD evidence suggests business entry and exit and job churn mirror the economy's ability to reallocate resources from less to more productive firms.<sup>27</sup>

In Australia, business entry rates have been relatively flat for some years, showing a modest downward trend between 2003 and 2015 (Figure 1.6).<sup>28</sup> Over this period, relatively fewer entrepreneurs were creating new firms, and they were more likely to exit than firms entering the market in earlier years. The overall downward trend in entry rates is more pronounced for entrepreneurial businesses.<sup>(h)</sup>

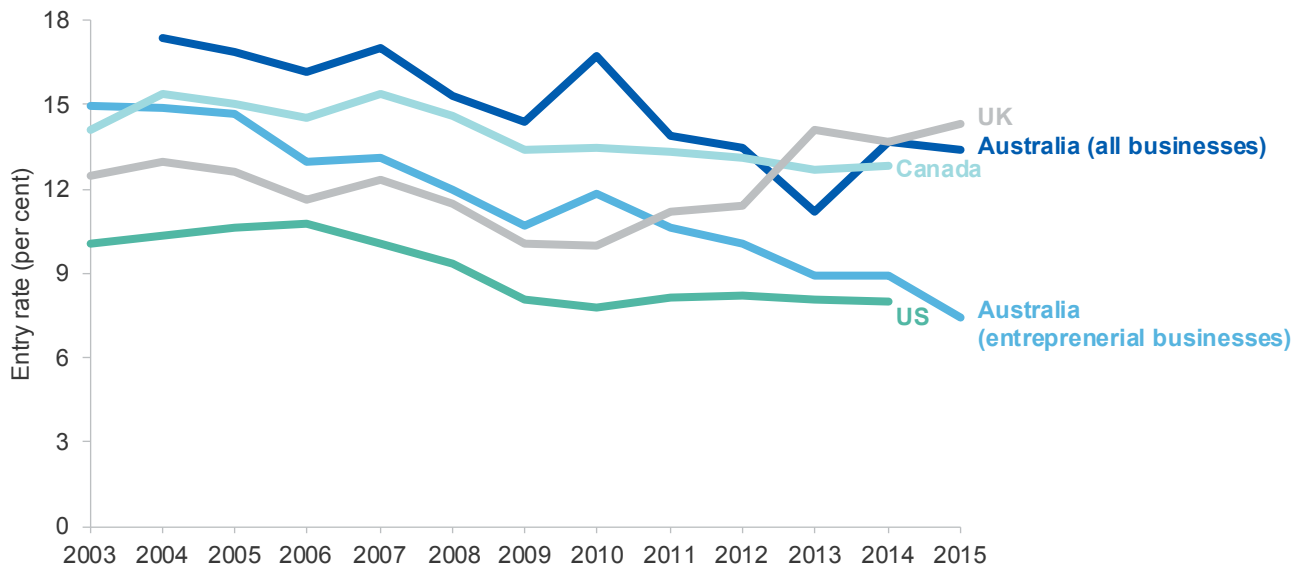
In 2015–16 business entry rates increased to their highest point in 6 years (14.6 per cent). From June 2015 to June 2016 the number of actively trading businesses in the market sector increased by 2.4 per cent (an increase of over 50,000 businesses). The rates of entry and exit were highest for firms without employees (16.6 per cent and 15.1 per cent respectively) and lowest for medium-sized businesses (2.3 per cent and 3.9 per cent).<sup>29</sup>

Most Australian industries recorded an increase in the number of firms in the year to June 2016:

- Construction had the largest increase, with the number of firms growing by 11,967 (3.5 per cent)
- Financial and Insurance Services, increased by 8,705 (4.7 per cent)
- Professional, Scientific and Technical Services, increased by 5,826 (2.3 per cent)
- Agriculture, Forestry and Fishing recorded the largest decrease, falling by 2,737 firms (1.5 per cent).<sup>30</sup>

(h) 'Entrepreneurial businesses' are new businesses that are not subsidiaries or spin-offs from existing businesses, and are not in the financial investment or superannuation industries.

Figure 1.6: Entry rates of actively trading businesses, 2003 to 2015



Source: Bakhtiari, S. (forthcoming) *Entrepreneurship Dynamics in Australia: Lessons from micro-data*, Department of Industry, Innovation and Science, Office of the Chief Economist Research Paper

## Entrepreneurial attitudes and opportunities

Despite a declining trend in entry rates of Australian entrepreneurs since the global financial crisis (GFC), the overall picture of the entrepreneurial climate and activity in Australia is positive.<sup>31</sup>

The 2016 Global Entrepreneurship Monitor (GEM) publishes a number of measures of entrepreneurship in Australia, the most notable being Total Early-stage Entrepreneurial Activity (TEA), which measures emerging entrepreneurship activity.

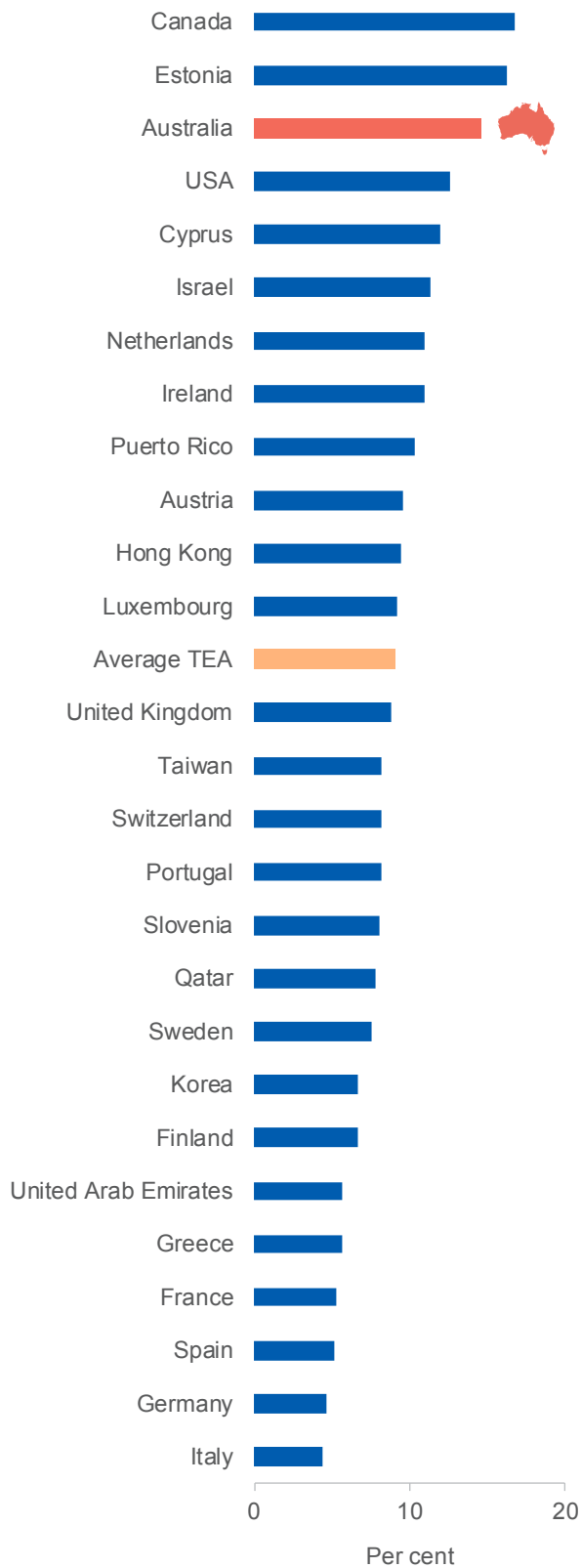
According to the 2016 GEM report, Australia's TEA index was 14.6 per cent, representing 2.2 million early-stage entrepreneurs. Australia's TEA is among the highest of all developed economies, slightly higher than the US (12.6 per cent) but below Canada (16.7 per cent) and Estonia (16.2 per cent)<sup>32</sup> (Figure 1.7).

### Definition 1.5: Total Early-stage Entrepreneurial Activity

**Total Early-stage Entrepreneurial Activity (TEA):** Percentage of the adult population between the ages of 18 and 64 years who are in the process of starting a business or who have just started a business which is less than 42 months old.

Source: The GEM Consortium (2017) *Global Report 2016*, Global Entrepreneurship Research Association, London

Figure 1.7: Total Early-stage Entrepreneurial Activity (TEA) in innovation-driven economies, 2016



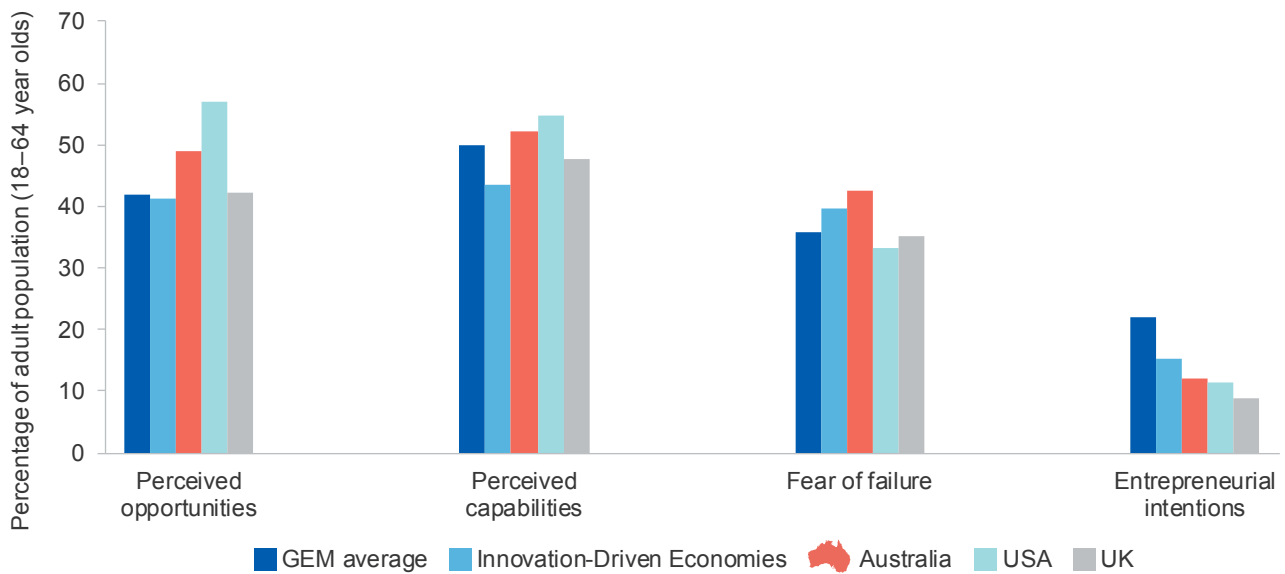
Source: GEM Consortium (2017) Global Report 2016/17: Global Entrepreneurship Research Association, London

The 2016 GEM findings suggest a combination of perceived business opportunities and entrepreneurial skills drives the high quantity and quality of entrepreneurship in Australia (Figure 1.8).<sup>(i)</sup> Approximately 49.3 per cent of Australians perceive good founding opportunities exist for a start-up venture and 52.3 per cent believe they have the necessary skills to start a business. Both measures are above the average of comparable innovation-driven economies (41.3 per cent and 43.8 per cent respectively).<sup>33</sup>

Entrepreneurial intentions expressed by non-entrepreneurs are lower in Australia (12.3 per cent) than the average for all innovation-driven economies (15.4 per cent).<sup>(j)</sup> Less positively, 42.9 per cent of non-entrepreneurial Australians reported perceived fear of failure as a reason why they would not start their own business. This is about ten percentage points higher than similar fears of failure in the USA and UK (33.3 per cent and 35.2 per cent, respectively) and three percentage points higher than the average of innovation-driven economies (39.8 per cent).<sup>34</sup>

(i) Perceived opportunities reflect the percentage of individuals who believe there is occasion to start a venture in the next six months in their immediate environment, whereas perceived capabilities reflect the percentage of individuals who believe they have the required skills, knowledge and experience to start a new venture.  
 (j) Entrepreneurial intentions are expressed as the percentage of individuals who expect to start a business within the next three years.

Figure 1.8: Entrepreneurial perceptions and intentions, 2016



Source: GEM Consortium (2017) Global Report 2016/17: Global Entrepreneurship Research Association, London

While Australia generally ranked highly relative to benchmark economies, the 2016 GEM report highlights areas where entrepreneurial activity could improve. For example, Australia compares poorly to other developed nations with respect to the level of international opportunities being pursued. Australia's percentage of Youth TEA (18–24 year olds) was almost half that of the top ranking nations.<sup>35</sup>

Although Australia ranks third behind only Canada (13.3 per cent) and Estonia (11.7 per cent) in terms of female entrepreneurship among the innovation-driven economies, there is a significant gender gap, with female entrepreneurial participation in Australia only 65 per cent that of males.<sup>36</sup>



## Feature Article: New firms, innovation and economic change: let us count the ways

**Paul D. Reynolds**

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New firms are a major source of economic adaption and change, often through contributions to innovation. These benefits reflect the multiple roles of ew firms of all sizes in economic adaption.

There has been substantial research on two issues:

- There is a strong positive relationship between the presence of new firms and subsequent increases in total jobs, economic growth, change in the economic structure and — a favourite among economists — total factor productivity<sup>(k)</sup>.<sup>38</sup> It appears that new firm creation is an important intervening variable, reflecting the responses of individuals and teams to changes in production technology, input costs, or new customer tastes.
- There is much evidence that if a cohort of new firms is tracked over time, say for five or ten years, the majority of the contributions in the final years — particularly job creation — is provided

(k) Recent policy prescriptions emphasize encouraging new, rather than small, businesses. <sup>37</sup>

from a small proportion of high-growth new ventures.<sup>39</sup> This latter finding is now considered a ‘stylised fact’ or ‘empirical generalisation’ and has led some to propose that public policies should focus exclusively on high potential new firms; some commentators have proposed that lifestyle or small scale firm creation should be discouraged.<sup>40</sup>

### Leaping from data to policy

There are several complications with this latter leap from ‘data’ to policy recommendations.

One critical issue is that contributions are measured within the cohort of new firms. Using such information as the basis for policy proposals reflects an assumption that this reflects overall job creation for the host economic system.

As economic growth of the host region has not been determined, this may or may not be the case. A direct approach would be to determine the presence of new firms and the jobs in the host region. This could be followed by tracking the firms’ developments over a given time, say five years, and then assessing the growth of the new ventures and concurrent regional job growth.<sup>(l)</sup> Apparently there have been very few efforts to implement such an assessment.<sup>(m)</sup>

One analysis compared the effects of firms born small (less than 20 jobs), medium (20 to 100 jobs) and large (over 100 jobs) on subsequent job growth in 382 U.S. labor market areas.<sup>43</sup> No significant impact on regional job growth from the prevalence of new large firms was present, but there were consistent positive associations with the prevalence of new small firms.

### Birthing businesses

While much attention is given to the role of firm creation in making positive contributions to economic wellbeing, it is not often recognised that business churning is an ongoing feature of most business populations; firms are constantly created, expanded, contracted and shut down. There are positive correlations among the levels of firm births, expansions, contractions, and quits; the prevalence of firm births measures one aspect of this churning

(l) There is, however, extensive research on regional characteristics that affect the prevalence of business creation or entrepreneurship. <sup>41</sup>

(m) One overview of the history of development of entrepreneurial research suggests that the effects on economic growth deserve more attention. <sup>42</sup>

activity. Those regions or economic sectors with greater churning are generally the ones with greater economic growth and adaptation.<sup>44</sup>

### **Innovating the establishment**

Another major finding is that most growth firms are in established sectors, often providing well-established products in new or more efficient ways<sup>(n)</sup>.<sup>45</sup> The proportion of growth firms that lead to an expansion of economic markets — creating new goods or services with strong customer acceptance — is generally small and impossible to predict. Further, the growth of individual firms may reflect increasing market share, either by absorbing the competition or driving them out of business. The result may be quite positive for the individual growth firm, but create little change in overall economic growth. The most spectacular growth firm in the United States has been WalMart, created in the 1960s, and which, 50 years later, has 1.4 million employees. While consumers may have benefited, retail employment in the United States has not grown, it has only been redeployed to different firms.

### **Creation makes a contribution**

The mass of new ventures that do not achieve high-growth nevertheless make a number of contributions.

First, regions with a high prevalence of business creation are those where it is an acceptable career option and knowledge of how to implement new ventures is widespread; an entrepreneurial culture exists. This will encourage many to pursue firm creation, particularly those with innovative ideas with untested potential.

Second, a large proportion of jobs are short-term, and new firms are a major source of these temporary positions. This reflects the short life of many business opportunities, which may be profitable for a short period of time, after which they are disbanded and the resources (physical assets, capital, management, and employees) redeployed, perhaps in other new ventures.

Third, much adaptation and innovation is incremental, and new ventures with a short life span are often taking advantage of a temporary opportunity. In retail it is not unusual for specialized outlets to expand rapidly until the market is saturated or a fad loses appeal; the outlets are then shut down.

Fourth, much innovation is provided by new, small firms and once its value is demonstrated the venture is absorbed — intentionally or covertly — by large established firms. The venture creating the innovation disappears, its contribution incorporated into the economy by known business entities.

Finally, almost every nascent entrepreneur thinks they are creating a different kind of business, even if the only difference is a change in a restaurant's menu, a better delivery system or a new price structure.

### **Unpredictable growth**

Some recent assessments have suggested that since rare, fast growing new businesses are responsible for the vast majority of new firm contributions, these initiatives are the only ones that should be encouraged and promoted with public resources.<sup>46, 47</sup>

But the inability to predict the growth potential of new ventures, along with the small proportion that provide net job gains and the many contributions from a mass of business creation activity, suggests this is short-sighted.

Until it is possible to predict, with some accuracy, the future potential of nascent ventures, it would seem that the social good is best served by encouraging a robust, diverse entrepreneurship sector.

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(n) High growth spurts also tend to occur several decades after initiation.