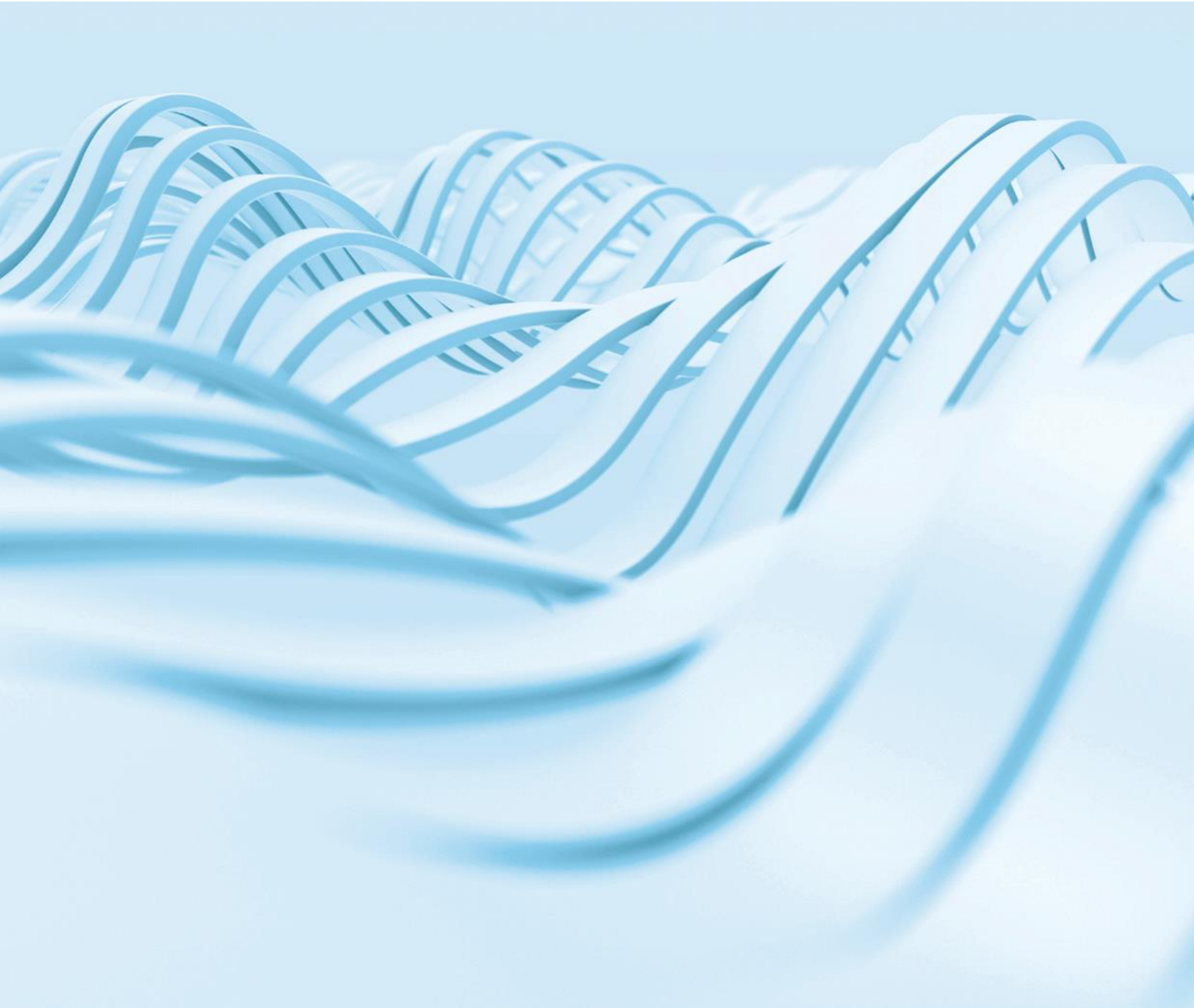
Australian Government
Productivity Commission

Report No. 100 – 7 February 2023

5-year Productivity Inquiry: Innovation for the 98%

Inquiry report – *volume 5*



The Productivity Commission acknowledges the Traditional Owners of Country throughout Australia and their continuing connection to land, waters and community. We pay our respects to their Cultures, Country and Elders past and present.

The Productivity Commission

The Productivity Commission is the Australian Government's independent research and advisory body on a range of economic, social and environmental issues affecting the welfare of Australians. Its role, expressed most simply, is to help governments make better policies, in the long term interest of the Australian community.

The Commission's independence is underpinned by an Act of Parliament. Its processes and outputs are open to public scrutiny and are driven by concern for the wellbeing of the community as a whole.

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ISSN 1447-1337 (online)
ISSN 1447-1329 (print)
ISBN 978-1-74037-759-1 (set)
ISBN 978-1-74037-764-5 (volume 5)

An appropriate reference for this publication is:
Productivity Commission 2023, *5-year Productivity Inquiry: Innovation for the 98%,* Vol. 5, Inquiry Report no. 100, Canberra

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Contents

The Commission's report is divided into 9 volumes: an overview document (volume 1) that presents our policy agenda, and inquiry content volumes (volumes 2–9) that explain in greater detail the reforms that make up the policy agenda, including a modelling appendix. The full report is available from www.pc.gov.au.

Preface

Between 1 and 2% of Australian businesses innovate in ways that are new to the world. Such leading innovations can promote productivity, but there are already many policies in place to promote them. What of the neglected 98% for which the potential for, and desirability of, new-to-the-world innovation is weaker? **Much productivity improvement involves the wider adoption of established, even dated, technologies and practices** among those millions of businesses.

There is a large group of Australian businesses whose management practices, uptake of technology and productivity are below their best practice peers. For example, many businesses undertake little or no assessment of their performance, though this is a major motivator and route to improvement. It is not possible for all businesses to achieve best practice because of large variations in managers' and employees' aptitudes and preferences, and the operating environments of firms. However, by incrementally improving the performance of those businesses, higher rates of diffusion of best practice could significantly lift aggregate productivity growth.

There are worrying signs that **some of the principal vehicles for acquiring and transferring knowledge are dormant or slowing.** Machinery and equipment investment, which typically embeds new knowledge and best practice, has collapsed as a share of GDP. Investments in intangible capital, like software and R&D, have been stagnating. As workers move between businesses, they bring their experience with different technologies and practices with them, sharing them with their new employer; yet, labour mobility between businesses has been declining. So too has the degree of churn in markets as measured by the generally falling rates of firm entry and exits. This is concerning because business exits and entries underpin an entrepreneurial culture and uptake of innovations, and shift resources into activities more likely to generate value and productivity. The one positive sign is that the average level of skills in the workforce has been gradually rising, which generally improves diffusion.

The solutions to these problems are different from the incentives, grants, venture capital funds and public research institutes typically used to stimulate novel innovation. The most important are the settings that determine the quality of the business environment because these determine the incentives, resources and capabilities of firms to invest in and adopt established innovations. Those policies encompass tax policy, the thousands of statutes and regulations that shape business options across almost all facets of the economy, trade and competition policy, skill formation settings, immigration and foreign investment policy. Policies that drive economic efficiency more broadly are the focus of Productivity Inquiry companion volumes on the business environment.

Some aspects of the business environment are particularly relevant for enabling diffusion in the business sector.

As a small open economy with limited (business and public) research capacity, **many ideas and technologies will come to Australia from overseas**. Linkages with overseas firms via trading relationships are important, as is foreign direct investment (FDI). Foreign investors have an incentive to channel knowledge, technologies and expertise to Australian firms, as well as financial capital, to improve the prospects for a return on their investment. More recognition of overseas standards, more streamlining of foreign investment approvals and the elimination of nuisance tariffs would more rapidly diffuse overseas innovations.

Skilled migration policy should be reframed as a way of diffusing innovation and best practice among Australian businesses. Businesses can be conceived as experimental laboratories in delivering goods and services to consumers, so it makes sense to understand the lessons from as wide a variety of experiments as

possible. Skilled migrant workers transmit knowledge and the know-how to practically implement it from all over the world. An expanded and adapted employer-nominated migration scheme would allow better matching of the skills and knowledge needed by employers and the unique capabilities held by migrants.

Information flows, including those arising from other businesses' experiences with new technologies and practices can be mediated by industry associations, consultants and experts (including academics). In Australia, industry associations play a critical role in realising spillovers by drawing together insights from their members' experiences with innovation and helping firms to apply them to their own circumstances. The chief problem is not that associations are deficient in this role, but that the potential recipient businesses often do not know how far away they are from best practice. In their role as data collectors, the Australian Tax Office (ATO), the Australian Bureau of Statistics (ABS), and various regulators have rich data that, in a curated form and with business consent, they could return to businesses to tell them where they lie on the spectrum of performance with their peers. No business wants to be last in the entrepreneurial race.

Innovation and best practice are equally important for the public sector. Australian governments are the major funders (and providers) of a large part of the economy, including educational services, the justice and defence systems, health, disability and aged care, and design and implement the tax and transfer system. General government spending amounts to nearly $900 billion or over 40% of GDP, with much of this — some $445 billion — spent on delivery of services to the Australian community. Against this scale and breadth of activities, even modest improvements in innovation and the diffusion of best practice will improve the quality of outcomes for citizens and in some cases, reduce fiscal pressures. (It can also have knock-on effects as best practice policy improves the business environment.)

There are many examples of effective innovation and diffusion in government. For example, the response to COVID-19 led to rapid expansions in e-health and new models of schooling.

However, innovation and the uptake of best practice is often sluggish, patchy and inconsistent across jurisdictions. For instance, while it has limitations, activity-based pricing for public hospitals was a big step forward for improved efficiency in the healthcare system, but it took 17 years before it was adopted by all jurisdictions. Benchmarking of governments' performance across multiple dimensions — school education, elective surgery waiting times, prisoner education, support services for people experiencing homelessness — suggest many have failed to mimic the practices of the best. (While the public know that there are big differences in performance, they know less about why and what could be done. Governments could readily undertake more analysis to uncover what lies beneath.)

Slow progress reflects that governments face unique challenges in innovation and the adoption of best practice. Sometimes that is reasonable. Ethics sometimes demands some slowness because people's lifetime wellbeing may be involved, for example, a new mandated way of educating Australia's 4 million school students. Governments have contested, ambiguous and vague objectives such that success is hard to measure, and they often (reasonably) decide to prioritise different social and economic goals. Businesses ultimately measure their success through profits.

But slowness also reflects structural defects. Uncoordinated actions of governments and agencies that share overlapping roles, siloed services, clashing funding incentives and risk-averse cultural norms tend to work against experimentation. Few publicly-operated services fear that poor performance will lead to their closure.

One solution is to **re-configure some of the poorly designed ways of commissioning and funding activities**. In public infrastructure and defence procurement, billions are spent on deficient, slow or over-budget projects because procurement models are far from best practice. In healthcare, the Australian Government funds primary care mainly through the small business sector (GPs), while the States and Territories are the primary funders of the most costly and sophisticated part of the system — large

government-run public hospitals. It makes sense to keep people out of hospital where possible, but hospitals have no incentives to prevent hospitalisation (and are in any case restricted in what they are allowed to do in primary health). There are novel funding models that could reduce these perverse incentives.

Government agencies create barriers to recruiting people from overseas that are much greater than those for private sector occupations despite immigrants being some of the best conduits for fresh ideas in policy. Citizenship and security requirements are arguably too restrictive and could be relaxed.

Ideas have a peculiarity that one person's use of them does not stop someone else from using them. **Where there is a sound public good basis, use of ideas should be free as this encourages diffusion and innovation**. Many Australian standards — which are an explicit way of codifying practices that should be widely diffused — are priced. That, and the charging arrangements for the academic literature arising from publicly-funded research, should be reformed.

There are significant productivity rewards on the table from improvements in diffusion, even modest ones. This volume of the 5 Year Productivity Inquiry presents the Commission's findings and recommendations for government to support increased innovation and diffusion to improve productivity across the Australian economy.

1. The case for strengthening the diffusion of innovation

Key points

- **While novel, 'new-to-the-world', innovation is an important source of economic performance, it relates to only 1 to 2% of Australian firms. The slow accumulation of existing knowledge across the economy — diffusion — is often overlooked as a source of productivity. It has the scope to lift the performance of millions of businesses.**
- **Diffusion of knowledge in the non-market service sector, which governments control, fund and often run, can lift the quality of services central to Australians' wellbeing (such as education and healthcare). Diffusion of best practice regulation can also raise the efficiency of the private sector.**
- **Australian businesses are not keeping up to the frontier of innovation, even in comparison to similar businesses in other countries. Yet they may not be aware of how far they lag behind. Many Australian businesses undertake little or no assessment of their performance, and overall management capability — a critical determinant of adoption of best practice — appears to be weak for a large share of businesses, and significantly worse on average compared with the United States.**
- **There are signs that the 'diffusion machine' has weakened, with slower growth of most of the key factors driving diffusion — labour mobility, business exits and entries, and overall investment in capital that embeds new ideas ('capital with brains') — such as equipment and machinery, R&D and software.**
- **The key policy levers for diffusion are different from those relevant to novel innovation. The quality of the business environment that affects knowledge flows and adoption — regulatory settings, skill formation, immigration and foreign direct investment policy, and competition policy — is far more critical than piecemeal interventions.**

1.1 A focus on diffusion

Advances in knowledge and technology have been the main driver of economic growth and transformation throughout history (Williamson et al. 2015). Brawn aside, workers' contribution to output reflects what is ultimately inside their heads, regardless of how it ends up there. Intangible capital — such as intellectual property, training, software, and organisational methods — are major conduits for that knowledge. But so is physical capital — all machines are the physical embodiment of knowledge. So, creating policy environments conducive to the creation of new ways of doing things ('innovation'), and diffusing and maintaining these, is the key to being an innovative economy.

In Australia, innovation policy has tended to give pre-eminence to interventions that foster the creation of novel productivity-enhancing ideas and technologies in selective parts of the business sector, including by leveraging the frontier research expertise in universities. Policies oriented towards novel innovation can be important for productivity growth,[1] though are often inadequately tested for their appropriateness, effectiveness and overall benefits.

One consequence is that innovation policies of seemingly general application turn out to have limited direct relevance to large parts of the modern economy. As documented for the United States, and with equal application to Australia, different parts of the economy innovate in different ways (Andrews, Chatterji and Stern 2022). The manufacturing, ICT and some business service industries make considerable use of formal R&D.[2] Much of the services sector does not. Patents are prominent in manufacturing and IT development industries, but of much lesser relevance in other parts of the economy (PC 2016a, p. 267). Hence policies based on the commercialisation of patentable IP will tend to be narrow in their coverage. Where innovation policy focuses mainly on cutting-edge scientific or technological breakthroughs, it tends to miss the way firms in much of the economy are innovating on the ground.

As noted in this inquiry's companion volume, *Keys to growth*, the Australian economy is increasingly dominated by the services sector. Key questions for innovation policy are: what does innovation look like across the broad sweep of the services sector? How do service firms innovate? How do they identify and implement changes to their service offering?

A narrative that concentrates on new-to-the-world innovation misses a significant piece of the productivity-innovation story — the huge power of small changes across many firms. Fostering the adoption and use — that is, the diffusion — of new and established technologies and ideas across the majority of enterprises in the economy represents a significant opportunity to increase productivity (box 1.1). This applies across all industries, but with particular relevance for services, such as in retailing, hospitality, transport and low-scale construction.

Diffusion will often involve the incremental adoption of already widely available, even dated innovations — for example, using accounting software to manage financials (rather than a 'shoebox of cluttered accounts') or creating a web page to improve the customer visibility of a business. But diffusion can also involve the absorption and adaptation of existing cutting-edge technologies, such as artificial intelligence applications to business processes. In this respect, diffusion and innovation are related concepts. A firm that adopts and possibly adapts an existing idea is a beneficiary of diffusion, but at the firm or industry level is still an innovator. Moreover, an innovative mindset and capability within firms often aids the absorption of new ideas from elsewhere. And an economy with strong diffusion channels implies a market for new ideas, hence greater incentives for new pathbreaking innovation. But a focus on diffusion is a good guide for innovation policy. In many respects, it is the main game.

[1] There is a vast literature on the impacts of novel innovation on firm performance and productivity. Significant work in this regard includes Hall (2011); Hall & Mohnen (2013); Crepon et al. (1998); Janz et al. (2004); and Lööf & Heshmati (2006).

[2] In 2020-21, three fields of research dominated Australian business R&D — information technology, engineering, and biomedical and clinical science — accounting for more than 80% of the total spending (ABS 2021c table 7). The industries in which these fields were most concentrated were manufacturing, and professional, scientific and technical services, which in turn were the recipients of about 80% of all Australian governments' funding of business R&D (ABS 2021c table 4).

Box 1.1 – What we mean by innovation and diffusion

The standard definition of innovation is that it is the process whereby businesses, governments and other organisations and individuals generate or maintain value by creating, adapting or using available knowledge and technology to introduce new or improved products (goods and/or services) or internal business processes.[a] Importantly, this definition includes innovation that is new to the world, to Australia or an industry, or even just new to the firm that is adopting and implementing the idea, production technique or technology.

Such innovation goes beyond physical goods with wide recognition that it also encompasses new ways to organise business processes and functions, and new marketing methods. Indeed, many important innovations have been of the organisational kind — for example, new ways to organise production and distribution — as opposed to new products (goods and/or services) or production techniques (Fagerberg 2018, p. 7; Thomson and Webster 2013). Franchising, just in time inventory management, and web-based sales are exemplars, now widely adopted globally and in Australia. The shift to working from home that occurred with the COVID-19 pandemic represents one of the more recent shifts in how work is organised. While the productivity impacts of that shift are not yet clear, the Productivity Commission has speculated that working from home may ultimately lead to productivity gains at the economy-wide level (PC 2021f, p. 3), and they have certainly saved commuting times for millions of people.

Innovation at the frontier of knowledge represents only a small share of innovation activity and innovating firms in Australia (and in most countries, see OECD 2020). Innovation *diffusion* — the process by which knowledge and technologies are communicated, adopted and adapted over time in an economy — is how the vast majority of firms achieve productivity growth. Without diffusion, new technologies and knowledge would have less impact on productivity growth — innovation requires businesses and other actors to *implement* or *apply* new ideas and technology that generate real returns (Hall 2004).

Modest incremental low-cost changes to a business' processes, goods and services ('micro innovations') that underpin much diffusion shift firms closer to the frontier, and can creep up on organisations because they are adopted in response to the demands of others. Cash-free transactions, for example, became essential for many organisations during the COVID-19 pandemic, as did online ordering and video-conferencing. The Restaurant and Catering Association told the Productivity Commission that most cafes and restaurants now use Uber Eats/Deliveroo (R&CA, pers. comm., 9 June 2022) — a massive uptake of technology compared with their previous models of delivery. Most regulators have relinquished paper forms (their own micro innovation), which in turn has required the regulated to go online. New equipment incorporates new technologies that require workers to learn new skills and firms to make organisational changes to use the equipment effectively. For example, new heavy vehicles have additional safety measures that their drivers and owners must understand and use, while mechanics for such equipment must acquire new skills (and diagnostic equipment).

a. Consistent with OECD/Eurostat (2018). Process innovations include new or improved methods for producing goods and services; organisational forms; marketing methods.

Some proponents of new-to-the-world innovation policy have concerns about a focus on diffusion. In their view, Australia will lag behind unless it develops successful new-to-the-world exports in growth industries. However, policies that help diffusion are not at the expense of businesses' attempts to create flagship new-to-the-world products, and there are already many polices aimed in the latter's direction. And prosperity is not reliant on the growth in exports of such flagship products. Even if resource prices fall in the future, Australia — as a country with a highly skilled workforce and other endowments — will continue to enjoy a comparative advantage in and export a range of goods and services (including tourism, education and some professional and technology services), as it imports goods and services that are produced better or more cheaply overseas.

Productivity gains in all of these sectors will be important and will be supported by more diffusion. Stylised whole-of-economy modelling undertaken by the Commission for this inquiry found that potential productivity improvements arising from more diffusion of new ideas, knowledge, business models, technologies and capabilities would lead to increased real GDP, gross national income and individual wellbeing (appendix A).

For many organisations, diffusion involves lower risks, shorter lead times, less external funding and fewer demands for a specialised workforce — making it attractive for the bulk of organisations. The strategy of seeking out, adapting and implementing existing innovations appears to have been a successful strategy for many Australian firms (DIIS 2017). Indeed, the productivity slowdown may reflect a slowing of diffusion processes rather than less fundamental innovation (as discussed further below).

Moreover, as a small, open economy with, by global standards, limited resources and R&D capacity, many ideas and technologies will come from outside Australia, underlining the importance of a global perspective on diffusion. For example, the challenges posed by climate adaptation and mitigation will require the adoption and adaption of existing technologies as much as the development of entirely new ones.

Diffusion pushes more firms to the frontier

Diffusion increases the productivity of those organisations that adopt and adapt existing, but new-to-the-business technologies and processes. This changes the relative proportions of low versus medium versus high performing organisations in the economy, raising national productivity. Among any group of organisations (comprising businesses, not-for-profit organisations and public sector agencies) there are some that are at the frontier of performance. These make the best use of their resources, are dynamic and future-focused, and are quick adopters of others' technologies. They may develop new-to-the-world innovations, though that need not be a key feature of their operations. The more organisations in an economy that are like this, the more productive is society overall, and the more rapidly it can absorb global technologies.

The bulk of organisations are behind the frontier, but by varying degrees — some close, some distant. Closing the gap between their performance and that of the best would increase average economy-wide productivity. That can occur through four mechanisms:[3]

- exit by those entities that have few prospects of improving (and therefore 'natural selection' of the fittest)
- entry by entities that are generally more efficient
- growth in the capabilities of the viable but lagging surviving entities
- through competitive pressures, increases in the market share of the most productive entities.

These mechanisms increase the average proximity of organisations to the frontier. One of the unique features of organisations run by the public sector, like schools, is that exits are rare and competition for the market is not very important, and so diffusion can only occur through the other mechanisms.

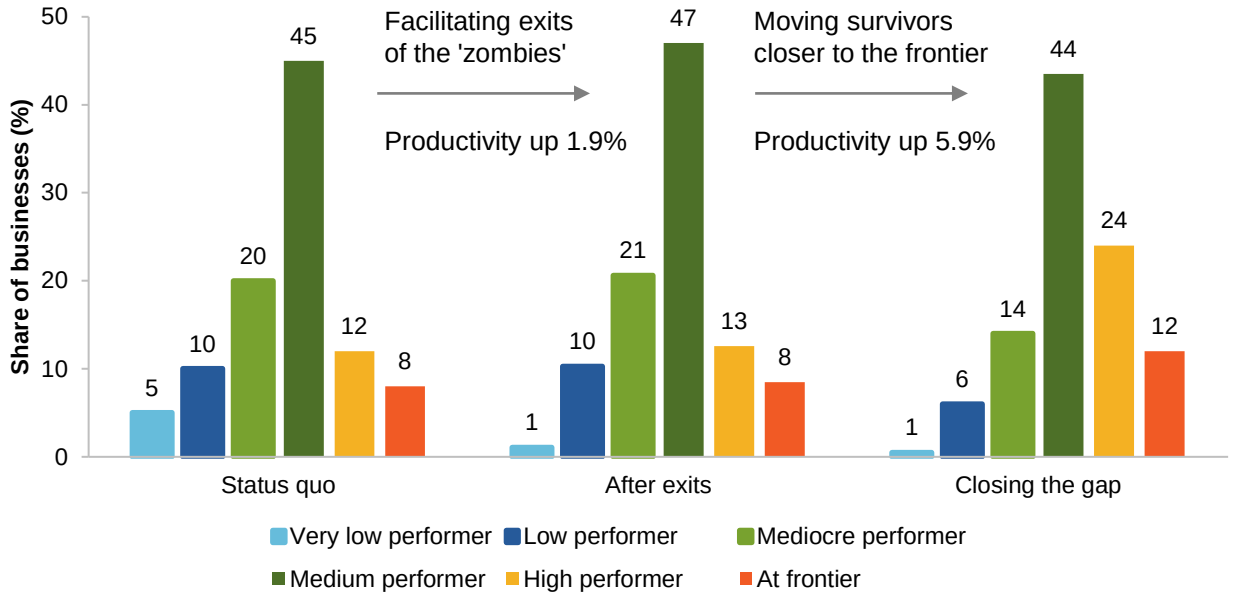
[3] These are 'average' effects. Businesses constantly face upward and downward shifts in productivity — for example, demand shocks affect capital utilisation, there are supply disruptions, and key staff come and go.

Figure 1.1 is a hypothetical depiction of the process, underpinned by some quantitative assumptions, which illustrates the effects of the above mechanisms. It illustrates that the reallocation of resources — from failing firms to new firms that are more efficient — can be an important driver of economy-wide productivity. The likely bigger effect arises when the surviving firms adopt better ways of producing their outputs and when the market share of the most productive firms rises. More output is produced by firms approaching the frontier.

Figure 1.1 ignores a vital dynamic feature of real markets — the frontier moves out as there are new global and domestic innovations. This creates new laggards. Global frontier technologies are not immediately diffused to all firms, being first adopted (and if necessary, adapted to the domestic context) by the most productive firms in an economy, before diffusing to other firms (Saia, Andrews and Albrizio 2015).

Figure 1.1 – Diffusion and firm exits compress relative productivity[a]

A simulation



a. The example assumes that exits are offset by entries, with entries more likely to be higher performing. The distribution of productivity performance is illustrative, with the assumed average relative productivity of any group relative to the most efficient organisation being 0.45 for very low performers (that is, productivity just less than half of the best performer), 0.6 for low performers, 0.755 for mediocre performers, 0.855 for medium performers, 0.925 for high performers and 0.975 for the frontier organisations. The changing shifts in the shares of organisations in each productivity grouping is assumed but does not represent large shifts in the standard deviation of the distribution of productivity levels across organisations. The average productivity of the 'after exits' case increases by about 0.16 deviations (based on the status quo distribution of productivity values) and by 0.35 standard deviations for the 'closing the gap' scenario.

The pace of diffusion differs across firms

There are many parts to firms' decisions about adopting innovations. Where diffusion consists of making an investment, this can give the business a 'technology'[4] that looks similar to frontier businesses. But the investment entails costs, such as any equipment or software purchases, staff re-skilling, and organisational changes needed for adoption. If those costs are not adequately offset by increased returns, then adoption reduces the firm's income, though it may still increase labour productivity.

[4] Technology is broader than tangible investments in machinery and equipment. It includes all the ways in which an organisation produces its output — their governance structures, skills, physical capital, intellectual property and so on.

Organisations vary in their capability to absorb existing technologies and in their need for them. So for some organisations, adopting an innovation later, if at all, may be a better strategy (Geroski 2000). This allows them to obtain new technologies at lower prices, to draw on a growing pool of people familiar with the technology and to use the lessons learned from early adopters, whether in Australia or more likely overseas. Waiting can also reduce the risk of committing to path-dependent technologies that may be sub-optimal in the long run.

For other businesses, diffusion of a productivity-promoting technology requires complementary investments and other changes to their processes, and the full set of investments may be too costly — particularly for small and medium enterprises (SMEs), which are the most common type of business in Australia (PC 2021d, p. 5). For instance, effective digitalisation of businesses requires skills and integration of systems, yet nearly 60% of Australian SMEs experience 'bad digitalisation' (MYOB 2022).

Some firms are 'satisficers', and do not necessarily want to advance much towards the frontier or have little realistic prospect of transforming their businesses. These might be pejoratively called 'laggards', but they can serve people's lifestyle choices and may improve labour market efficiency in some cases.

> … some of the laggards with limited scope for growth, such as some family businesses, may still support employment, in particular for workers with lower than average employability and in lagging regions. (Berlingieri et al. 2020, p. 20)

In meetings with various industry associations, the Productivity Commission was often told about business owners — typically of smaller businesses — who have little time to put aside to focus on innovation or future-looking business strategies. For these businesses, the impetus for change comes from external advice (by their accountants for example) or from impending closure.

Moreover, in some cases, a new technology or organisational innovation has limited applicability to many businesses, such that their absence is not a problem. For example, the take-up of working from home — spurred by lockdowns and COVID-19 infection risks — represented a new, or at least more frequently, adopted way of organising work. Its diffusion amongst businesses was variable, but in many instances, a low rate of adoption is desirable (or inevitable) given the nature of the businesses. Very few businesses in accommodation, food services and construction have any significant share of their workforce working from home as their businesses rely on workers being physically present at the location of production (PC 2021e, p. 16).

The Commission's analysis of cloud computing further illustrates the complexity of firm variations in adoption of technology (McMillan et al. 2022). We found four groups of businesses — those who adopted cloud services and benefitted from them (*leaders*), those who did not adopt and should not have (*wise non-adopters*), those who adopted them but should not have (*'naïve' leaders*), and finally those that did not adopt, but should have (*true laggards*). A policy and economic environment that limits the significance of naïve leaders and laggards will tend to improve productivity.

Finally, the resources for being at the frontier are scarce in Australia, regardless of whether the organisation is private, public sector or not-for-profit. For example, one of the challenges for many social programs is that they rely on highly skilled and motivated staff and managers, who are in short supply, meaning that complete diffusion of best practice is not feasible.

1.2 Innovation and diffusion in Australia

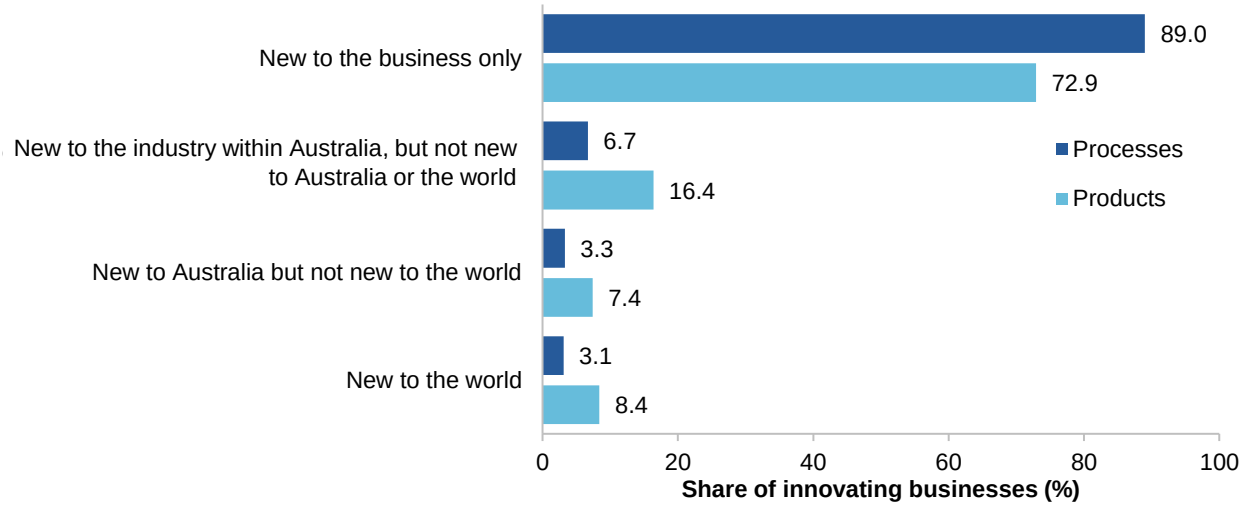
Most Australian businesses do not introduce new or *significantly* improved products or processes (the usual measure of innovation). For example, in the two years ending mid-2021, almost 80% of Australian businesses did not introduce any (significant) new good or service, and over 60% did not introduce a new process (ABS 2022c). And far fewer Australian businesses are at the global frontier in respect to innovation

— over the same period, more than 98% of businesses did not introduce any goods or services that were new to the world and almost 99% did not introduce any processes that were new to the world. Looking at this tiny group of firms therefore misses the bulk of those innovating.

When businesses do innovate, the vast majority of new products or processes are only new to the business — which is one measure of diffusion as such innovation draws on other established products and processes (figure 1.2).

Figure 1.2 – Most Australian business innovations are only new to the firm[a]

Product and process innovation, 2 years ending June 2021



a. Process innovations include new or improved methods for producing goods and services; organisational forms; and marketing methods.

Source: ABS (*Innovation in Australian Business,* 2020-21 financial year, Cat. No. 8158.0).

Compared with other countries, Australia receives a mixed report card on innovation and diffusion. The World Intellectual Property Organisation paints a dismal picture of Australia as a weak diffuser — 78th in the world in knowledge diffusion and 52nd in terms of knowledge absorption (WIPO 2021, p. 47). However, the WIPO definitions of diffusion and absorption[5] are problematic measures in the sense meant by this report because they only narrowly capture the ways in which diffusion and absorption of knowledge occurs in an economy. Accordingly, these measures have the same bias that surrounds typical narratives of innovation, accentuating high-technology and manufacturing, and ignoring the non-business sector and non-traded sector despite their pre-eminence in modern economies like Australia.

Better measures of diffusion and diffusion capability paint a more sanguine, albeit still mixed, picture of Australia's comparative diffusion performance.

Global comparisons of the uptake of certain digital technologies, such as business adoption of cloud computing and broadband connections, suggest that Australian businesses are moderate or fast adopters in some areas and slow in others. For example, in 2020 more than 70% of Australian businesses with employment of 10 or more people had purchased cloud computing services, which places Australia in the

[5] This diffusion measure is a weighted combination of the IP receipts' share of total trade, production and export complexity, the high-tech export share and ICT service export share. The absorption measure is based on the weighted shares of trade for IP payments, high tech imports and ICT services, FDI net inflows as a share of GDP, and the share of research talent employed in the business sector.

top 5% of firms in the OECD.[6] On the other hand, Australian businesses' take up of more advanced digital capabilities, like big data analysis and artificial intelligence (AI), lags most other developed economies (PC 2022a). The rate of AI adoption, for example, is relatively low with Australia in the 15th percentile among OECD countries in 2020.

Overall rates of goods and services (product) innovation — which includes new-to-the-world, new-to-Australia and new-to-the-firm innovations — among Australian businesses is about at average levels of OECD countries (OECD 2022b). Process innovation is higher than the OECD average. However, the product innovations implemented by Australian businesses are more likely than other OECD countries to be new-to-the-firm rather than new-to-the-world or new-to-Australia — indicating that diffusion, rather than novel innovation, is relatively more important in Australia (though new-to-the-firm innovation still accounts for about 50% of product innovation among OECD countries) (OECD 2022b).

Managerial capability varies, but generally lags other countries

While it can be difficult to accurately capture the level of diffusion, particularly for micro innovations, at the firm level, firms' management practices provide some indication of their capacity to make small productive changes. Firms using advanced management practices have been shown to be more productive across a broad range of countries (Bloom, Sadun and Van Reenen 2017, pp. 16–17; Bloom and Van Reenen 2007, pp. 1368–1371; Criscuolo et al. 2021, pp. 23–31; O'Neill, Sohal and Teng 2016), including Australia (Agarwal et al. 2014, p. 6497). Management training also has large and persistent effects on firm performance over time (Giorcelli 2019, p. 139). The OECD estimates that the productivity gains from upskilling managers could be three times higher than for upskilling workers,[7] with significant gains even in less knowledge-intensive services like wholesale and retail trade and transport (Criscuolo et al. 2021, pp. 28–29).

Evidence on the practices of Australian managers suggests that many do not examine key performance aspects of their businesses, which acts as a barrier to making changes (figure 1.3). A composite score of overall management capability among Australian businesses shows that capabilities are relatively low, at about 0.3 (with the range of possible scores being between 0 and 1) (Agarwal et al. 2019). An increase in the overall management capability score of 0.1 is associated with a 6.2% increase in labour productivity (ibid p. 28). However, there appears to be a gulf between actual deficiencies and perceived ones. In 2020, only 2.4% of Australian businesses said that shortages or deficiencies in business management skills adversely affected their core business activities.[8] This suggests that approaches to improve management practices may need to go beyond providing skills but will also need to credibly reveal the deficiencies to managers who do not recognise they have any.

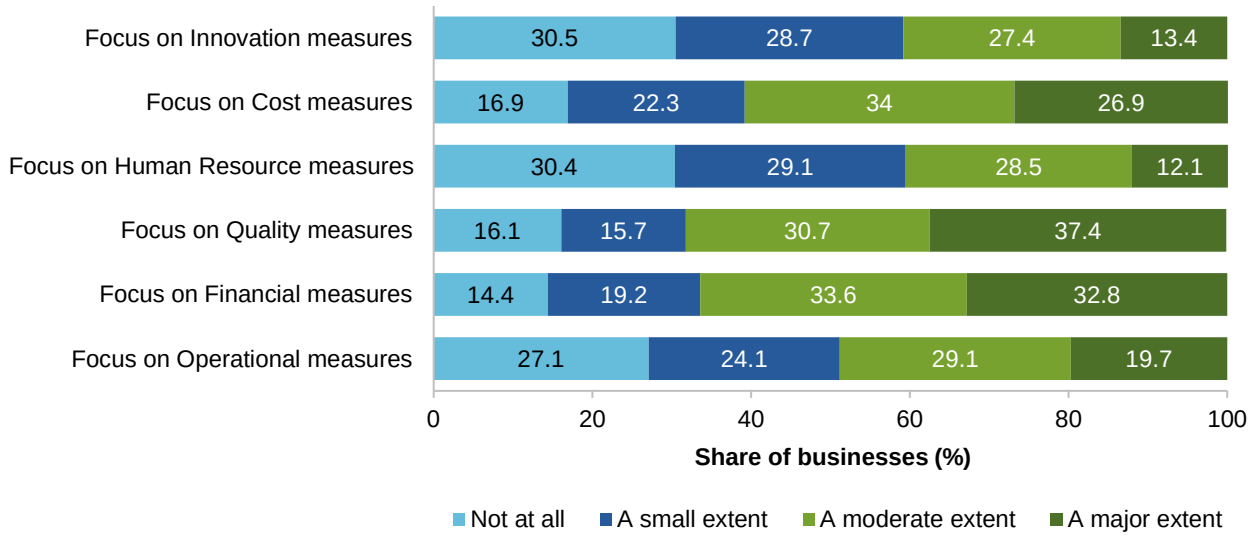
[6] Based on the OECD dataset for ICT Access and Usage by Businesses.

[7] Criscuolo et al. (2021, p. 28) estimated that the productivity gains for a medium productivity firm associated with upskilling 1% of the workforce, either managers or workers, as 3% for managers and 1% for workers.

[8] Surprisingly, this result does not vary with business employment size, though the need for management sophistication might be expected to do so. The figures are drawn ABS *Business Characteristics Survey* from ABS Stat Data Explorer for 2020.

Figure 1.3 – Many Australian businesses undertake little or no assessment of their performance

2019-20

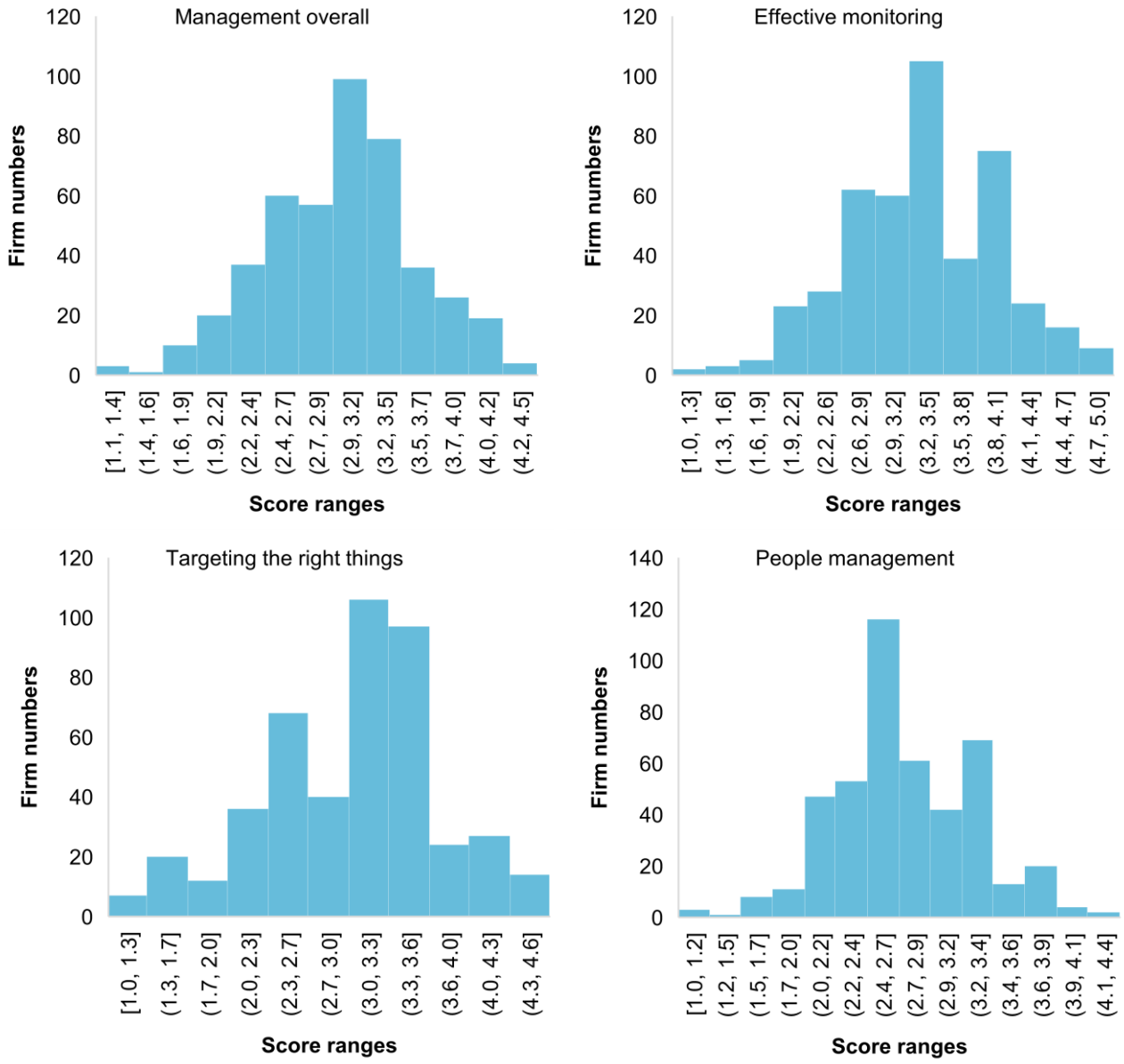


Source: ABS (*Characteristics of Australian Businesses,* 2019-20 financial year, Cat. no. 8167.0).

More detailed information is available on the distribution of performance in Australian manufacturing, which illustrates a wide dispersion in managerial capability across firms (figure 1.4). In addition, while entrepreneurship and managerial capability will always vary across business managers, the global evidence suggests that there are opportunities to improve average capabilities and with that, improve upon the slow accretion of better practices. In manufacturing, Australian firms are worse than the United States, which has higher average capabilities (figures 1.5 and 1.6). Empirical work suggests half of the productivity gap in manufacturing between Australia and the United States is the result of lower levels of management capability (Bloom, Sadun and Van Reenen 2017).

Figure 1.4 – There is wide dispersion in managerial capability in Australia[a]

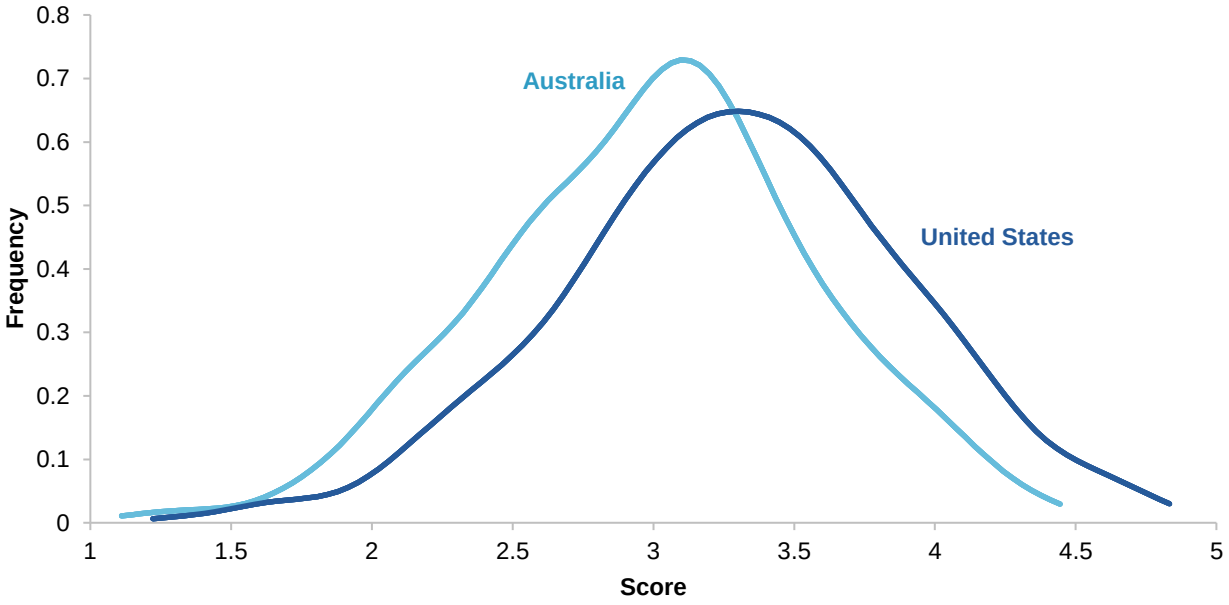
Manufacturing firms



a. Lower scores reflect poor management practices.

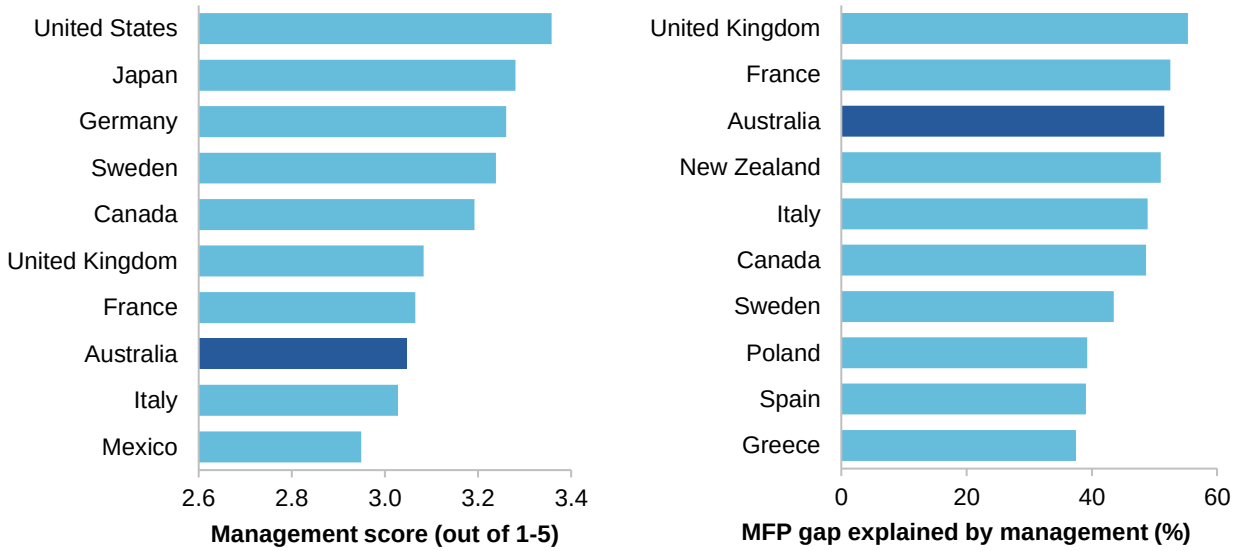
Source: Based on data from 451 Australian manufacturing businesses from the World Management Survey (Bloom et al. 2021) and described in Bloom et al. (2014).

Figure 1.5 – Closing the gap — there appears good scope for Australian firms to move closer to the best practice management frontier[a]



a. Density kernels based on data from 451 Australian and 953 US manufacturing businesses from the World Management Survey (Bloom et al. 2021) and described in Bloom et al. (2014). Higher scores represent better management capability.

Figure 1.6 – Management capability in Australia lags behind our global peers[a]



a. Relates only to manufacturing. The right-hand side chart explains the extent to which the management capabilities of businesses explain the divergence between manufacturing multi-factor productivity in each country and the United States.

Source: Bloom, Sadun and Van Reenen (2017).

Investment in capital with brains and job mobility have slowed

Beyond managerial capabilities, there are other factors that underpin diffusion of knowledge across Australian firms. Diffusion is also a product of investments in the resources that shift businesses' productive capabilities — 'knowledge-based' capital or capital with 'brains'. These investments include the acquisition of intangible capital in software, research and development, exploration, and artistic works, the skills of workers, and the knowledge embedded in machinery and equipment. While investments in the latter are often not seen as a part of knowledge-based capital, they facilitate learning through use and reverse engineering. (There are other forms of intangible capital, such as databases and managerial capabilities, but these are incompletely captured by official statistics.)[9]

Putting aside investments in workers' skills (which are not collected by the Australian Bureau of Statistics on the same basis as other knowledge-based investments), overall investments in capital with 'brains' has been falling in recent years, especially R&D and machinery and equipment (figure 1.7). In contrast, investments in the quality of labour — a summary measure of skill development and relevant to the creation and absorption of knowledge — has been rising consistently over the past 15 years (figure 1.8).

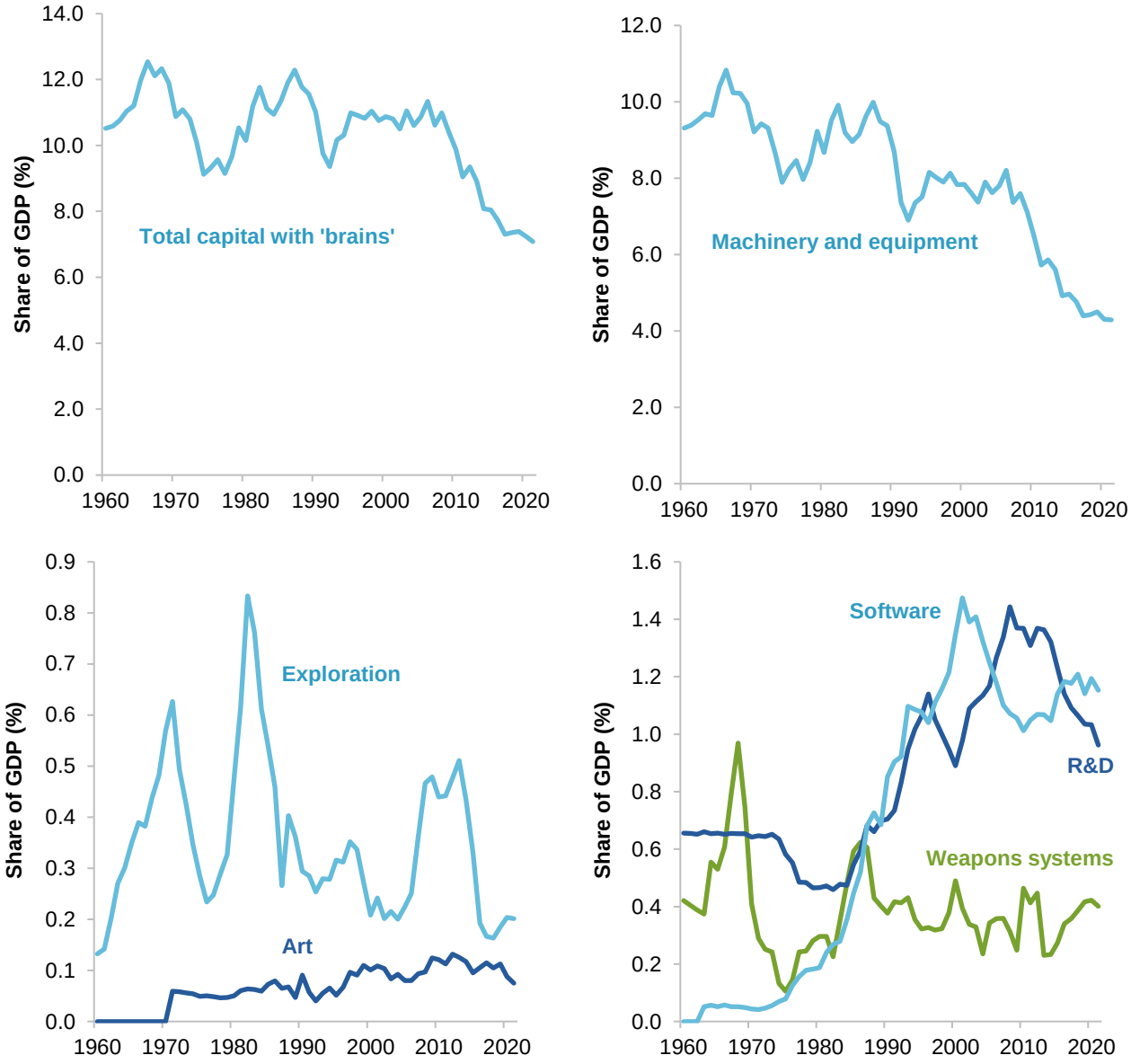
Worker mobility between firms is another conduit for diffusion of knowledge, regardless of whether that is precipitated by a firm exit. Workers acquire capabilities through formal learning and training, through job experience and with personal experiences. When they move between organisations, they carry those capabilities across. There are two gains for the recipient organisations. They acquire variety — people with new ideas compared with the incumbent workforce. They also benefit from matching efficiency. A worker who finds their current job does not fully use their skills searches for more compatible and often more highly paid jobs. If job mobility falls, especially for workers with less routine jobs, then this can disrupt this beneficial source of diffusion and innovation. The evidence suggests that job mobility has been falling in Australia.[10]

[9] Figure 1.7 does not capture shifts in the nature of plant and machinery over time, such as, say, a shift from large mining trucks to supercomputers. Notably, while the mining share of equipment has fallen as a share of GDP, so has non-mining.

[10] While labour mobility is likely to be a significant source of diffusion, it should also be recognised that high labour turnover reduces the incentives for businesses to provide formal training (one of the reasons why governments sometimes support industry training). Moreover, while knowledge unquestionably is carried by worker mobility, it is likely that the marginal benefits depend on the levels of skills of the worker and the source business. For example, the periodic movements of employees from one fast food franchise to another is unlikely to add much to the capabilities of the acquiring franchise.

Figure 1.7 – Capital with 'brains' has been falling[a,b]

Capital spending as a share of gross domestic product 1959-60 to 2020-21

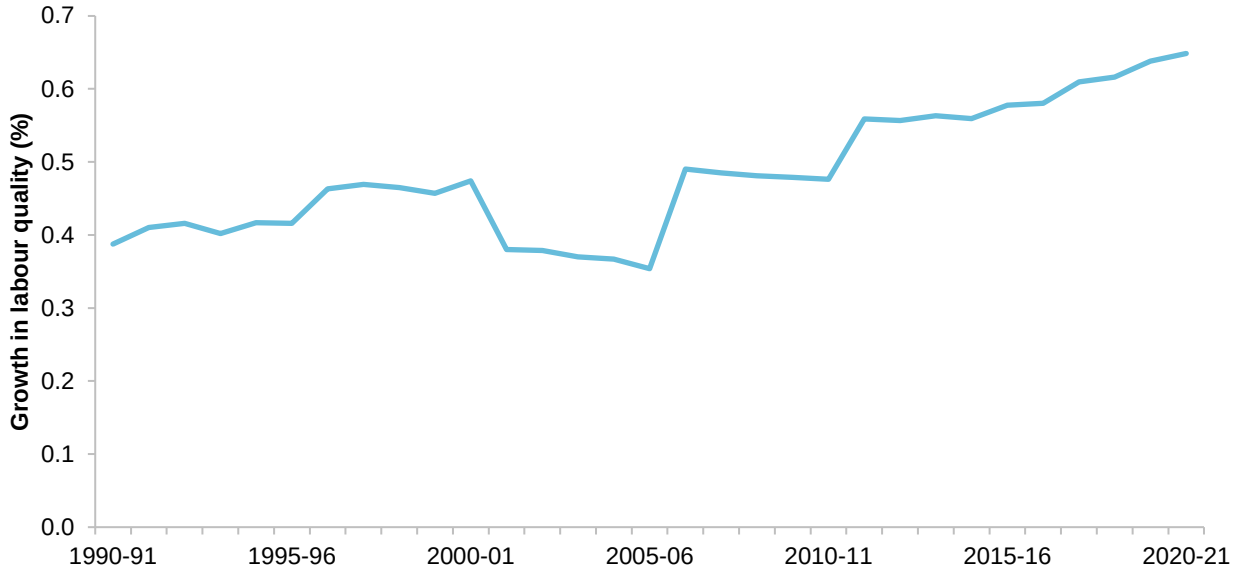


a. Knowledge-based capital spending is often defined as the sum of gross fixed capital spending on computer software, research and development, mineral and petroleum exploration, and artistic works. The individual shares of current price spending on these to current price gross domestic product is shown above. In addition, investment in machinery and equipment and weapons systems also embody knowledge. While this is partly an outcome of knowledge-based capital spending, much of these forms of capital are imported and provide an independent source of knowledge. Accordingly, the combination of all of these forms of capital are referred to as investment with 'brains'. Some important aspects of such capital are not included, such as investments in workers' skills and organisational capabilities.

Source: ABS (*Australian System of National Accounts,* 2020-21 financial year, Cat. no. 5204.0).

Figure 1.8 – The latent capabilities of labour has been increasing slowly but steadily[a]

Annual changes in labour quality 1990-91 to 2020-21



a. The measure of labour quality is derived as the ratio of quality-adjusted labour inputs to hours worked.

Source: ABS (*Estimates of Industry Multifactor Productivity, Australia,* 2020-21 financial year, Cat. no. 5260.0.55.002).

Some indicators suggest slowing diffusion

Australia's poor productivity performance may partly be attributed to weakening diffusion of frontier technologies from overseas. The gap between global frontier firms and Australian firms (outside of the resources and financial market sectors) appears to have grown over time, with Australia firms catching up to the frontier more slowly than previously (Andrews et al. 2022). This is a general trend, observed for OECD countries more generally, with the concern that, while progress at the global technological frontier remains strong, there has been a breakdown in the diffusion 'machine' so that catch-up has flagged (Andrews, Criscuolo and Hansell 2019; van Ark, O'Mahony and Timmer 2008; OECD 2015b).

The widening gap between the global frontier and Australian firms does not appear to have occurred between laggards and leaders within Australia. The dispersion in labour productivity levels across firms has *fallen*, especially for wholesale trade, retail trade and construction (Campbell et al. 2019). Most of this reduction reflects catch-up by the bottom 25% of performers. This could imply improved diffusion within Australia and higher labour productivity growth than would have occurred had the gap not closed. However, it could also reflect decreasing firm entry rates in these industries as new firms are more likely to engage in experimental innovation activity, which increases dispersion (Campbell et al. 2019, p. 17) — implying a decline in innovation overall. The labour productivity gap of firms at the 75th percentile and 25th percentile is still wide.

Business entry and exits

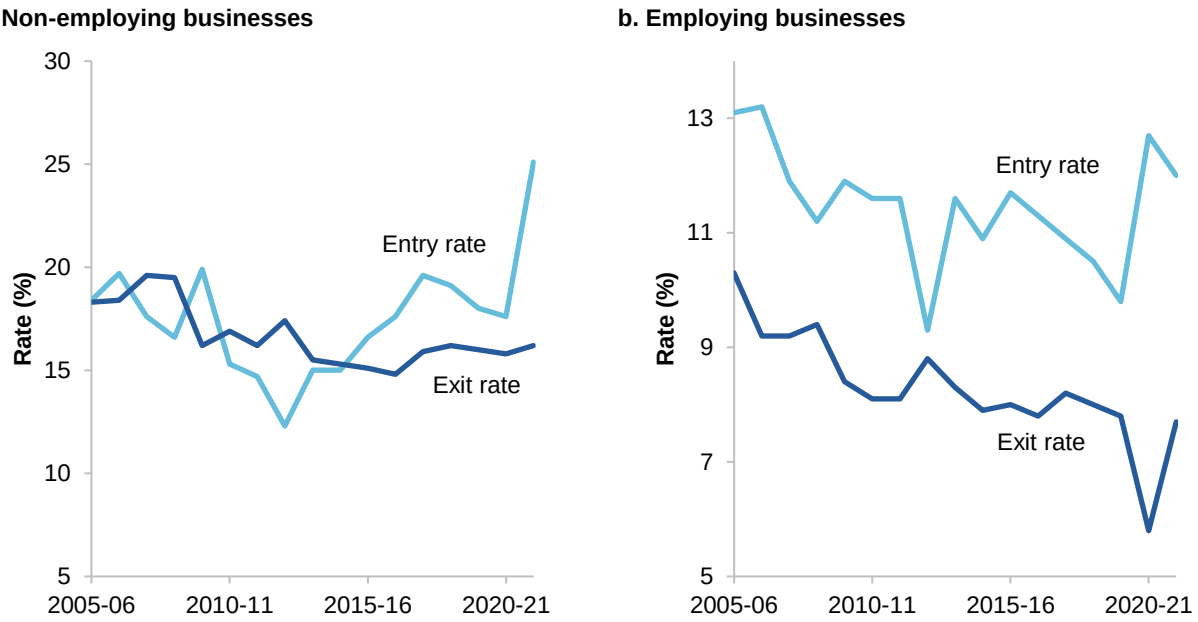
Business exits and entries are a potentially important dimension of business dynamism. New entrants increase competitive pressures on incumbent firms, increasing their incentive to improve and reduce costs through innovation (Aghion et al. 2005). New entrants also purchase a disproportionate share of old physical capital, providing an opportunity for incumbents to sell existing capital and buy innovative new capital (Ma, Murfin and Pratt 2021). New and younger firms also tend to be innovative and more likely to adopt new technologies, with start-ups and entrepreneurs often bringing existing ideas to new places or industries.

Recent empirical work also suggests that younger firms catch-up to the productivity frontier more quickly than mature firms (Berlingieri et al. 2020). However, not all new entrants thrive — many exit soon afterwards due to poor profitability and productivity.

There is some evidence of a weak downward trend in entry rates for employing businesses, but the rates are volatile (figure 1.9). While probably much less important for business dynamism, entry rates for non-employing businesses have *risen* significantly from 2012-13, partly due to the rise of self-employment in the gig economy, particularly in the ride-share and other transport industries — as highlighted in Ellis (2021) and this inquiry's companion volume *A more productive labour market*. (The data for 2020-21 and 2021-22 are non-representative, reflecting the impact of COVID-19.)

Figure 1.9 – Rates of business exits and entries showed generally declining rates prior to the COVID-19 pandemic[a]

2005-06 to 2021-22



a. Based on measures of exit and entries over the ABS's estimates of the counts of Australian businesses. There are minor discrepancies of numbers between successive statistical reports. The effects of the pandemic and various government policy measures to stimulate the economy explain the uncharacteristic results for 2020-21 and 2021-22.

Source: ABS (*Counts of Australian businesses, including Entries and Exits,* various years, Cat. no. 8165.0).

Firm exit rates in Australia have been trending down for employing businesses (and been largely static for non-employing businesses over the past five years). The downward trend partly reflects significant reductions in business-related bankruptcies and personal insolvencies (box 1.2), though the share of total business exits accounted for by such business failures is small. In any case, the changes in bankruptcy and insolvency laws in recent years have been to improve the efficient re-allocation of resources to avoid 'fire sales' and to enable fundamentally sound businesses to be restructured.

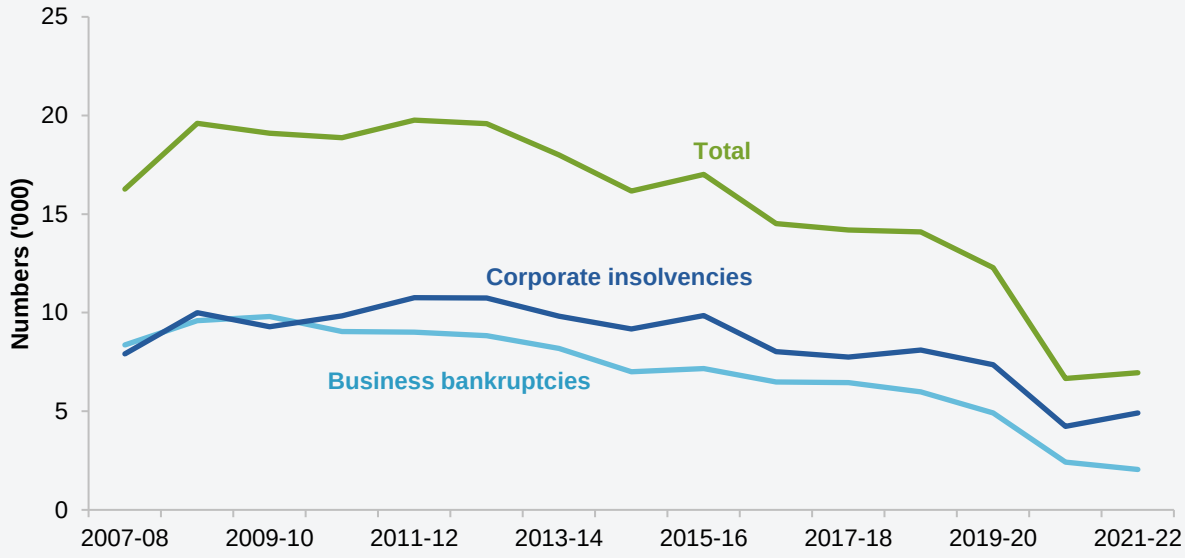
Box 1.2 – The role of bankruptcies and insolvencies in firm exit

In 2018-19, prior to the onset of the pandemic, bankruptcies and insolvencies were already at their lowest level since the late 1990s (RBA 2020, p. 33). By 2021-22, business bankruptcies and corporate insolvencies were less than half their 2018-19 levels (figure 1.10).

Several changes to Australia's insolvency and bankruptcy laws in recent years will have contributed to the decline in business exits and will do so in future years. In particular, reforms to Australia's corporate insolvency laws in September 2017 gave companies more breathing space to undertake a formal restructure rather than become insolvent (reforms introduced a safe harbour for company directors from personal liability for insolvent trading, and a stay on enforcement of ipso facto clauses).

Though its effects will not yet be obvious in the failure data, the introduction in January 2021 of a new formal debt restructuring process for small businesses is aimed at reducing exits of small businesses, while a simplified liquidation pathway is aimed at speeding up liquidation (and the subsequent reallocation of resources) for those businesses that do fail. The patterns in the past few years will also reflect the influence of pandemic business support programs such as JobKeeper and industry-specific supports, such as the COVID-19 Consumer Travel Support Program. Temporary changes were also introduced to insolvency arrangements during the COVID-19 pandemic as part of the package of business support measures, which reduced business failures below counterfactual levels.

Figure 1.10 – Business-related bankruptcies and corporate insolvencies declined between 2007-08 and 2021-22[a]



a. The total is the sum of Business bankruptcies and corporate insolvencies. Non-business bankruptcies are excluded. The estimate of bankruptcies for 2021-22 includes an estimate for the last quarter of the year.

Source: AFSA (2022) and ASIC (2022).

Of the remaining exits, many will not entail failure as businesses can cease due to retirement of the owner, re-structuring or the sale of a profitable business. Nevertheless, many other exits reflect poor productivity and profitability arising from unanticipated demand and supply shocks or management deficiencies.[11]

Declining rates of exits will be problematic to the degree that low productivity businesses survive, slowing the diffusion of best practice and using resources best allocated to more efficient businesses. While exits can be adverse for business owners and employees, they also build up entrepreneurial experience and encourage the acquisition of new skills.

The overall picture is that a smaller share of businesses exit than 15 years ago, particularly for employing businesses, which is where most activity in the economy is concentrated. Why that is the case and whether it really interferes with the 'diffusion machine' is not clear. Some evidence suggests that the number of businesses at the edge of financial viability ('zombie' businesses) has *not* risen as a share of all businesses since 2007, and that these businesses have had limited adverse effects on aggregate firm performance (Bowman 2022).

1.3 The policy levers for diffusion are different from those for novel innovation

Policies for business

Governments typically stimulate novel innovation through business tax concessions, grants and procurement policies, and via funding of public sector research institutions and universities. These policies recognise that innovation at the frontier involves especially high-risk activities, the returns from which are diluted because other firms can adapt the ideas without paying for them. These policies are also helpful for diffusion, because innovators absorb others' ideas; but they are not the main policy levers driving diffusion.

In general, the policy approaches to diffusion relate to the broader economic environment influencing firm behaviour and performance, which is a central concern of chapter 2 and other volumes of the Productivity Inquiry.

- Regulations can stifle or encourage diffusion. For example, a benign regulatory environment for foreign investment not only increases access to financial capital but is a conduit for adoption of best practice from businesses that often operate globally.
- Skilled migration does not just bring people with valuable qualifications into Australia, but people with tacit knowledge acquired from working in overseas organisations with more varied management approaches, technologies, and cultures than those available domestically.
- The education system is almost all about diffusion — spreading contemporary knowledge among people and giving them the skills to learn new ones.

Governments may themselves play a role in business knowledge diffusion though extension programs, regtech, and the provision of data and information that supports good decision making by firms (chapter 2).

Policies for non-market services

A large part of the economy and one central to many Australians' wellbeing is not in the market sector, but funded, organised and often directly provided by governments. In that case, governments act as the

[11] One survey of CEOs who had experienced a business failure found about one quarter attributed it to lack of leadership, 14% to a poor understanding of finance and about 10% to poor governance structures (Australian Centre for Business Growth 2018).

equivalent of business managers and shareholders in private entities, with the same challenges of management quality, adoption and diffusion. Their management quality and capacity to innovate, adopt and diffuse best practice is as important as it is for business (chapter 3).

In the case of the creation and diffusion of innovations for services provided or funded by government, different considerations come into play than for private organisations.

- The incentives are different — the model of vigorous competition between private business rivals that encourages adoption is hard to emulate for such services. Unlike most market activities, many government functions are delivered through monopolies. The productivity effects of insolvency and business exits on productivity are largely non-existent.
- There are also significant ethical issues in scaling up innovations unless they have a strong evidential basis. For example, the universality of service provision means that adopting a new approach to teaching affects the whole student population (who, given the compulsory nature of schooling, have no capacity to opt out as customers do for most private sector innovation). The social license to innovate is different in the public sector.
- Government agencies are more likely to have cultures antithetical to risk taking and innovation. Some risk-aversion may be justified when considering the potential human and taxpayer costs of errors. Nonetheless, the degree to which public service provision is overly conservative is something governments can change through new governance and recruitment arrangements.
- Scaling up of innovation also appears to be more challenging in the public sector than in the private sector because the specialised resources to replicate successful innovation are scarce, and because there are few people devoted to the task of explicit diffusion.
- Complex funding arrangements and split responsibilities between levels of government increase the transaction costs of diffusion, which have few parallels in business where joint ventures and collaboration are typically managed through robust contractual arrangements that maximise value for the parties. And while the multiple states and territories that make up Australia's federation can be a source of innovation, they can also make it costly to diffuse innovations (for example because of weak networking, incompatible computing systems and different bureaucratic processes).

Given these unique aspects, the policy antidotes for limited government diffusion (chapter 3) share only some commonalities with those that apply to private businesses (chapter 2). (Not-for-profit organisations straddle both groups, so that the lessons from chapters 2 and 3 will often be relevant.)

2. Enabling innovation diffusion in Australia

Key points

- **Promoting diffusion of established technologies and practices across firms and industries requires more generic policy settings than those that target 'new-to-the-world' innovation.**
- **Commercial and market settings ultimately provide incentives for firms to seek out and adopt innovations. But regulation and policy can either facilitate or unduly hinder the process.**
- **Adopting innovations developed overseas is critical to Australia's productivity. Linkages with overseas firms via trade and foreign direct investment (FDI) give Australian businesses access to information and ideas about innovation from the global frontier.**
  - Reducing trade barriers and FDI fees is important to maintain this channel for diffusion.
- **A firm's workforce — its managers and employees — determine its abilities to identify, evaluate and absorb external information and make the broader organisational changes needed to benefit from transformative technologies such as digital technologies.**
  - Skilled migrants often have knowledge of frontier technologies and practices and bring skills that are lacking in Australia. Measures to facilitate skilled migration would promote innovation diffusion.
  - Creating industry-agnostic research and training linkages to industry and removing barriers to university-industry collaboration enable researchers to apply their capacity-building knowledge and skills to industry.
  - Government training support should focus on transferable skills that augment the absorptive capacity of firms, such as digital and management skills.
- **Innovation diffusion depends on information. While industry organisations and business networks facilitate information flows and spillovers, businesses may benefit from more tailored information to help identify the need and opportunities for innovation.**
  - Data collected by government agencies can be used to help businesses benchmark their performance and provide insights that promote innovation. Benchmarking tools should be accessible (e.g. online) and include tailored results and case studies on best practice.
  - Government can directly increase the pool of knowledge available to businesses by requiring open access to government funded research and by partnering with intermediaries like industry associations.

As noted earlier, the obstacles to the diffusion of already known innovations and the policy levers to address these obstacles generally take a different form to those widely used to stimulate new-to-the-world innovation. In particular, the policies that promote diffusion of established technologies and practices in an economy tend to be more general and broad-based. They aim to affect all firms in all industries, not just those creating and commercialising new-to-the-world innovations.

These policies include:

- broad conditions that maximise the incentive for firms to experiment and adopt innovations
- facilitating the transfer of knowledge, skills and technologies from overseas
- building critical skills for firm-level innovation — management capabilities in particular
- enabling the flows of information that support good decision making.

Many of these policy areas are covered in companion volumes for this inquiry, as they relate to broader issues around creating a dynamic business environment (discussed in the *A competitive, dynamic and sustainable future* volume), flexible labour markets (*A more productive labour market*) and an education system that meets Australia's skills needs (*From learning to growth*). As such, while the relevant recommendations to improve these settings and their role in supporting diffusion are discussed throughout this chapter, the detailed analysis underpinning these recommendations are found in the respective companion volumes.

2.1 An enabling environment for diffusion of new knowledge and technologies

Framework conditions

The broad regulatory and financial environment in which businesses operate is important for diffusion. It shapes the incentives, resources and capabilities of firms to *adopt* established innovations and *adapt* them to their specific circumstances.

While decisions to adopt and adapt innovative product lines and processes predominantly rest with firms, governments can influence aspects of the environments in which these decisions take place, altering firm incentives and barriers to adoption.

Business and regulatory environment for innovation and its diffusion

Market conditions and exposure to competition

The relationship between competition and adoption of innovation works in several ways. Where businesses operate in a competitive environment, they face pressures to upgrade their product lines and processes (by reducing costs, or increasing variety or quality for consumers) or risk loss of market share to competitors that do so. Conversely, in the absence of competition, there may be less market pressure for businesses to innovate, but greater rewards for those who do.

Domestically, competition is not uniformly strong across product markets within the Australian economy. Some Australian markets are highly concentrated, including in sectors where scale economies are strong (such as supermarkets), firm entry is highly regulated (such as in banking), or competition is inherently weak due to natural monopoly characteristics (such as in electricity distribution and transmission).

But this does not, and need not, imply an absence of innovation. Increased market concentration at the aggregate level does not appear to result in lower firm entry — which would reduce sources of innovation

uptake (Bakhtiari 2020, p. 23). (See the Commission's companion volume on *A competitive, dynamic and sustainable future* for the Productivity Inquiry.)

However, exposure to international competition via trade has the potential to be an important source of innovation diffusion. Import competition provides local firms with an incentive to adopt innovations as a way to remain competitive, reduce costs and improve product lines and processes to maintain market share (Kiriyama 2012, pp. 15–16).

Exports also play a role. For exporting firms, access to overseas markets can expose them to more intense competition, while increasing the potential returns to innovation adoption due to a larger market size and allowing firms to spread the cost of innovation over a larger market (Bloom, Van Reenen and Williams 2019, p. 177). Innovation uptake is strongly correlated with exporting, with exporters 7–10% more likely to introduce new or significantly improved products or processes than non-exporting firms (Tuhin 2016, p. 2).

Regulatory and administrative procedures

When done well, regulation can protect against harms without unduly affecting the incentive to innovate. Indeed, while often not intended, regulation can even encourage diffusion due to its effect on the capabilities of businesses. Single Touch Payroll and My Health Record (both discussed in the inquiry's companion volume *Australia's data and digital dividend*), and the growing importance of 'regtech' (PC 2020h, and discussed in chapter 3), have encouraged many businesses to go digital, or have lowered the costs of compliance, reducing businesses' administrative inefficiencies. Competition policy limits the market power of large dominant incumbents, facilitating entry and discouraging complacency.

Nevertheless, poorly designed regulation can reduce incentives for existing firms to adopt productivity-enhancing technologies and practices, and prevent new entrants from bringing innovative ways of doing things into an industry or country (OECD 2015a, p. 79). This is likely to be particularly limiting for labour-intensive service industries where innovation diffusion relies more on adoption of new business models and processes as a vehicle for experimentation (rather than large capital investment or traditional R&D) (PC 2020f, p. 37). For example, adoption of new approaches could be hampered by regulations that:

- create barriers to entry, for example, barriers to entry in retail pharmacy. On the one hand, pharmacy regulations eliminate competition from other potential providers, stifling technology, while conversely, the potential role of pharmacists to take on some clinical roles is limited by scope of practice restrictions
- reduce the scope to use technology as a replacement or complement to labour input, for example, because of workplace agreements
- curb incentives of business managers and directors to take risks with innovative new approaches, for example, because of personal or professional liability concerns, including in contracts with governments (AICD, sub. 44, p. 3; Consult Australia 2018, p. 8)
- limit scope to employ staff skilled in new technologies or processes because their qualifications or skills are not recognised in the relevant jurisdiction
- presume the use of a particular technology to enable compliance, or specify the means by which compliance must be achieved (compared with performance-based regulation, which specifies required outcomes or objectives) (Attrey, Lesher and Lomax 2020, p. 6)
- favour, through industry or product standards, incumbents using existing technology or processes
- limit capacity to use an existing building or site in an innovative manner, for example, because of the way the site is zoned or the need to undergo a lengthy redevelopment approval process.

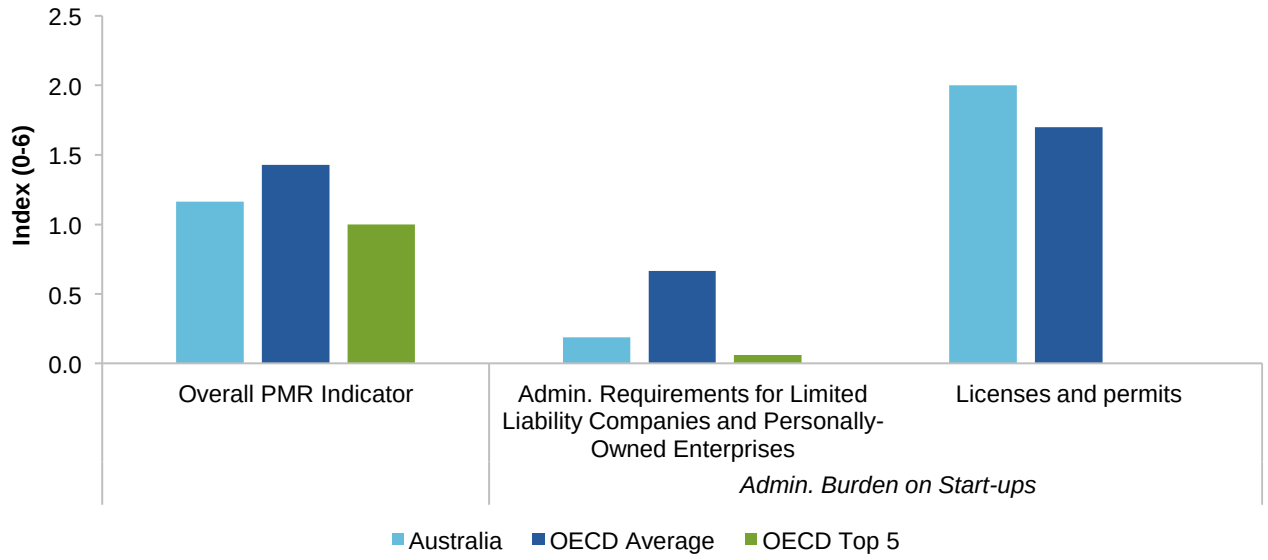
As this list indicates, there is no single regulatory policy lever that drives innovation and diffusion. Rather, it is the 'hard grind' of regulatory design and implementation on multiple fronts that makes a difference, supported by strong frameworks like transparent regulatory impact analysis.

In many cases, progress is being made, such as Automatic Mutual Recognition of occupational licences, reforms to bankruptcy and insolvency arrangements over the past five years (box 1.2 in chapter 1) and the increasing awareness of the need for technology-neutral regulation. Overall, regulatory barriers to firm entry and expansion are generally lower in Australia than in most OECD countries (figure 2.1) (OECD 2018).

But the regulatory thickets caused by the accumulation (and combination) of past rules still limit the pathways for firm-based innovation. The unglamourous task of achieving greater regulatory neutrality in specific areas is arguably more important to the economy's innovative capability than many of the policies aimed at high-end new discoveries.

Figure 2.1 – Australia has relatively light administrative requirements to set up businesses but burdensome licensing and permit requirements[a,b]

OECD Product Market Regulation Indicators, sub-categories 2018



a. Index scale from most to least competition friendly (0 to 6). 0 represents international best practice. Admin. requirements measures the costs of complying with requirements to set up new businesses; licences and permits measures the existence of measures to simplify licensing procedures. **b.** NSW data has been used by the OECD as representative for Australia.

Source: OECD (2018) *Product Market Regulation Database*.

Access to finance

Uptake of innovative new product lines and processes can be costly to finance. For firms with relatively low access to internal resources, including many small businesses and start-ups, access to external finance could be crucial to adopting new approaches. Well-functioning financial markets can therefore play an important role in supporting business innovation uptake (Levine 2005, p. 871).

Australian businesses frequently report access to external financing as a barrier to innovation. One in five businesses (19.7%) reported such problems in 2019–21 (figure 2.2) and this increases to almost 30% when considering only firms engaged in innovation.[12]

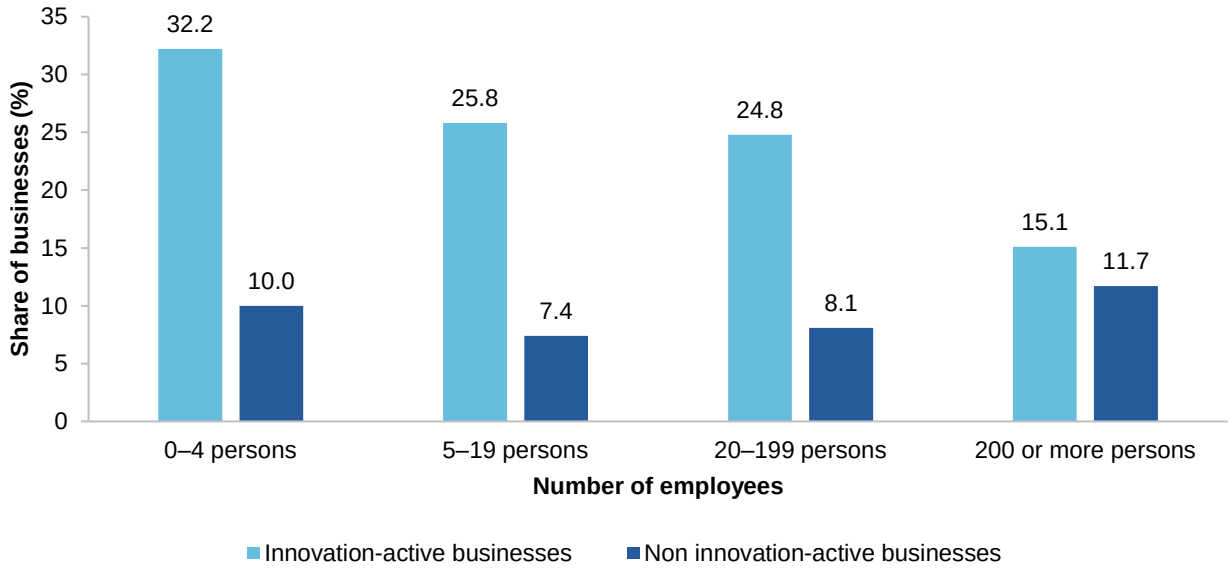
These difficulties are more acute for firms that are small and/or young (Kido et al. 2020, p. 7). Small businesses, in particular, typically do not have assets to use as collateral for debt finance, and unsecured

[12] This is likely a lower bound estimate as it does not capture firms that were dissuaded from even seeking finance.

finance may not be available (PC 2021d, p. 2) or may attract a higher interest cost, reflecting the increased risk for the lender (Connolly and Bank 2018). Small firms can also be more exposed to volatility than larger firms, which can further raise the risk premium included in their cost of finance (PC 2021d, p. 9). In Australia, the differential in the cost of finance (that is, the difference between interest rates charged on borrowed funds) for small and large firms is larger than the OECD average (OECD 2021, p. 95).

Figure 2.2 – Businesses frequently report access to additional funds as a barrier to innovation

Lack of additional funds as a barrier to innovation, 2019–21[a]



a. Innovation-active firms are firms that reported one or more innovations, or firms with abandoned or ongoing innovation activities related to product or process innovations.

Source: ABS (*Characteristics of Australian Business*, 2020-21 financial year, Cat. no. 8158.0).

Australia's prudential rules for lending to SMEs are more stringent than international standards, which partly explains the relatively lower availability of capital for SMEs — particularly for loans not secured by property (PC 2018, p. 35). Changing the underlying prudential requirements for SME business lending would significantly improve SME access to finance (PC 2018, p. 32). Changes to capital adequacy requirements for authorised deposit-taking institutions that commenced in January 2023 could support banks' SME lending going forward (APRA 2022). In particular, the risk weights applied to SME lending that is not secured by property have been lowered from 100% to 75% for lending less than $1.5 million in size, and 85% for lending above this amount (APRA 2021, p. 36). This could facilitate more access to finance by SMEs and more readily enable business uptake of innovation.

More broadly, Australia's SME lending market is evolving as new lenders and loan products emerge and the diffusion of overseas innovations in the use of data and AI opens up new ways for many SMEs to access finance (PC 2021d, p. 2). This includes lending against intangible assets (such as invoices and other expected receipts) and on an unsecured basis. The Productivity Commission has observed that the relatively small funding market for newer lenders in Australia could constrain lending to SMEs via these channels (PC 2021d, p. 3). Recent government initiatives — such as the Australian Business Securitisation Fund (ABSF) — have sought to expand the pool of capital available to these lenders through securitisation. In addition to investing in funding facilities that are providing capital to SME lenders, the Australian Office of Financial Management — in administering the ABSF — has also supported more standardised reporting of SME loan data, which could facilitate more accurate

assessments of loan quality (by investors and credit ratings agencies) and therefore more willingness to provide capital to these lenders (PC 2022d). This could eventually further improve SME access to finance and support businesses that require additional capital to invest in innovation.

How these recent initiatives, including APRA's changes to capital adequacy requirements and the activities of the ABSF, have affected SME access to finance is unclear, as it is too early to fully assess their impacts across the Australian economy. The government should monitor the effects of these initiatives on SME lending over time to understand whether they are having the desired result and whether adjustments or further responses are required to reduce barriers in accessing finance. This monitoring may require more detailed and comprehensive data collection on business lending, for example by APRA, as existing datasets are relatively aggregated and typically do not capture SME lending by smaller lenders (which new market entrants tend to be) (PC 2021d, p. 46).

Finding 5.1
A business environment conducive to diffusion

The business environment provides the incentives and capabilities for firms to adopt innovations. The policies that shape the business environment to promote diffusion of established technologies and practices tend to be more general and broad-based than those that target new-to-the-world innovation. They aim to affect all firms in all industries, not just those investing in creating and commercialising highly novel innovations. Policies that promote openness and competition, implement well-designed regulation and improve access to finance all play a role.

Recommendation 5.1
An enabling environment for small business access to finance

The Australian Government should monitor the effects of APRA's changes to capital requirements and risk weights for loans to small and medium enterprises (SMEs) that are not secured by property, and the activities of the Australian Business Securitisation Fund, to understand whether they are having the desired impacts on SME lending. Adjustments or further responses could be required if barriers to SMEs accessing finance remain. APRA may need to collect more detailed data about business lending to enable the government to undertake this monitoring.

2.2 Facilitating the diffusion of innovations developed overseas

As a small open economy, Australia has a comparative advantage as an importer and adapter of advanced technologies and other productivity enhancing innovations, because our relative size means that it is not optimal for us to invent everything domestically (Ferris, Finkel and Fraser 2016, p. 13; Hemmings and Park 2017, p. 10). The diffusion of innovation from overseas is facilitated by trade and investment between Australian and foreign firms — particularly those firms that are at the global frontier for a given good or service.

Evidence from Andrews et al. (2022) showed that the productivity gap between the global frontier firms and Australian firms is growing over time. The implication is that the gains from diffusion of technology from overseas are getting larger and more valuable over time. An Australian firm can make huge gains simply by adopting processes and technologies from global frontier firms, or patterning its products and services on theirs. Nevertheless, only 3% of innovating firms in Australia introduce *processes* and 7% of firms introduce *products* that are new to Australia but not the world (figure 1.2). Most innovating firms use products and processes that are new to their firm only, implying that there may be potential for facilitating increased diffusion of innovation to Australia from foreign sources.

Trade connects Australian businesses to the global frontier

Importing and exporting goods and services are major channels through which trade can facilitate innovation diffusion to Australian firms. Information and ideas about innovation are more likely to come from one's supply chain, that is, from suppliers or from customer firms (figure 2.9, below). Given that most innovation comes from overseas, it is particularly valuable for Australian firms to be importing from (or exporting to) firms overseas.

As importers, Australian firms can access frontier innovation via imports of capital goods and intermediate inputs that embody new technologies. Using imported goods can give firms new ideas for product lines and processes (Kiriyama 2012, pp. 9–10), and facilitate innovation through imitation, 'leading to product cycle, in which products are first invented in some parts of the world, and then imitated in others' (Melitz and Redding 2021, p. 3). This also applied for services imports, which could become an increasingly important channel for diffusion of innovations from overseas as global trade in services increases in the future (as discussed in this inquiry's companion volume *A competitive, dynamic and sustainable future*). For example, in the technology industry, exposure to foreign ideas has already informed the creation of new products, platforms and services in Australia:

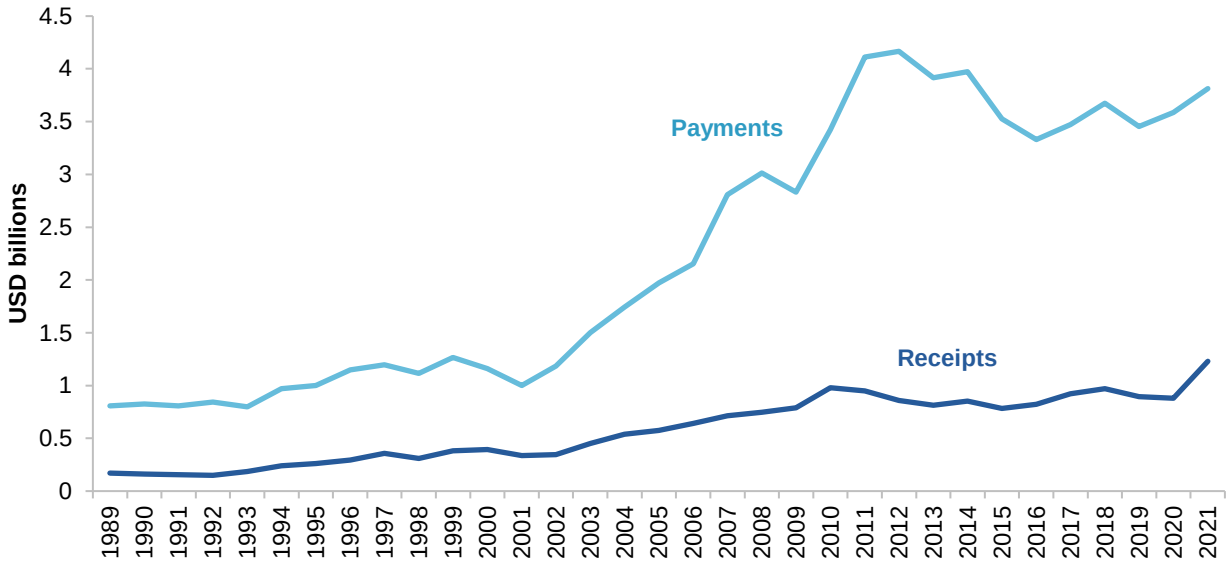
> Australian marketplaces Catch and Kogan were created out of businesses originally developed on ebay.com.au. Similarly, the founders of Afterpay built and leveraged their knowledge of e-commerce on eBay to drive new innovations in payments while thousands of Australian pure play online retailers have been able to grow from small to larger businesses on eBay. (eBay, sub. 114, p. 2)

Complex capital goods, like semiconductors, require advanced knowledge and some vendors are willing to transfer this knowledge so that importers can effectively use these goods (Kiriyama 2012, p. 10). Supply chains are a major source of innovation diffusion even in the service sector. Supply chain management systems like Systems Applications and Products (SAP) software create the potential for diffusion by facilitating information flows across businesses.

Firms can also import intangible technology in the form of intellectual property licences, 'increasing the pool of ideas' for innovation (Kiriyama 2012, p. 14). Australia is a net importer of innovation, with payments for foreign intellectual property far exceeding the receipts of Australian intellectual property sales (figure 2.3).

Figure 2.3 – Australia imports significantly more intellectual property than it exports[a]

Intellectual property payments and receipts



a. Charges for the use of intellectual property (BoP, current USD).

Source: World Bank (2021a, 2021b).

Barriers to trade take the pressure off domestic incumbents to adopt global best practice, by weakening competition and by lowering product variety. The Indian motor vehicle industry provides a vivid international example. Until the 1980s, the lack of import competition and diffusion meant that most Indian car manufacturers used 1950s vintage technology (Sagar and Chandra 2004, p. 2). Australia was never so bad, but there is good evidence that trade liberalisation promoted productivity in domestic firms (Bloch and McDonald 2001).

Indeed, Australia has successfully implemented reforms removing many of the traditional barriers to international trade in goods, such as import tariffs and quotas. But trade barriers can come in other forms. Anti-dumping regulations still provide significant protection for some narrow product classes. Many barriers to trade in services remain in place, particularly so-called 'behind the border' barriers, such as foreign licensing restrictions. The key question is whether these and other trade barriers (for example, quarantine provisions) have any material impacts. This is further discussed in the inquiry's companion volume *A competitive, dynamic and sustainable future*, which recommends the government reduces such barriers by immediately reducing Australia's statutory import tariffs to zero and progressively removing existing anti-dumping and countervailing measures.

Regulatory restrictions on particular types of technologies can also impede innovation diffusion from overseas — for example, outdated vehicle design rules that preclude a freight business from importing a vehicle that is more productive than currently permitted vehicles (Terrill, Burfurd and Fox 2022, p. 29). Slow approval processes for pharmaceuticals and other medical technologies can reduce the diffusion of interventions that are more effective than existing ones, or can prevent us from resolving a shortage of any given pharmaceutical, reducing the effectiveness ('productivity') of health care. Issues of regulatory barriers can be addressed by more responsively and quickly updating compliance requirements for industry or, in some cases, could be solved by more widely aligning with or accepting international standards, wherever practicable (see the Commission's companion volume, *A competitive, dynamic and sustainable future*, which recommends that governments increasingly accept product standards adopted in other leading economies as 'deemed to comply', provided that a transparent review can be undertaken where a significant safety risk is identified.

For exporters, competition with goods and services from overseas provides exposure to new ideas and creates incentives to adopt those ideas. And access to larger markets can make some technology adoption more feasible, if the technology requires a larger scale to be viable (Bloom, Van Reenen and Williams 2019, p. 177). For firms in the business-to-business segment, they may be selling to overseas firms who introduce them to more advanced systems and expectations. There is strong evidence that as firms become exporters, their productivity increases significantly, in part due to the diffusion of innovation (Melitz and Redding 2021, p. 26). For example, exporting by SMEs in the manufacturing and professional, scientific and technical services industries is associated with an increased probability of introducing new-to-market innovations compared with non-exporting SMEs (Majeed and Breunig 2021, p. 15).

Finally, importers and exporters may learn about overseas innovations through more informal channels; participating in trade conferences, business networks, and so on (discussed in section 2.4). Other Australian firms may also learn about productivity-enhancing technologies or superior organisational and managerial practices via knowledge spillovers from other trade-exposed Australian firms (Ciuriak 2013, p. 36; Saia, Andrews and Albrizio 2015, p. 9) and simply inspecting new goods can generate ideas (Kiriyama 2012, pp. 9–10). However, firms need to have sufficient 'absorptive capacity' to identify and incorporate these ideas and practices into their operations (section 2.3 and box 2.3).

Finding 5.2
Trade is an important source of knowledge diffusion

Trade enables Australian firms to access information and ideas about innovation from the global frontier, via their suppliers and customers. Imports are an important source of diffusion of intangible technology, with the value of Australia's imports of foreign intellectual property far exceeding intellectual property sales. And for exporters, selling to overseas customers and competing with overseas firms provides exposure to new ideas and incentivises the adoption of product and process improvements.

Foreign direct investment is an important source of knowledge and expertise for Australian firms

Looking at trade between OECD countries, Bournakis, Christopoulos and Mallick (2018, p. 14) concluded that 'imports together with FDI [foreign direct investment] are crucial vehicles for diffusion of foreign knowledge' (see also PC 2020c, p. 7). This is because it involves a material level of control and influence[13] by the foreign investor, who is involved long term and provides much more than a source of financial capital to firms. FDI brings expertise, new business models, technologies and processes as well as global connections, which can spread knowledge and good management practices to Australian firms. Majeed and Breunig (2021, pp. 12–13) found that for the average Australian firm, foreign ownership was nearly as likely to result in the firm introducing new-to-Australia and new-to-world innovations as firms conducting their own R&D.

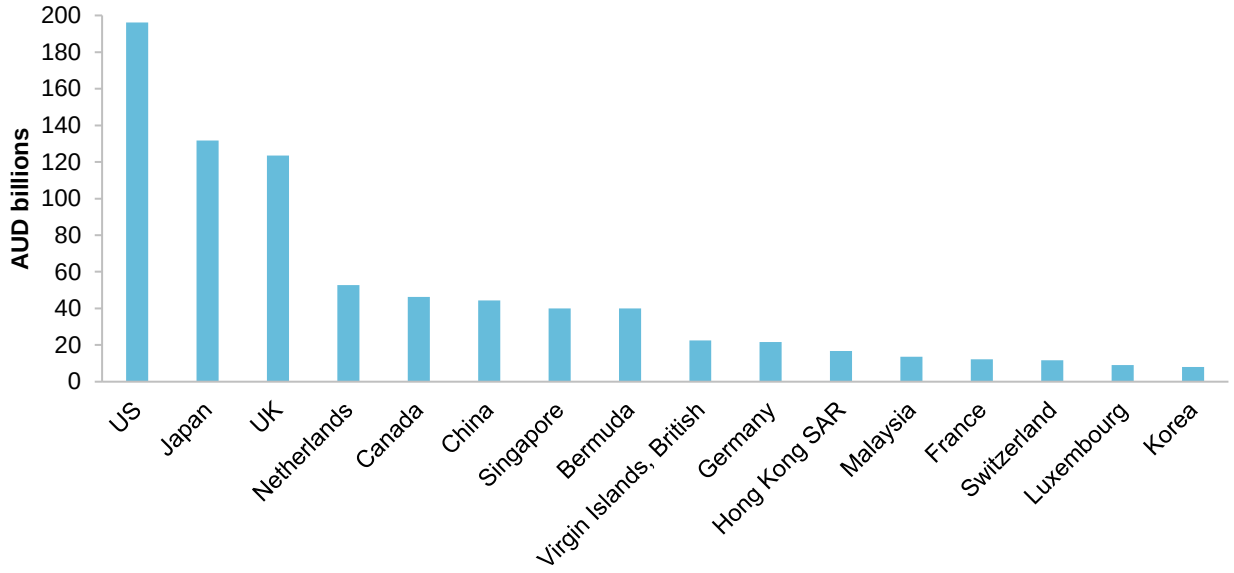
Just as international trade in goods and services facilitates diffusion from the global frontier via several interrelated channels, FDI can facilitate innovation diffusion to Australian firms via several interrelated channels. These include FDI that takes the form of investment in R&D; knowledge spillovers from

[13] FDI is investment in an enterprise or asset where the foreign investor has control or a significant degree of influence over its management. Generally, investment is considered to be direct when an investor has 10% or more of the voting power in an organisation.

multinational corporations to domestic firms; and spillovers to competing firms in the same industry as those receiving FDI (Kiriyama 2012, p. 12; PC 2020c, p. 58). Given that over 50% of Australia's inward FDI comes from advanced economies — the United States, Japan, the United Kingdom, the Netherlands and Canada (figure 2.4) — it is likely that FDI creates significant opportunities for technology spillovers.

Figure 2.4 – Over $450 billon of Australia's inward FDI comes from the United States, Japan and the United Kingdom

Australia's main sources of foreign direct investment, 2020



Source: Austrade (2021c).

In addition, although the literature focuses on inbound FDI as the more significant channel for diffusing innovations from overseas, outbound FDI also represents a potential source of new ideas and knowledge. For example, Australian businesses making direct investments in overseas companies may learn about and bring back product and process innovations that can be implemented in their domestic operations. This channel could become more important in the future as Australia increasingly exports equity capital, such as through outbound investment from our growing superannuation funds (noting that much of this will occur as outbound portfolio — rather than direct — investment, which would not have the same diffusion benefits).

Investment in R&D

Foreign investment in R&D can be a channel for diffusing innovation from the global frontier as it provides a mechanism for innovations to be adapted to the Australian market, as well as transferring skills and knowledge to Australian firms.

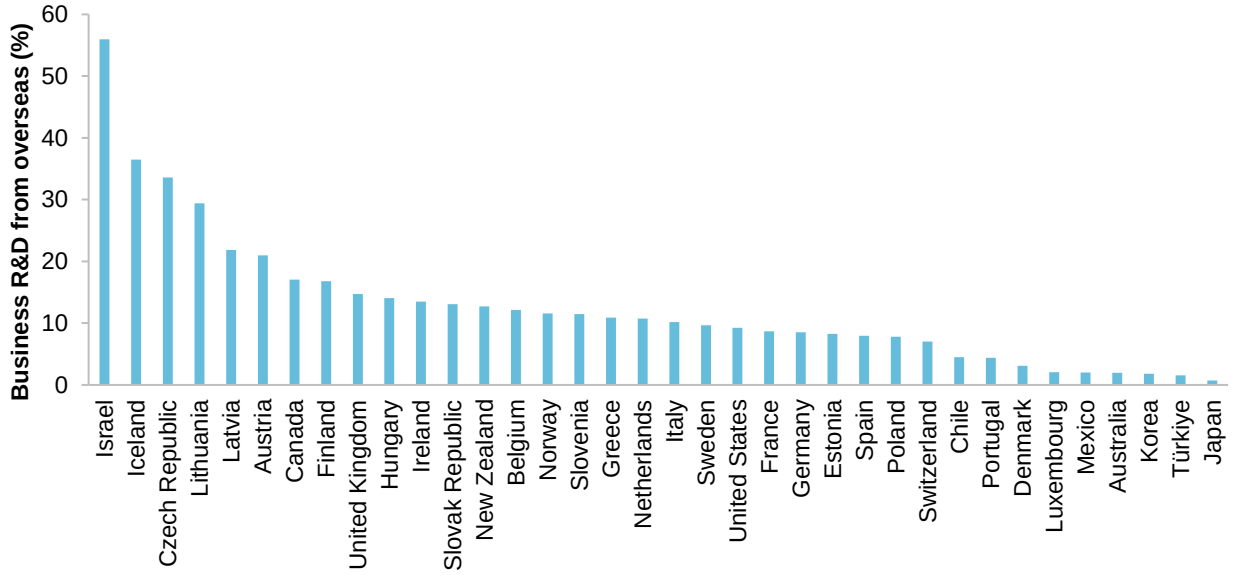
R&D can facilitate diffusion of innovation by being a channel for multinational corporation investment to adapt innovations to the Australian market. For example, Neoen, which has invested more than A$3 billion in Australian renewables since 2012, 'has also tested and deployed batteries at a large scale and with significant innovation. These projects were undertaken in collaboration with Tesla and network operators' (Austrade 2021b). Similarly, Accenture has announced it will establish the 'Accenture Adelaide Hub', which 'will include the development of National Security Operations and Cyber Defence capabilities, new Advanced Technology Centres of Excellence in areas such as Oracle, SAP, Splunk and Salesforce and Intelligent Operations capabilities to develop and deploy advanced analytics and artificial intelligence' (DTI 2020). As

well as creating novel innovations, these initiatives can serve to diffuse ideas and expertise from abroad to the Australian market.

In 2019-20 about $351 million invested by businesses in Australian R&D came from overseas, representing about 1.9% of the total spent by businesses on R&D in Australia (ABS 2021c), which is very low compared with the rest of the OECD (figure 2.5). This suggests that encouraging FDI may increase investment in R&D from overseas sources that bring the potential for innovation diffusion.

Figure 2.5 – Compared with other OECD economies, relatively little Australian R&D funding comes from overseas[a]

Business expenditure on R&D from overseas sources, OECD 2019



a. OECD data: this table presents research and development (R&D) expenditure statistics performed in the business enterprise sector by industry according to the International Standard Industrial Classification (ISIC) revision 4 and by source of funds (business enterprise, government, other national funds, and funds from the rest of the world).

Source: OECD (2022a).

Knowledge spillovers

Inward FDI leads to interactions between multinational corporations and their domestic customers and suppliers that can generate spillovers — sometimes referred to as 'vertical spillovers' (Criscuolo and Timmis 2017, pp. 71–72). These can include spillovers of technology, innovation, technical know-how and management capability (PC 2020c, p. 58) that lead to improved general productivity for local firms (BCA 2010; McKissack and Xu 2016, p. 11; Roy 2016, p. 152). For example, multinational corporations may demand more or better-quality inputs from suppliers, and may directly share knowledge and technology and encourage the adoption of new practices to achieve this (box 2.1).

FDI can have a direct impact on Australian workers' skills and knowledge as foreign-owned firms provide formal (such as seminars or courses) and informal (such as on-the-job) training to their workers (PC 2020c, p. 62). In the services industry, spillovers can occur when multinational corporations partner with training providers to improve the training and skills of their workers and of their customers' and suppliers' workers. For example, in 2022 Apple expanded its partnership with RMIT University and the University of Technology Sydney to deliver coding and iOS training in Australia (Apple 2022).

Innovation diffusion can also occur through 'horizontal spillovers' to their competitors. Local firms may 'observ[e] foreign firms, or diffusion might occur from labor turnover as domestic employees move from foreign to domestic firms' (Keller 2021, p. 10). A major potential channel for horizontal spillovers is the movement of workers between firms (section 2.4). However, empirical evidence of these spillovers is harder to observe (Gorg and Greenaway 2004, p. 1; Mistura and Roulet 2019, pp. 13–14), with some studies finding supporting evidence for horizontal spillovers (Javorcik and Spatareanu 2008, pp. 12–15) and some finding no evidence (Javorcik 2004, pp. 13–17; Newman et al. 2015, pp. 179–184).

Box 2.1 – Examples of FDI that potentially yielded broader spillovers

Foreign investment creates potential channels for knowledge spillovers, such as:

- spillovers from multinational corporations' FDI that creates hubs and networks for local firms:
  - GE Additive, a subsidiary of GE, has partnered with the University of Sydney to 'establish capabilities in metal additive manufacturing technology at the Sydney Manufacturing Hub, a space for training specialists and academics working in additive manufacturing, and the incubation of small to medium manufacturing enterprises' (University of Sydney 2020)
- spillovers from multinational corporations sharing capital goods, infrastructure and expertise:
  - Mitsubishi Heavy Industries has invested in Australian Green Hydrogen and Green Ammonia projects (MHI 2020)
- spillovers from multinational corporation investment in R&D:
  - IP group (UK-based) and the Clean Energy Finance Corporation have 'invested in Hysata … [whose] advanced electrolyser technology has the potential to significantly improve the efficiency of hydrogen production' (Austrade 2021a).

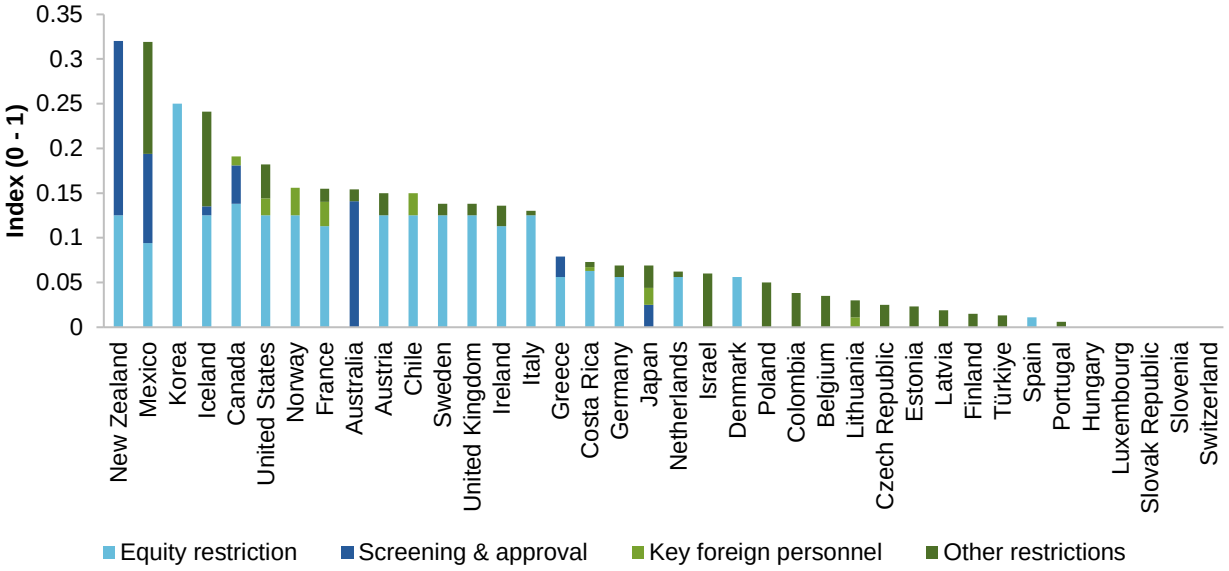
Government has a role to play in FDI regulation

The Australian Government has an important role to play in keeping barriers to FDI low. Australia's foreign investment approvals process is seen to impose more significant screening processes than other OECD economies (figure 2.6) (IMF 2021, p. 22). These screening processes have been tightened in recent years for a range of reasons, including during COVID-19. These restrictions arguably create an additional burden — in time, compliance cost and uncertainty — to potentially desirable investments.

The Australian Government also sets application fees for foreigners seeking to invest in Australia (regardless of whether the investment is allowed to proceed). As discussed in the inquiry's companion volume *A competitive, dynamic and sustainable future*, these fees are in excess of recovering the costs incurred by government in assessing applications and they continue to rise, which poses a risk of chilling FDI flows and lowering the associated productivity benefits. That companion volume notes that FDI application fees should not be used as a tax base and recommends that adjustments (such as indexation to investment thresholds and changing fee tiers) should be made to fees for FDI into agricultural land assets to bring them in line with other forms of investment.

Figure 2.6 – Australia's FDI restrictions are mostly screening and approval[a]

OECD FDI Regulatory Restrictiveness Index, 2020



a. Scores range from 0 (open) to 1 (closed).

Source: OECD (2022c).

Finding 5.3
FDI brings knowledge and new technologies into Australia

Foreign direct investment (FDI) is a critical channel for diffusing knowledge and technologies developed overseas to Australian firms. While Australia is very open to foreign investment, with relatively high FDI as a share of the economy, its FDI screening and approval processes are viewed as more restrictive than in other OECD countries. Australia's FDI fees are in excess of cost recovery and could risk chilling FDI flows.

2.3 Diffusion through human capital

Building Australia's human capital can assist diffusion

The skills and knowledge embodied in the workforce — in economic terms, the stock of human capital — is fundamentally important for innovation adoption and productivity more broadly. Human capital is the technical and tacit knowledge of a firm's workforce and management, which can be built through channels such as formal education and work experience, and through connections and interactions with other businesses, organisations and networks. It is a critical component of a firm's 'absorptive capacity' (box 2.2) — that is, a firm's ability to learn from and capitalise on the innovation and research of others (Cohen and Levinthal 1989, pp. 569–570).

Box 2.2 – Human capital is the foundation of firms' absorptive capacity

Human capital can improve a firm's absorptive capacity in several ways.

- **Having an in-house research capacity**. This can increase a firm's ability to identify and recognise the value of new, external information; assimilate it; and apply it to their circumstances. For example, undertaking R&D can facilitate innovation adoption to the extent that an existing research capacity lowers the cost of finding and learning about existing technologies (Bloom, Van Reenen and Williams 2019; Cohen and Levinthal 1990, pp. 148–149). In a meta-analysis of 241 studies on innovation, knowledge transfer and absorptive capacity, Zou, Ertug and George (2018, pp. 97–98) confirmed statistically significant positive relationships between measures of absorptive capacity and innovation, as well as between absorptive capacity and the ability of a firm to recognise the value of, assimilate and apply external knowledge.
- **Having employees with sufficient technical and tacit knowledge**. The skills and knowledge embodied in a firm's workforce is also an important factor in how easily a firm can identify new and existing technologies, learn the principles of how they work and how to use and adapt them to the firm's specific circumstances. While traditional innovation policy tends to focus on the stock of researchers capable of undertaking R&D, the successful diffusion and productive use of new technologies also relies on the capabilities of the workforce more broadly (Criscuolo et al. 2021, p. 11; Griffith, Redding and Van Reenen 2004, p. 890). Technical and tacit knowledge allows workers to identify and learn about new technologies and practices, and to adapt them for the firm's specific needs and market. While this can mean employing researchers, engineers and technicians, firms can also access needed skills and capabilities through collaborating with or contracting out their innovation needs to other businesses, research institutes and universities.
- **Having employees with specific frontier knowledge**. For example, a firm's employees may know about existing technologies because of prior work experiences and connections with other businesses. In fact, businesses get most of their ideas for innovation from their own employees or from businesses owned by the same company (ABS 2022a). This is in large part a result of workers moving from one firm to another and bringing the ideas and approaches of their previous firm to their new employer.
- **Having high-quality managers and organisational capital**. A firm's management is an important component of absorptive capacity. Firms may need to adapt and re-organise production processes and workflows to make the best use of newly adopted technologies. While this is particularly the case with more complex technologies like IT and digital technologies (Andrews, Nicoletti and von Rueden 2020, p. 10; Bloom, Sadun and Reenen 2012, pp. 196–197; Pellegrino and Zingales 2018, pp. 14–23), better management — acquired through training or bringing on people with the necessary management experience — independently increases productivity. Better management also complements productivity gains realised from technology transfer, increasing the benefits from adopting technologies embodied in capital goods (Giorcelli 2019, pp. 139–140). More generally, a more adaptable and creative workforce will be better able to adjust to new processes and products.
- **Having diversity in the managerial cohort**. Increasing the diversity of managers in firms can improve the variety of skills, perspectives, tacit knowledge and innovative ideas within firms. Economic theory predicts that too little diversity may prevent complementarities arising between different skill sets, knowledge and practices (Alesina, Harnoss and Rapoport 2013, p. 2). There is an observed productivity premium associated with greater diversity amongst managers (Criscuolo et al. 2021, pp. 32–39) — though it should be noted that management diversity may be correlated with other productivity enhancing recruitment practices, making the size of this premium unclear.

The quality of a firm's management is also a factor in how successfully new technologies are adopted and used by the firm. Managers have a disproportionate role in firm-level productivity to the extent that they are responsible for 'deciding what to do' and 'getting the organisation to do it' (OECD 2019a, p. 8), including decisions about innovation.

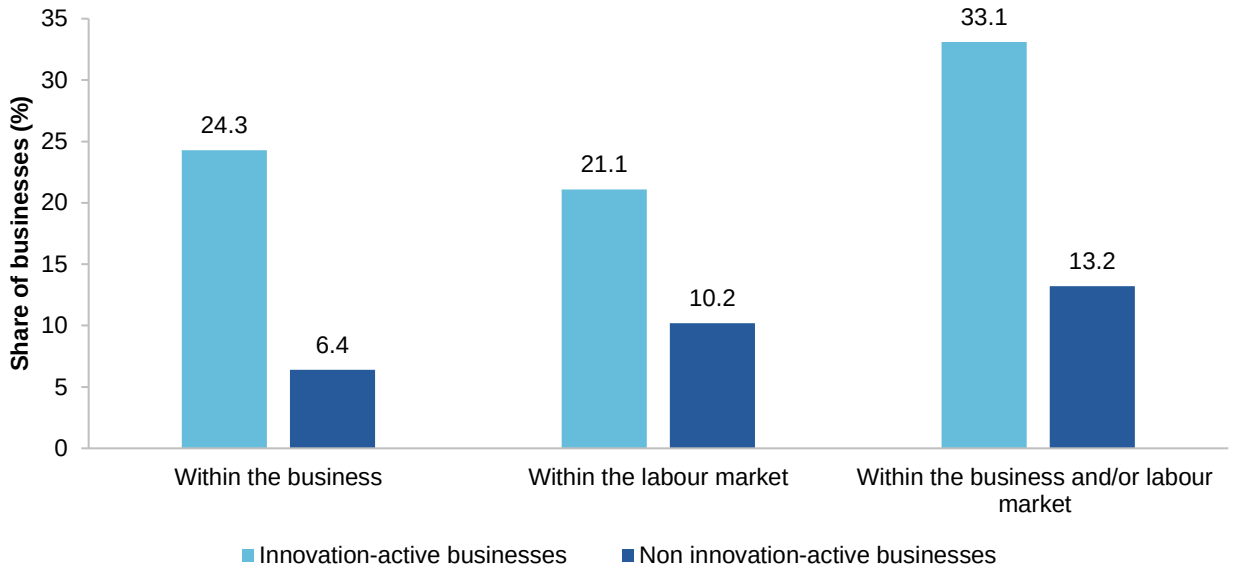
In Australia, innovation-active businesses report more frequently monitoring Key Performance Indicators (KPIs), offering performance bonus schemes and employing Principal Managers under the age of 50 years compared with non-innovation-active businesses (ABS 2017). Moreover, better management practices increase the likelihood that firms will introduce new-to-market innovations (Majeed and Breunig 2021, p. 12), or innovate at all (Gahan et al. 2016, p. 60).

Lack of skills and management capabilities is a barrier to the diffusion of innovations

A high proportion of Australian firms report a lack of skilled labour as a barrier to innovation (figure 2.7), both within their business and in the broader labour market. About one third of innovation-active firms[14] report that a lack of skilled labour is a barrier, suggesting that a perceived skills deficit constrains the extent and/or types of innovation undertaken even by businesses that are already innovating.

Figure 2.7 – Firms report a lack of skilled labour as a barrier to innovation[a]

2019–21



a. Innovation-active firms are firms that reported one or more innovations, or firms with abandoned or ongoing innovation activities related to product or process innovations.

Source: ABS (*Characteristics of Australian Business*, 2020-21 financial year, Cat. no. 8158.0).

Moreover, businesses that are not actively engaged in innovation are also constrained by a lack of skilled labour, suggesting that a lack of appropriately skilled workers may also deter businesses from innovating in the first place. Skilled labour gaps are felt more acutely as a barrier to innovation by SMEs than larger firms. As noted by the Australian Small Business and Family Enterprise Ombudsman (ASBFEO):

[14] An innovation-active business is one that introduced any type of innovation and/or had innovation that was still in development or abandoned during the survey reference period (here, the two years ending 30 June 2021).

> It is difficult for small businesses to take up technology opportunities without adequately skilled staff. (ASBFEO, sub. 64, pp. 3–4)

Another area of skill shortage, and one that may be less obvious to firms, is in management skills. As argued in chapter 1 of this report, and previously discussed by the Commission (PC 2020g, pp. 20–22), limited management capability may be holding back Australia's productivity growth. Consultations undertaken for this inquiry provided insights into some of the consequences for innovation of poor management capability.

Managers may struggle to re-organise their operations to make the most **effective use of adopted technologies**. For example, the Australia Retailers Association (ARA) suggested that within their industry:

> the COVID-19 pandemic, coupled with a huge appetite for digital transformation and use of digital technologies, drove an increased online presence among their members, followed by a "second wave" of technology adoption to deal with problems arising from systems that were hastily put in place during the pandemic. (pers. comm. 6 June 2022)

A recent survey of 1500 Australian SMEs showed 59% of surveyed firms reporting that adopted digital solutions were hindering them in some way, suggesting that the firm had not successfully integrated the innovation into its existing processes. Moreover, 42% of surveyed businesses had given up on using some digital business solutions (MYOB 2022). This points to the risk that persistent gaps in management capability may lead some firms to 'over adopt', or fail to benefit from adopted technologies, potentially deterring future innovation.

Moreover, limited management capability may mean firms fail to fully **realise the benefits of their technology innovations**, even when the firm is at or near the global technology frontier. For example, the Interactive Games and Entertainment Association (IGEA), which represents the video games industry in Australia and New Zealand, suggested that while the industry was at the global frontier in terms of technical skills, some start-ups are held back by management experience. According to IGEA, the 'sector does not need help to get on top of the latest technology or techniques for making games … it's the boring things — management, business skills — that [their members] may not always prioritise as much' (IGEA, pers. comm. 7 June 2022).

The Council of Small Business Organisations Australia (COSBOA) suggested that smaller firms do not have **time to allocate to up-skilling themselves as managers and owners**, because they often prioritise training their staff first (COSBOA, pers. comm. 9 June 2022).

Finding 5.4
Management capability for successful technology adoption

Limited management capability is holding back some businesses from making good adoption decisions and from getting the best outcomes from their investments in developing and adopting new technologies. Firms with stronger management are more likely to make good decisions about whether or not to adopt new technologies and practices, and when and how intensively to adopt them. Such firms are also more likely to be able to make the broader organisational changes that are needed to benefit from transformative technologies such as digital technologies. Despite a huge appetite for digital transformation in many industries, skills and management capability gaps (and a lack of tailored information) has seen some firms lose out from adopting new digital technologies, reducing their willingness to pursue future productivity-enhancing innovation.

Governments play an important role in building the human capital that enables diffusion of innovations

Governments play a pre-eminent role in developing the skills of Australians. Skills are a conduit for transferring new knowledge as well as information about how to use novel innovations. Governments' role extends beyond funding and managing the education system (schools, vocational education and training (VET), and universities) to immigration policy.

Nevertheless, the design and funding of the education system is pivotal to innovation and diffusion. Increasing the attainment and quality of education, including early childhood education, schools, higher education and VET, increases workers' capacity to identify and make productive use of new technologies and practices. A highly skilled workforce may also make Australia a relatively more attractive destination for foreign investment (PC 2020c, p. 54), and for investment in projects with high skills requirements. The Productivity Commission has undertaken a more detailed assessment of Australia's education system's role in skills formation in this inquiry's companion volume *From learning to growth*, and also through a review of the National School Reform Agreement.

Skilled migration

Skilled migration is viewed narrowly as a means to resolving short-term skill needs. But more broadly than this, skilled migration is also a way of diffusing innovation and best practice among Australian businesses. Businesses can be conceived as experimental laboratories in delivering goods and services to consumers, so it makes sense to understand the lessons from as wide a variety of experiments as possible, particularly those overseas. Australia's skilled migration policy will therefore be central to the diffusion of innovation and future productivity performance.

As previously discussed, one of the key ways that firms learn about innovations is through the normal churn of workers between firms in an industry. When hiring a worker that has been working for a competitor, or another segment of the industry, a firm may learn about new ways of doing things, techniques or equipment that it was not aware of. Australian firms find more innovation ideas from their own workers than from any other source (detailed in figure 2.9 below); and for many of those workers, their innovative ideas are built on knowledge and experience from their previous employers. 'Knowledge spillovers' from the movement of workers between firms has been documented to be one of the main ways that technology firms learn about innovation and grow their productivity in the Silicon Valley, for example Saxenian (1996).

In many industries, the most technologically advanced firms in the world are overseas, and the majority of innovations are taking place in firms overseas. When local firms employ skilled migrants, they are also bringing in some of the knowhow and ideas from overseas. For example, analysis from New Zealand finds that the share of recent, high-skilled migrants (or returnee New Zealanders) in a firm is significantly and positively associated with innovation. In particular, firms that employed returning New Zealanders were more likely to introduce innovations that were new to New Zealand (McLeod, Fabling and Marr 2014, pp. 21–25).

In addition to knowledge of specific innovations from overseas, skilled migrants also bring valuable skills that may be in short supply in the domestic market, including skills that limit firms' ability to innovate (figure 2.7). There may even be specific skills that only exist overseas in particularly innovative areas. As noted by the Business Council of Australia:

> … it will continue to be the case that much of the innovation occurs offshore, and the new skills supporting that innovation will first be developed offshore. (BCA, sub. 16, p. 9)

The Productivity Commission considers skilled migration policy in a companion volume to this inquiry, *A more productive labour market.* That report recommends that the government shifts away from overly restrictive and inflexible occupation lists for employer-sponsored temporary and permanent skilled migration. Instead, the government should implement wage thresholds for employer-sponsored visas, whereby employers can sponsor overseas workers in any occupation as long as they are paid above the relevant threshold (with a lower threshold for temporary migration and permanent migration thresholds to increase with age).

Implementing this recommendation would mean that firms could hire skilled migrants with any skill or knowledge that they would be willing to pay above the wage threshold for, without waiting for a skill list to be updated. But importantly, such a change would also allow firms to hire workers with valuable knowhow, even if their skills on paper do not seem to be very different from local workers. The local beer manufacturer who hires an engineer from a plant in Europe is aware that they are thereby gaining new knowledge. If the firm judges any worker's knowledge and skills to be worth paying a substantial premium for, that type of worker would qualify for skilled migration under the proposed changes. These changes to skilled migration policy would clear the path for substantially more diffusion of innovation from overseas.

Researchers in industry

For firms engaging in more technical or adaptive types of innovation, an in-house research capacity may be needed to better identify and evaluate new information and apply that information to their circumstances. For such firms, employing researchers may be a particularly important component of their absorptive capacity.[15] Increasing the supply of industry-ready researchers may complement other government incentives for firms to undertake in-house R&D activities via industry policies such as the Research and Development Tax Incentive (box 2.3).

Box 2.3 – Absorptive capacity and the R&D Tax Incentive

While business investment is R&D is widely recognised as a crucial input to technological innovation — particularly highly novel innovation (Majeed and Breunig 2021, p. 2) — it also plays a role in innovation *diffusion* through two channels. First, business R&D may involve adapting existing innovations to fit a firm's specific circumstances or market. Second, undertaking in-house R&D may increase a firm's ability to identify and recognise the value of new, external information, to assimilate it, and to apply it in their operations. To the extent that this lowers the cost of learning about new technologies, R&D can facilitate innovation adoption and catch-up to the national frontier (Bloom, Van Reenen and Williams 2019; Cohen and Levinthal 1990, pp. 148–149).

In Australia, the main policy lever for business R&D — and for business investment in innovation more broadly — is provided through the Research & Development Tax Incentive[a] (R&DTI), which aims to encourage businesses to undertake R&D that may not be viable for an individual business, but may yield outcomes that have a wider benefit to Australian society (PC 2017a, p. 23). The R&DTI lowers the cost of undertaking R&D and, through a refundable tax offset, alleviates liquidity constraints for cash-constrained start-ups and SMEs. It also provides concessions to improve the asymmetric tax

[15] As discussed in more detail in section 2.4, businesses can also access those skills through collaborating with universities for innovation.

Box 2.3 – Absorptive capacity and the R&D Tax Incentive

treatment of profits and losses and the bias this creates against risk taking in the economy, including R&D (Business Tax Working Group 2011, p. 13).

Previous reviews of the R&DTI, and consultations undertaken for the inquiry, have raised a number of concerns with the program, including limited additionality (Ferris, Finkel and Fraser 2016, p. 14) and the stifling effects of some aspects of the program's administration, including uncertainty about eligibility and the ex-post compliance assessments that may require small firms to retrospectively pay back their offset (ASBFEO 2019, p. 5).

Given the importance of policy certainty and history of tinkering with the R&DTI, additional changes beyond those previously recommended may be unwise. However, given the connection between researchers and absorptive capacity, one option worth considering concerns changes to eligibility criteria. Currently, the program uses a broad concept of eligible expenditure, allowing almost any type of expense that is directly relevant to an eligible R&D activity except interest payments and the purchase of capital assets (Ferris, Finkel and Fraser 2016, p. 12). Focusing eligibility criteria on personnel costs could stimulate additional absorptive capacity by bringing additional researchers into firms. However, prior research suggests an increasing focus on personnel with a limited supply of researchers may just lead to higher wages rather than additional R&D activities, reducing the effectiveness of public support (Ferris, Finkel and Fraser 2016, pp. 12–13). Further work would be required to assess the elasticity of supply of researchers.

a. The R&D Tax Incentive is jointly administered by the Australian Tax Office and AusIndustry.

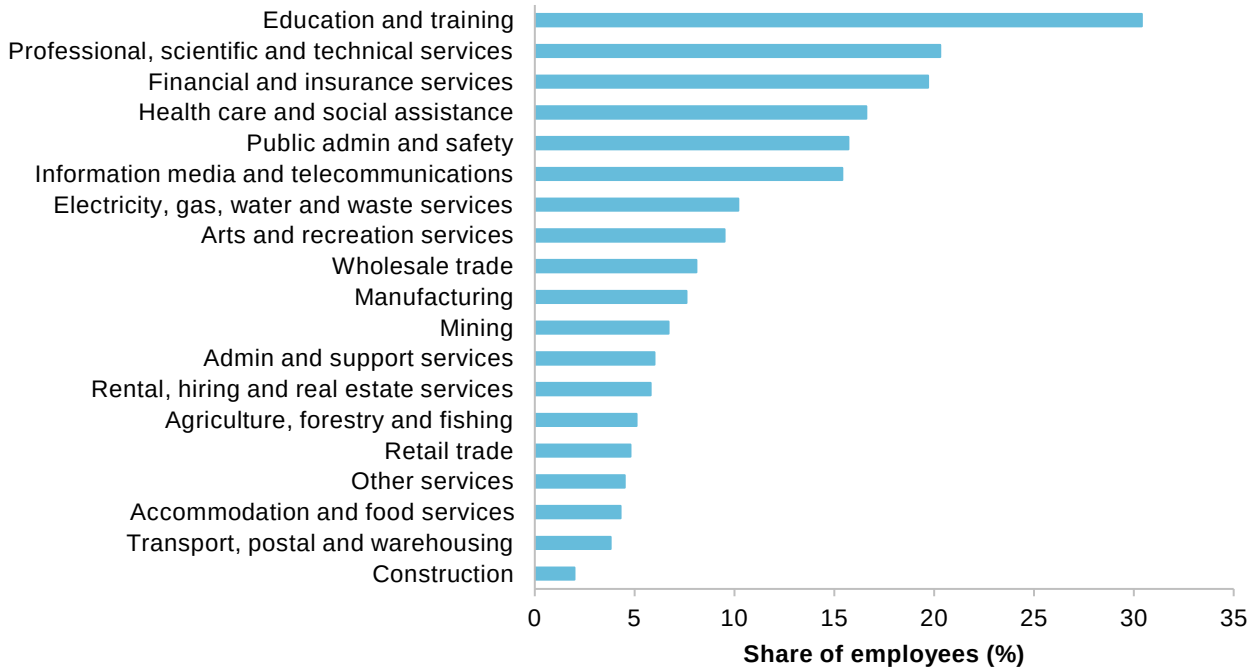
There is substantial scope to increase the industry-readiness of researchers by ensuring that people with postgraduate qualifications are provided with pathways to engage with industry. Some industries already tend to have large numbers of post-graduate educated employees, particularly education, professional services, financial services and health care (figure 2.8). But linkages could be improved by creating more connections between students and industry when they are engaged in study. Data from the Department of Education, Skills and Employment indicate that less than 14% of higher-degree research students engage with end users in some way (DESE 2022a). Although the number of university-industry research collaborations have been increasing (ARC 2018), there is still scope to create more linkages between early career researchers and industry.

To increase the supply of researchers with industry-relevant research experience and increase knowledge commercialisation, the federal government committed $296 million for the National Industry PhD Program under its University Research Commercialisation Action Plan (DESE 2022d, pp. 89–95). The program will support 1800 PhD candidates and 800 industry fellows to undertake industry-focused research projects over the next 10 years, with preference given to applications aligned with the National Manufacturing Priorities.

Creating researcher training with linkages to industry increases the likelihood that researchers can become employed in industry, which then helps diffusion take place. For example, Monash University's Graduate Research Industry Programs, which establish and facilitate student scholarships for PhD students in particular industries, have had a high success rate linking PhD students to industries such as water sustainability, food and dairy, sustainable public transport, chemicals/plastics/polymers, digital health and behaviour change for sustainability (Monash University, sub. 184, pp. 8–9).

Figure 2.8 – Education, professional and financial services, and health care have large numbers of postgraduate trained workers

People employed with postgraduate education relevant to the job, 2018-19



Source: ABS (*Qualifications and work,* 2018-19 financial year*,* Cat. no. 4235.0).

However, increasing innovative outcomes and diffusion by better leveraging highly skilled researchers in industry likely requires more than supply-side measures — business demand for and capacity to use researchers' skills also matters. Moreover, the program may be of insufficient scale to make a significant difference to industry (Howard 2022; IRU 2021, pp. 7–8). Preferencing applications aligned with the National Manufacturing Priorities restricts the range of industries, disciplines and types of research activities and that may benefit from the program — services industries and social sciences researchers, for example, are less likely to participate in the program.

Recommendation 5.2
An industry-agnostic approach to National Industry PhD Program

The Australian Government should actively promote innovation diffusion across a range of industries as part of its role in capability building. By adjusting the National Industry PhD Program so that it is industry 'agnostic' and does not preference applications aligned with the National Manufacturing Priorities, the Government could encourage diffusion of new knowledge and best practice into the services and social sciences.

Improving the capabilities of the existing workforce

There is a large market for workforce development and training in Australia, with 23% of Australians aged 15–74 undertaking work-related training[16] in 2020-21 (ABS 2022e). Moreover, supply chain partners, consultants and industry associations offer training to build the capabilities of firms, and in some cases, allow firms to 'outsource' certain management skills (box 2.4).

Box 2.4 – Businesses can seek private solutions in the market to build capabilities for innovation

Lifting workforce capabilities does not always require government involvement. In fact, firms are able to access a range of private solutions to build the skills of their workforce and managers, or outsource tasks requiring skills lacked by the firm.

- For larger firms in particular, **consultants** provide an outsourcing opportunity, creating a quick and easy way to bring skills and knowledge into the firm. And smaller firms often source outside expertise (in accounting, for example).
- Local business networks and industry associations provide a range of services — for example, the provision of advice and some consulting services — that are more accessible than consultants to smaller, resource-constrained firms.
- Participating in supply chains provides opportunities for up-skilling through formal training and informal mechanisms, like incidental exposure to better management practices. For example, the Australian Digital and Telecommunications Industry Association (ADTIA) told the Productivity Commission that the digital, smart products and subscription TV and streaming sector requires additional training for local cablers through both enterprise internal training and the VET system because customer expectations of cablers often exceed installation practices to include information about the products themselves (ADTIA, pers. comm. 24 June 2022).

Given the importance of lifting the capabilities of smaller, resource-constrained firms, industry associations play an important capability-building role.

- The Interactive Games & Entertainment Association (IGEA) offers **short courses** on how to run a studio, runs webinars on areas where support is needed (such as in applying for grants and project management skills), and ran an education summit to bring together educators to ensure consistency and that available offerings target the industry's skill needs.
- Some industry associations, such as the Restaurant and Catering Association and the Australian Retailers Association, deliver nationally recognised training in the VET sector as registered training organisations (RTOs). The Council of Small Business Organisations Australia (COSBOA) suggested that running a RTO was one way that industry associations can better enable diffusion. Partnering with existing RTOs is another common strategy.

If governments invest in building capabilities for innovation outside of the broader education system, they should prioritise policies and programs with the highest expected social return. Given the potential effect on

[16] Work-related training is training which did not form part of a qualification and was undertaken for work purposes.

productivity of improving management capabilities, programs to address skills gaps in the firms that will most benefit from it — namely, SMEs — may be one way to generate a high social return.[17]

In this context, many of the Australian and State and Territory government programs that aim to build workforce skills target particular segments of the workforce — such as mature or young workers — or provide services to help small business owners and managers improve the overall performance of their business (box 2.5). Such programs may help to build firms' innovation capabilities if they:

- target skills needed by businesses to effectively adopt and integrate new technologies, such as digital skills
- help improve management skills
- help businesses to identify opportunities to innovate as a way to reduce costs and improve performance.

Box 2.5 – Programs that may help build skills businesses need for innovation

General programs

Various government programs that provide support to upgrade skills and improve business performance may also build the skills and management capabilities needed to successfully identify and adopt innovations.

For example, the Australian Government's **JobTrainer Fund**, which was introduced during the COVID-19 pandemic, provides financial support for job seekers and young people (including school leavers) to upskill or reskill in areas of identified skills (DESE 2022b), whereas the **Skills and Training Incentive Program** assists mature age Australians to update their skills and stay in the workforce (DESE 2022c). To the extent that these programs target skills needed by businesses, they may also support innovation capabilities.

Other programs indirectly support management capability by providing information and services that help businesses to identify opportunities to improve business performance — including through innovation. For example, the ATO's **Small Business Benchmarking** provides free benchmarking for small businesses on industry-relevant performance indicators, including guidance on when a business may have room to improve (ATO 2022).

State Governments also play a role through a variety of programs including advisory and concierge services to small businesses, such as the NSW Government's **Business Concierge** and **Business Connect** programs (Service NSW 2022). In addition, initiatives that encourage small businesses to access specialist advisers and business support services (such as financial, accounting, strategic or management advice) — including the Tasmanian Government's **Small Business Advice and Financial Guidance Program** and the Victorian Government's **Small Business Specialist Advice Pathways Program** — can help these businesses to access the skills they need to adopt innovations (CPA, sub. 106, p. 6).

[17] Submissions to the inquiry recommended that measures be put in place to help SMEs build skills that currently stand as a barrier to adopting and using new technologies, specifically digital and management skills. The Australian Institute of Company Directors argued for "measures to harness the untapped productivity potential of small and medium sized enterprises (SMEs) and NFPs, including support schemes focused on management and digital skills" (AICD, sub. 44, p. 2). The Australian Small Business and Family Enterprise Ombudsman noted that there is a digital skills gap that needs to be filled to underpin economic growth and this is demonstrated by the continued demand for higher-level digital skills in Australia. Training should focus more on generic transferrable skills rather than on skills with specific applications" (ASBFEO, sub. 64, p. 4).

Box 2.5 – Programs that may help build skills businesses need for innovation

Programs focussing on novel approaches and entrepreneurs

Services offered under AusIndustry's **Entrepreneurs Programme** provide advice and funding for entrepreneurs and businesses to connect with researchers and undertake research projects (Innovation Connections) and to bring a novel product, process or service to market (Accelerating Commercialisation) (Business.gov 2022). The CSIRO also runs a range of programs directed towards entrepreneurs and research teams, such as the **ON programmes**, which include training in customer discovery and market validation activities, as well as an accelerator to help commercialise ideas (CSIRO 2019). State Governments across Australia also offer a variety of grant programs and fund accelerators and start-up hubs, such as the **Victorian Innovation Hub** and **Sydney Startup Hub**, which provide support for collaboration and staff development to help start-ups grow (Department of Jobs, Precincts and Regions and DJPR 2018; Investment NSW 2022).

Some government programs directly target the skills and management capabilities needed for innovation. Like most existing business innovation policies, these programs tend to target businesses engaging in highly novel, new-to-market innovation. Some offer support to connect businesses with research institutions and commercialise novel products and technologies. Evaluations and feedback from inquiry participants suggest that some of these programs, such as the Enterprise Connect program (2008–2014) have had a positive effect on firm performance (Bruno 2020, pp. 12–16). However, their wider impact is likely limited by a lack of program consistency over time. The relatively small number of businesses assisted (relative to the R&D Tax Incentive, for example) (DIIS 2019b, p. 44) and the focus on highly novel innovators may mean that skills imparted are not as relevant or easy to diffuse to other businesses.

Existing workers can also develop management capabilities and other skills relevant for improving diffusion through the broader education and training system, which includes both formal learning resulting in a qualification and other options such as unaccredited short courses. As discussed in this inquiry's companion volume *From learning to growth*, formal learning options are more commonly undertaken by younger people (including students before they enter the workforce), and government investment tends to focus on the initial post-school, pre-employment period, rather than ongoing training throughout a worker's lifetime. That volume includes a recommendation that the government could encourage uptake of lifelong learning options by trialling targeted policies for work-related upskilling and reskilling, and extending self-education tax deductions to education that is likely to lead to income outside of current employment. Existing programs designed to support lifelong learning, such as Employability Skills Training and the incoming Skills and Training Boost, should also be evaluated for their effectiveness at facilitating additional training.

2.4 Collaboration and networks can catalyse innovation diffusion

The diffusion of innovation requires channels for collaboration and networks for knowledge transfer. Such linkages are critical to allow information about innovations to spread — to *diffuse* — among businesses. These include:

- within business and business-to-business linkages, such as information flows through supply chains (see section 2.2 for examples relating to international trade)

- business-to-business linkages via an intermediary, such as industry associations and consultants
- research institutions-to-business linkages, such as with universities.

Channels for information and innovation diffusion

Information is critical to the uptake of innovation. Businesses need to know what technologies and practices exist in the market place, their compatibility with the business' organisation and how to adapt and integrate them into their organisation (Hall 2004, p. 19). Sources of information include research organisations (universities and public research institutions); firms in the same or related industries (including foreign firms); and industry organisations and networks. However, not all sources of information will be perceived as equal by firms, with some sources likely to be considered both more trustworthy and relevant to a business' situation (Nooteboom 1994, p. 343).

The business community is the most important channel for diffusing information about innovations

Firms responding to the ABS *Business Characteristics Survey* (figure 2.9) indicated that they derive ideas and information about innovation from a wide range of sources. Interestingly, Australian businesses source most of their ideas for innovation from within their own organisation. Although some of this comes from in-house R&D and on-the-job ingenuity, a large part of this comes about from workers moving between firms and bringing diverse skills and knowledge from their previous workplaces with them. In its 2017 Innovation Benchmark Report, PwC noted that, of the 1222 firms they interviewed, over two thirds agreed that:

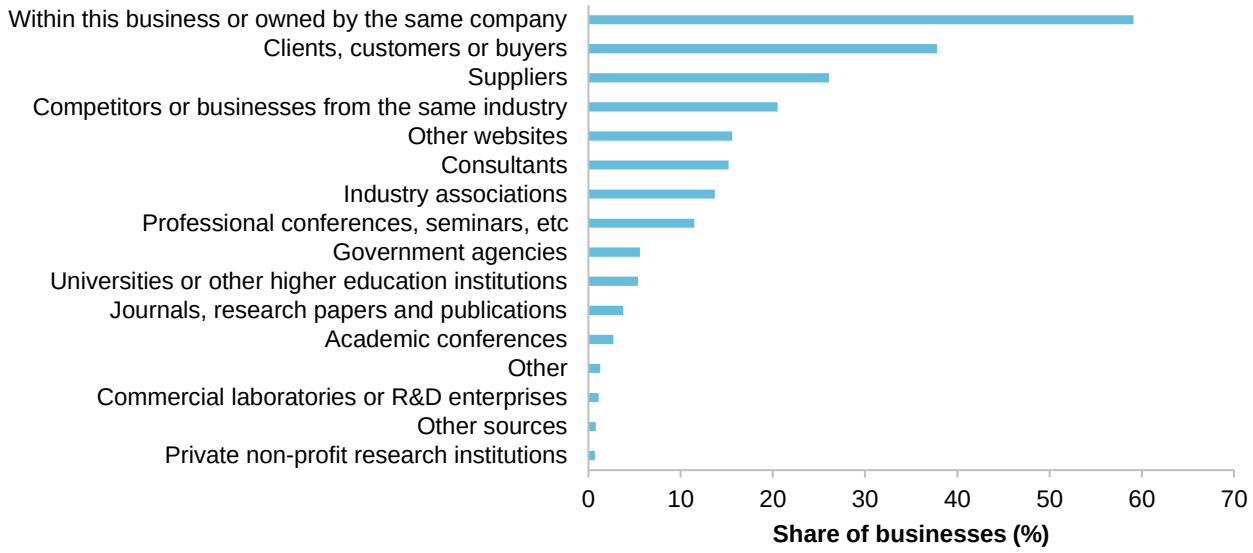
> bringing in employees with fresh thinking and establishing innovative behaviours and cultures are the most critical success factors for innovation, well above other criteria, such as increasing the innovation budget or establishing a clear business model for innovation. (Eriksson 2017)

Businesses also learn about innovative ideas and processes from their clients, their competitors and from their suppliers (figure 2.9). Direct interactions with suppliers and clients can be a trusted source of information, particularly where there are strong existing business relationships. Large, efficient firms (such as multinational corporations) even have incentives to actively transfer information up and down their supply chain (section 2.2). Equally, competitors' experience with adopting and using new technologies can be an important source of information about innovation (Stoneman and Diederen 1994, p. 924), when that information can be shared or observed.

Seeing how technologies have performed in other businesses can reduce uncertainty about the potential costs and benefits from adoption, reduce the need for costly experimentation, and play a role in socialising more complex organisational and technological innovations. For example, contactless payment systems have diffused rapidly through the Australian economy because they provide immediate and clear benefits for businesses (AMTA, sub. 163, p. 9), so much so that, although contactless payment technology was invented in the United States, Australian adoption rates of contactless payments by 2016 were 20 times higher than in the United States (NSW PC 2022, p. 47). This is particularly relevant for time and resource-poor small businesses. Participants in consultations for this report emphasised the importance of visibility for successful innovations. The higher uptake of more common foundational technologies, like cloud technology, is partially due to their increased visibility to Australian businesses compared with niche technologies, such as 3D printing (PC 2022a, pp. 10–11).

Figure 2.9 – Innovative ideas mostly come from within businesses or from clients and customers

Sources of ideas or information for innovation, innovation-active[a] businesses, 2019–2021



a. Innovation-active firms are firms that reported one or more innovations, or firms with abandoned or ongoing innovation activities related to product or process innovations.

Source: ABS (*Characteristics of Australian Business*, 2020-21 financial year, Cat. No. 8158.0).

Many of these information flows will occur without government intervention. In some industries, spillovers among competitors may be actively promoted, as in agriculture where on-farm demonstrations and farmer networks actively encourage learning from early adopters. This will also be the case in creative industries where mutual support is actively encouraged, such as in the interactive games and entertainment sector:

> [the] sector is a very sharing sector — our members are very happy to talk about and share their experiences with other companies. (IGEA, pers. comm., 7 June 2022)

Beyond such mutual support, business associations can facilitate formal collaboration such as joint ventures. Collaboration between firms has been found to improve firms' capacity to innovate (De Propris 2002, p. 350) by connecting businesses with the know-how, capabilities and resources they need to adopt, adapt and successfully integrate innovations into their operations. For example, collaboration has been found to increase the probability that Australian firms will innovate (Soriano and Abello 2015, pp. 349–352) and introduce innovations that are new-to-the-market (Majeed and Breunig 2021, p. 13).

Collaborating also helps to establish networks between businesses, both formal and informal, that facilitate the flow of information and knowledge throughout the Australian economy and from overseas. Collaborations often arise spontaneously, as firms see the mutual benefit of engaging each other. For example, 'young and small Australian companies who may not have a strong business focus can develop project management skills via collaborations with overseas companies' (IGEA, pers. comm., 7 June 2022). However, these collaborations can also be facilitated by public initiatives (such as challenges, contests, hackathons), incubators and accelerators, or publicly funded mechanisms like the Cooperative Research Centres.

Intermediary organisations play an important role in realising spillovers and connecting businesses

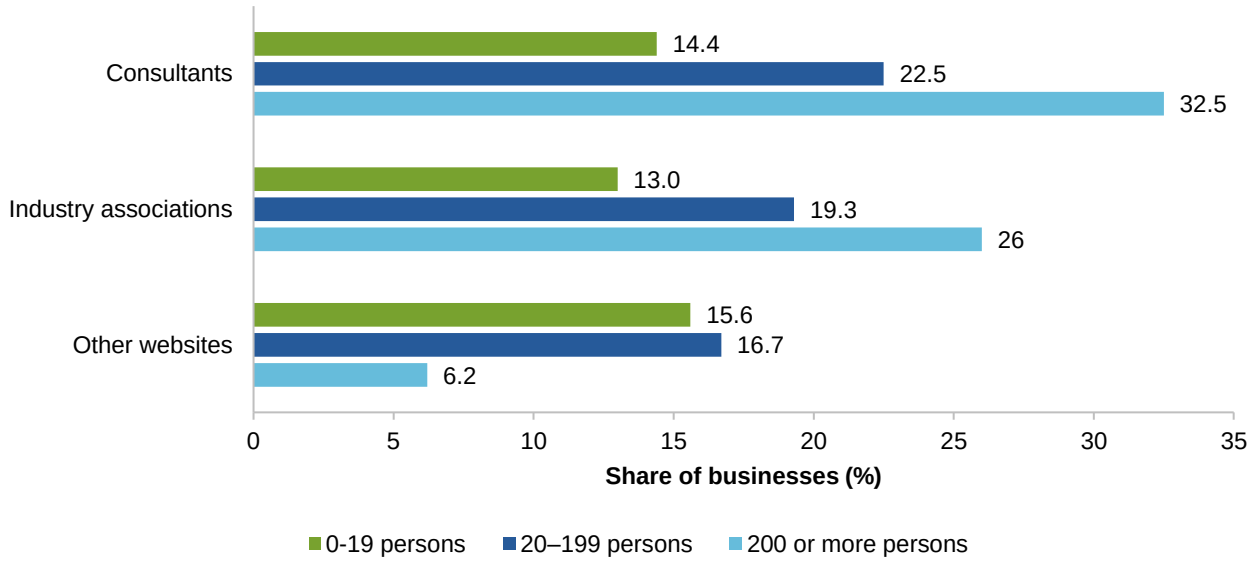
Intermediary organisations can play an important role in helping businesses build capacity for innovation adoption. These can include consultants and business advisers, industry associations or platforms for third party information accessible via web resources. These intermediaries can facilitate early stage innovative development and transformation and can also help firms with commercialisation and diffusion later in the innovation process (Bergek 2020, pp. 379–382).

Businesses rely on different intermediaries depending on firm-specific characteristics, such as firm size. For example, larger firms are more likely than small or medium firms to 'outsource' identifying valuable ideas by using consultants (figure 2.10). Smaller firms, on the other hand, are more likely to rely on their own research using open-knowledge sources (websites, journals, research papers or publications) than large firms.

Access to these open-knowledge sources can be challenging for some businesses (and for intermediaries providing advice to businesses such as industry associations, discussed below). For example, many academic journals, research papers and publications are locked behind paywalls that can be expensive to access for businesses and individuals that do not have a subscription, even though the research has often been funded by taxpayers. Restricted access can limit the reach of this research and its use not only for commercialising novel innovations in areas such as medicine and climate technology, but also for disseminating existing innovative practices to small businesses and individuals (Foley 2021). The impacts are felt not only by the business community, but also by government departments developing policy in areas such as education, health and climate change (chapter 3), as the latest evidence on effective practice in these areas is often published in locked research journals.

Figure 2.10 – Larger firms are more likely to 'outsource' innovation, while smaller firms rely more on open sources of information

Sources of ideas or information for innovation, innovation-active[a] businesses, 2019–21



a. Innovation-active firms are firms that reported one or more innovations, or firms with abandoned or ongoing innovation activities related to product or process innovations.

Source: ABS (*Characteristics of Australian Business*, 2020-21 financial year, Cat. No. 8158.0).

Opening up access to this research could therefore have significant benefits for diffusion and productivity growth. There are alternative models for diffusion of academic research that avoid user charges, including author pays or requirements that publicly-funded research be freely available through open-source arrangements (as is the case for much medical research in the United States). The Productivity Commission's inquiry into intellectual property sets out a model for this reform (PC 2016a). The Australian Academy of Science noted that the United States has already moved to make all federally funded research publicly accessible by 2025 (AAS, sub. 200, p. 2).

In this context, the Chief Scientist has recently proposed an open access model for research distribution in Australia, which would apply to both existing and future government-funded work (Brookes 2022).[18] The model allows publishers to continue to be paid for their functional roles such as managing peer review and editing processes, but would be required to make research freely available online for all Australians, with national agreements covering both the functional publishing costs and nation-wide read access. The government should consider the benefits and costs of this proposed model and other potential approaches in working towards open access to currently-locked research.

Consultants and other business advisers also communicate information about innovations to stakeholders and can help to build absorptive capacity within organisations. For example, accountants can leverage their existing trusted relationships with time-poor businesses (especially small business) to help improve their technology and practices. Recognising this important role, Chartered Accountants Australia and New Zealand has a CA Catalyst program that trains accountants to provide advice to their clients on a range of issues such as digitisation (including cyber security and data analytics) and sustainability (CAANZ 2021), so that these trusted business advisers can be a mechanism for technology and innovation diffusion. COSBOA stressed that improving innovation adoption requires people to get advice from trusted advisers and organisations, noting that 'good adopters [have] good support and connections in the community, good advisers, and are connected to their organisations' (COSBOA, pers. comm., 9 June 2022).

Industry associations also play a very important role. Associations can share technical information with their members. They can host professional conferences, seminars, meetings and trade shows, which are effective at creating networks and facilitating the flow of information between businesses. As the Australian Retailers Association put it when discussing the importance of visibility of new innovations, 'if you don't see it, you can't be inspired by it and want to buy it' (ARA, pers. comm., 6 June 2022). The Interactive Games & Entertainment Association similarly told the Productivity Commission another way they help build awareness of innovation is by running the 'Australian Game Developer Awards', which highlights innovation and excellence in a range of areas including engineering, art and sound design (IGEA, pers. comm., 7 June 2022).

More generally, industry associations can facilitate connections among firms, including leading and laggard firms; young and established firms. Associations can also connect firms to government agencies and support. For example, among its other services, IGEA facilitates connections between firms by performing an introductory role between its members by hosting formal and informal events (IGEA, pers. comm., 7 June 2022). IGEA suggested that some new collaborations and publishing deals came about because social events brought firms to together. The Restaurant and Catering Association indicated that they work with platforms (such as Uber Eats) and technology companies to make adoption easier, providing information to platforms to better help them provide a service to firms in their industry (R&CA, pers. comm., 9 June 2022).

[18] It should be noted that opening access to Australian-funded research would also increase Australian businesses' and government departments' exposure to a larger body of international research on a topic, as the freely available articles would have extensive references to other research. However, these businesses and departments would still not have free access to the underlying international research under such an access model.

Governments' role is limited, but can provide indirect support

Supporting connections with intermediaries

Government has a limited direct role to play as intermediary between businesses. As noted by Nooteboom (1994, p. 343), while government does not usually have a vested interest in a particular innovation — and as such, is regarded as a trustworthy source of information by businesses — government may not be seen as competent to judge the applicability of a given technology or practice for a firm. Moreover, inquiry participants suggested that information that is critical for diffusion — such as on digitalisation and cyber security — is provided by government agencies but can be overly technical and reliant on jargon, limiting its usefulness for small businesses in particular. Intermediaries may help to 'translate' government information.

Nonetheless, government can indirectly support with initiatives that create or invest in industry-connected intermediaries. This may be particularly relevant for diffusing newer technologies and processes that are untested in Australia or in a given industry, where a lack of information about how they perform under local circumstances, or the adaptations needed to suit the local market, may be a barrier adoption and use. While early adopters — both *leaders* and *naïve leaders* — are an important source of information for other firms about the performance of novel innovations, they can incur significant costs in adopting and trialling new technologies. The incentives for secrecy that this creates can mean that other potential adopters must incur the same costs to evaluate and trial the technology, delaying wider adoption. Indeed, several industry associations told the Productivity Commission that more coordinated testing and evaluation of new technologies might enhance diffusion by reducing uncertainty and enhancing spillovers of information that is critical to good decision making about adoption.

It is difficult to make a case that firms who incur the costs of researching, importing, adapting and trialling a new technology should share their experiences with other firms, as this would presumably reduce the payoff and their incentive to innovate in the first place. But if those initial costs are shared — with relevant industry associations, government or other non-commercial entities — then making that information available to other firms could enhance diffusion.

An example of government playing this role is by funding the establishment of Industry Growth Centres (box 2.6). The Growth Centres are positioned as a link between research, industry, government, and global markets, and while their remit does not explicitly include a role in diffusion, some Growth Centres undertake activities in support of innovation diffusion — for example, the Advanced Manufacturing Growth Centre has explicit principles involving researching, demonstrating and promoting awareness of best practices in advanced manufacturing (AMGC 2021). The Growth Centres' established networks and links between research and industry may be better utilised to upskill and diffuse innovation to and between existing businesses, particularly from overseas, rather than focusing on trying to commercialise and scale new-to-the-world innovation.

The future of the Growth Centres is uncertain. The original intention was for the Centres to become financially self-sustaining, but they vary in the strength of their financial positions (Riley 2022). The 2020 evaluation of the initiative observed that some Growth Centres have successfully accessed funding from the private sector and other government programs (such as research funds), but ultimately noted that 'it is unlikely the [Growth Centres] will become self-sustaining. It may be possible that a public/private funding model will provide a transitional platform' (ACIL Allen 2020, pp. vii, ix).

Box 2.6 – Industry Growth Centres

The Industry Growth Centres were established in 2015-16 to support competitiveness in sectors considered to be of competitive strength and strategic priority[a]: advanced manufacturing, known as the Advanced Manufacturing Growth Centre (AMGC); cyber security, known as AustCyber; food and agribusiness, known as Food Innovation Australia Ltd (FIAL); medical technologies and pharmaceuticals, known as MTPConnect; mining equipment, technology and services, known METS Ignited; and oil, gas and energy resources, known as National Energy Resources Australia (NERA) (DIIS 2019a).

Each Growth Centre was tasked with four key priorities: increasing collaboration and commercialisation, enhancing management and workforce skills, improving access to international markets and opportunities, and identifying opportunities for regulatory reform (DIIS 2019a). The Centres were intended to focus on areas where industry organisations were yet to develop, as well as to more closely engage with the research sector (Nous Group 2019, p. 7).

An assessment by Nous Group in 2019 suggested each Centre was generally meeting its objectives and business plan. Of their four priorities, the centres were found to have focused the most on increasing collaboration and commercialisation of research (Nous Group 2019, p. 6). An evaluation by ACIL Allen in 2020 found that the Centres have supported Australian industries to become more competitive, and that an industry-led approach is a sound way to deliver long-term value (ACIL Allen 2020, p. vi).

a. Labor proposed a seventh Growth Centre focused on the battery production supply chain during the 2022 election campaign (Riley 2022).

To the extent that Growth Centres continue to operate broadly similarly in the future — by facilitating connections between industry, government, researchers and markets — governments could partner with these networks to reach a wider business audience in specific industries when they implement other programs to support diffusion. For example, programs that build management and other capabilities, and extension services for small businesses (section 2.3), could be marketed or launched through these networks to promote awareness and uptake. These partnership efforts could also extend to governments working with other intermediaries — such as industry associations (discussed above) — which would improve their ability to reach businesses in industries that are not currently supported by a Growth Centre, including a range of service industries.

Facilitating knowledge transfer with extension services

Governments can also facilitate the transfer of technical or industry-specific knowledge on the existence and proper implementation of new technologies, similar to the extension services offered in the agricultural sector.[19] Extension services have been used mainly in agriculture as a way of transferring knowledge and innovations — often developed through publicly funded R&D — to farmers for their practical use.

There is a significant body of evidence suggesting that agricultural extension generates significant positive social returns. For example, based on a meta-analysis of 289 studies on the returns to agricultural R&D and extension in the post-war period, Alston et al. (2000, p. 201) found an overall median rate of return to extension of 63%. In a study focused on the Australian broadacre industry, Sheng et al. (2011, pp. 28, 31) estimated that past public investments in extension generated an average rate of return that could be as high

[19] This was also proposed by Professor Christopher O'Donnell (sub. 40, p. 12).

as 47% a year — contributing about 0.27 percentage points to annual total factor productivity growth in the broadacre industry.

The key policy question is whether variations on this model could work in industries other than agriculture. As noted in chapter 1 of this report, different sectors of the economy innovate in different ways, with implications for the shape of the innovation ecosystem in each case. For example, agriculture is traditionally characterised by significant industry-specific R&D (performed centrally and funded by industry levies or public subsidies), with a fairly stable population of farm businesses who are often not competing with one another on price, quality or volume. In other industries, businesses' needs tend to be more differentiated and there can be more secrecy and competition about innovation.

Outside agriculture, extension services have had more mixed results. For example, the Manufacturing Extension Partnership (MEP) in the United States, which provides extension services to manufacturing SMEs, was not without problems. Econometric evidence indicated that the program has had positive and significant effects on labour productivity and rates of firm survival, particularly for small firms (Lipscomb et al. 2018, p. 41). However, despite the original intent for the program to become self-financing after a six-year period of government support, the program has not managed to become self-sustaining, and continued support for the program in the United States has been contentious (Sargent 2019, pp. 3–4).

Moreover, the specific design of the program is crucial to ensure that the services provided match the needs of businesses. For example, the original design of the MEP, which targeted the transfer of federally funded technologies to SMEs, was found to be misguided — manufacturing SMEs did not need advanced technologies. Rather, their needs were more basic, including off-the-shelf technology and more general management advice (Sargent 2019, p. 4).

Extension services have had more limited applications outside of manufacturing and agriculture. However, some of the practices of industry associations may be considered as examples of extension-like services. For example, the Restaurant and Catering Association told the Productivity Commission that, among other services, they help the businesses that reach out to them to identify challenges and solve problems, including translating and providing information about innovations already available in the market (R&CA, pers. comm., 9 June 2022). More broadly, there are some not-for-profit organisations that provide extension-like services to businesses (sometimes for a fee) as part of their business mentoring programs, including specifically for small businesses (SBMS nd).

Despite the mixed results of extension services outside agriculture, given their success in agriculture, some variation on this theme is worth considering to better enable the diffusion of innovations and avoid the worst aspects of other forms of industry policy. The government should fund a trial of extension services in several other sectors, tailoring the approach depending on what services are relevant for most small businesses in that sector (for example, guidance on adopting commonly available technologies and innovations that are widely available in the market, rather than advanced technologies that may not be useful for many businesses). Early engagement with businesses in the sector will be important to identify the types of services that would be most beneficial.

Recommendation 5.3
Improving collaborative networks and knowledge transfer

Governments could strengthen collaborative networks for diffusion and facilitate knowledge transfer through:

- trialling government-funded extension services, which have so far been focused on the agriculture industry in Australia, to support diffusion of technical knowledge and relevant technologies in other sectors. The initiative should be tailored by sector depending on what services are relevant for most small businesses in that sector, with early engagement between government and businesses to identify the types of services that would be most beneficial
- requiring open access for government funded research in journals, papers and publications that is currently locked behind paywalls. In implementing this change, the government should compare the benefits and costs of the Chief Scientist's proposed open access model with the benefits and costs of other potential approaches
- partnering with intermediaries — such as industry associations and other advisory or network bodies — that have existing connections between industry, government, researchers and markets when implementing programs to support diffusion (such as capability development initiatives and extension services). This would enable governments to reach a wider audience with their diffusion initiatives.

University-industry collaboration

University-industry connections are largely utilised for transferring and commercialising novel innovation. However, linkages with universities can also build absorptive capacity across firms and spread knowledge and skills within and across industries — making the potential for diffusion of innovation higher across the economy. These connections can include:

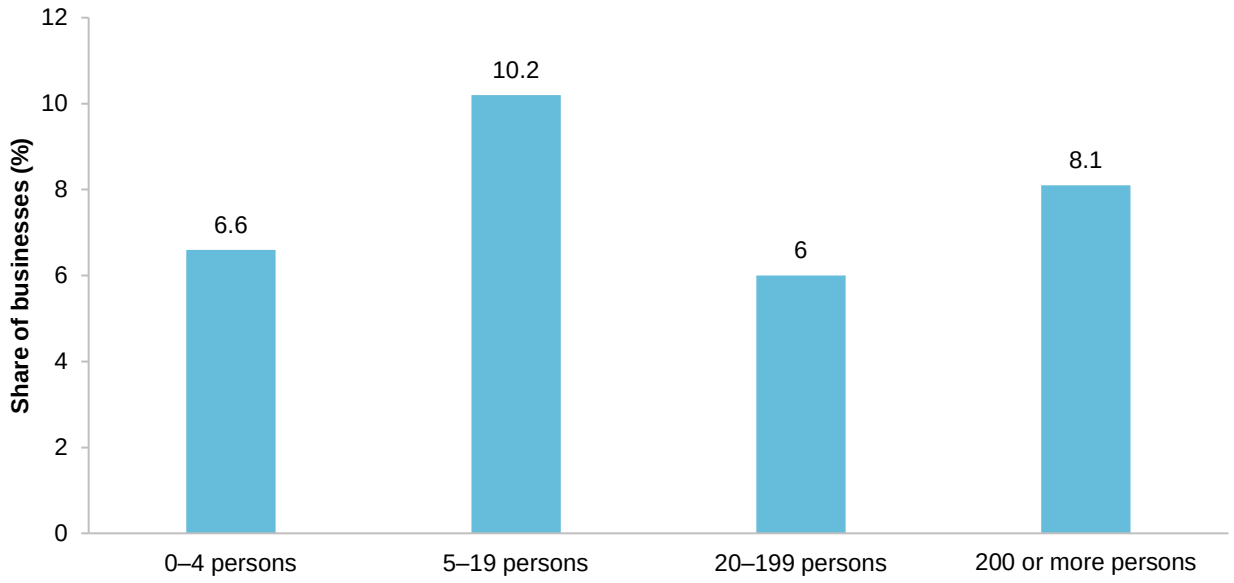
- joint R&D conducted between businesses and research institutions, like universities (including industry PhDs)
- patent licensing
- the hiring of researchers with graduate training or PhDs who have strong links to universities
- input into course content, for example by professional bodies
- consulting by academics.

There is a widely held view that Australian business collaboration with universities is poor.[20] Data from the ABS show that, among all innovating firms, collaboration with universities is highest among small businesses (5–19 employees), though levels of collaboration are relatively low overall (figure 2.11). Similarly, figure 2.9 shows that universities play a very minor role as a source of information and ideas about innovation, relative to other channels of information.

[20] This view appears to be largely informed by data drawn from the OECD Innovation Indicators database, a compendium of statistics about the innovation activities and outcomes of firms across OECD member countries (OECD 2022b). However, caution is needed in using these indicators because: i) Australia's reference period is one year (e.g. the ABS *Business Characteristics Survey 2018-19* in the most recent update) whereas, for the other countries in the survey, the reference period is two or three years; ii) the data for Australia only covers firms with 10+ employees, and only covers a subset of industries, to be consistent with the Eurostat Community Innovation Survey (CIS-2018) (see notes in OECD 2022b).

Figure 2.11 – Small firms collaborate with universities relatively more than larger firms[a]

Collaboration for innovation with Australian universities or other higher education institutions, 2019–21



a. As a share of innovation-active firms

Source: ABS (*Characteristics of Australian Business*, 2020-21 financial year, Cat. no. 8158.0).

Strengthening industry connections with universities should look beyond direct commercialisation

Low levels of engagement between firms and universities may reflect the relatively less common, new-to-the-world research and innovation that is typically done in collaboration with universities (and with other government and private not-for-profit research institutions).

However, it may also reflect a narrow view of the ways that firms can leverage university expertise and research — one that treats university knowledge transfer as synonymous with research *commercialisation*. For example, the recent University Research Commercialisation Action Plan (the Action Plan) (DESE 2022d) highlighted some barriers to university knowledge transfer. However, measures introduced in the Action Plan are designed to increase university research commercialisation by addressing (primarily) university and researcher disincentives and barriers to university-industry collaboration, focused on advanced manufacturing.

In fact, the channels for knowledge transfer are considerably broader, including not just commercialisation activities, such as IP licensing and academic spin-offs, but also knowledge transfer through labour mobility and consulting, as well as spillovers from conferences and networking (OECD 2019b, p. 32).The importance of these channels can differ across fields of research, types of institutions and sectors, as certain kinds of research and types of knowledge are better suited to specific transfer activities (Hughes et al. 2021, pp. 25–36). Moreover, being overly focussed on measures that only capture a single channel of knowledge transfer may miss other types of knowledge transfer and can fail to support the relative strengths of different institutions. For example, regional and technical universities report valuing their ongoing relationships with firms and industries as a pathway for students, joint research and collaboration over more traditional commercialisation activities.

There is considerable scope to strengthen connections between businesses and universities. As discussed in section 2.3, clearer pathways into industry for early-career researchers holds considerable potential. But mid- and late-career academics could also be a valuable channel for the diffusion of innovation, if

appropriate linkages between industry and them can be created. One possible channel is academic consulting with private industry (and government), although complex approval processes and procedures may reduce the incentives for academics to seek out opportunities for consulting (box 2.7).

Box 2.7 – Barriers to academic consulting

Academic consulting is a channel for universities to engage with and transfer knowledge to industry and governments, and to transfer insights from social science research in particular (OECD 2019b, p. 62).

However, consultancy procedures and approval processes may increase transaction costs associated with consultancies and reduce the incentives of academics to engage in them. This may arise as a result of a preference for consultancies to be provided through the university rather than privately by academics.[a] Conducting consultancies through the university has advantages. For example, staff may be covered by the university's professional indemnity insurance policies (for example, Monash University 2022); be able to use their professional title and university position; and use the university's facilities and resources. However, the involvement of a university contracting office or legal teams may lead to time delays (Verreynne, Torres de Oliverira and Mention 2021, p. 11). Further, academics who consult through the university may receive only a small share of the consulting fees, and may be restricted to using their share of fees on their academic research expenses, which could also reduce their incentives to seek out consulting opportunities.

Academics and firms may prefer to contract directly for consultancy or advisory services. Universities generally allow academics to engage in private consulting (also referred to as paid outside work) for up to 52 days in a year or 20% of their time.[b] However, associated conditions and procedures — which are intended to ensure that academic staff fulfil their obligations to the university and limit any risk to the university — may reduce academics' incentives to pursue private consultancies as a knowledge transfer channel through:

- approval processes, such as requiring approval above the level of the Head of Unit. For example, Monash University requires that paid outside work be approved by the Sub-Faculty Dean or Head of School/Institute (MNHS), Dean or Executive Director (or delegate) (Monash University 2022)
- prohibitions on using university titles or positions. For example, the University of Western Australia's Consultancy Policy prohibits private consultancies from making use of a University position or professorial title (UWA 2021); the University of Queensland (UQ) prohibits academics from using their position or association with UQ as the basis for obtaining 'secondary work' (incl. independent contracting and consulting) (University of Queensland nd)
- conditions for using university resources (e.g. the requirement to obtain permission and reimburse the university for using resources).

a. As an example, UQ's Consultancy, Secondary Employment and Internal Work Policy indicates that it is the University's preference that any non-research work be conducted through UQ as consultancy rather than as secondary employment (University of Queensland nd). **b.** The University of Melbourne specifies 13 days in a quarter, where the dean, or Vice-Chancellor in the case of a dean, can approve an arrangement where the days are averaged over two quarters (University of Melbourne nd). Neither the University of Queensland nor Monash University appear to specify how much time can be used for private consulting.

Individual universities have the right to set their own approaches to academic consulting based on their operational needs and risk management processes. However, unnecessarily burdensome administrative requirements create disincentives for academics to undertake consulting and reduce the potential for knowledge transfer from universities to industry and government. If universities are unable or unwilling to

lower these barriers to academic consulting, the government could help to foster more activity, such as by setting guiding principles to govern universities' approaches to academic consulting and standardised processes and fee requirements. This could be an area that is incorporated into the Australian Universities Accord that the Australian Government has committed to establishing, noting that the panel currently providing advice to the government on the Accord has been directed to examine opportunities to boost collaboration between universities and industry in order to share new knowledge, innovation and capability.

Finding 5.5
An overly narrow focus on university research commercialisation

Recent policy initiatives to increase knowledge transfer are too narrow in their scope in that they focus on direct commercialisation activities and advanced manufacturing industries. By focusing on research commercialisation, policy initiatives to increase knowledge transfer treat knowledge transfer as synonymous with commercialisation, even though other channels — such as consulting by academics — may be more relevant for certain types of firms and industries (especially service industries), research areas (especially social sciences) and research institutions.

Finding 5.6
Administrative constraints can act as barriers to academic consulting

Although university academics are generally allowed to provide consulting services to industry and government, university procedures and approval processes can reduce incentives for academics to pursue such work. For example, requiring the involvement of a university contracting office may lead to delays. Or requirements about how consulting revenue is distributed and obligations to limit risk to the university may also create barriers. These disincentives create a missed opportunity for a valuable knowledge transfer channel.

Recommendation 5.4
Reducing administrative barriers to academic consulting

The Australian Government should reserve the right to facilitate more consulting by university academics, should universities be unable or unwilling to lower unnecessary administrative barriers that disincentivise academics from undertaking consulting. This could be incorporated into the Australian Universities Accord, with the government setting guiding principles to govern universities' approaches to academic consulting and standardised processes and fee requirements.

Other opportunities to foster spillovers and information flows

Benchmarking can highlight opportunities for innovation where businesses are under-performing relative to their peers

Perceiving a need — or equally an opportunity — to improve business performance can lead firms to seek out and adopt productivity-enhancing technologies and practices. Yet as discussed in chapter 1, most

Australian businesses undertake little or no assessment of their own performance, with innovation measures receiving the least attention (figure 1.3). One explanation may be a lack of time. Managers who are time and resource poor may not have the capacity to assess the performance of their business. As noted by the Australian Institute of Company Directors (AICD):

> Feedback from AICD members, for instance during consultation on cyber reforms, is consistent that due to resourcing and time constraints many SMEs and NFPs struggle adapting to digital technology changes and building management capability. (AICD, sub. 44, p. 9)

However, a lack of information and effective performance measurement tools may also be a factor. Benchmarking tools can help businesses to identify areas of under-performance by allowing them to compare their performance with similar businesses across a set of relevant performance indicators.

A range of business benchmarking initiatives exist in Australia, offered by government agencies, as well as for-profit businesses or industry bodies to benefit their customers and members (box 2.8). In general, government-provided services have not been developed primarily for the purpose of providing benchmarking tools for businesses. Rather, they have been developed either to provide value back to businesses that supply data required by that government agency (for example, where businesses respond to surveys conducted by the ABS and the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES)), or as a complement to other activities undertaken by the agency (for example, benchmarks developed by the ATO for monitoring compliance can also be used by businesses to assess their performance). While some consideration has been given about how this information can be used to provide tailored insights back to businesses, there is currently limited analysis of the underlying drivers, actionable advice, or connection to other services that could assist businesses.

In contrast, services developed by private providers and industry associations tend to be more directly targeted at providing benchmarking services to businesses. The services differ in the detail they provide to businesses, and in particular, the degree to which the information is tailored and actionable for an individual business, with private services tending to offer the most tailored and actionable advice (for a fee).

Box 2.8 – Existing benchmarking initiatives

The Australian Government provides several benchmarking initiatives. These include:

- small business industry benchmarks published online by the ATO (2022), which provide ranges for general performance indicators based on tax return data, tailored to an extensive range of highly disaggregated industries (although not tailored to individual businesses that access the service)
- an initiative currently being developed by the ABS, which will provide tailored benchmarking reports to small-to-medium businesses when they participate in relevant ABS surveys and report their data through a new streamlined reporting application linked to their existing accounting software (ABS 2022a)
- some government agencies that may also provide data at a sufficient level of granularity to enable benchmarking — for example, ABARES provides a variety of agricultural indicators by farm size and type through its Farm Data Portal that can be used by farmers to benchmark their performance (ABARES 2022).

In addition, several for-profit providers offer benchmarking services to Australian businesses (Benchmarking.com.au 2021; FMRC nd; GE Digital 2022) and some industry bodies also offer similar services for their members — for instance:

Box 2.8 – Existing benchmarking initiatives

- Dairy Australia has developed the Dairy Farm Monitor Project, which provides comparative data to dairy farmers through an online portal (Dairy Australia 2022)
- the Innovative Manufacturing Cooperative Research Centre created the benchmarking and diagnostic tool 'futuremap' for small and medium enterprises in the manufacturing industry to map their capabilities in 13 areas of industrial competitiveness, including market positioning, leadership and digitalisation (Ai Group, sub. 179, p. 17). The tool provides a self assessment and then identifies tailored opportunities for immediate and medium-term growth opportunities
- Business Excellence Australia has created the Australian Business Excellence Framework that 'focuses on an organisation's ability to sustain innovation and provides organisations with guidance on establishing innovation systems' (BEA, sub. 159., p. 5), which could be used as a framework for performance benchmarking.

How can benchmarking initiatives better support innovation diffusion?

There are three key considerations for developing effective benchmarking tools that encourage innovation diffusion — obtaining access to data, encouraging businesses to use the tools that are developed, and ensuring the tools offer meaningful insights and assistance that promote innovation.

Regarding access to data, improving data sharing arrangements across agencies and increasing the collection of data from government funded entities (for more detail see PC 2022a, p. 43) could increase the usefulness of data for benchmarking purposes. However, this would need to be balanced against the need for data security and maintaining confidentiality for individual businesses. The inquiry's companion volume *Australia's data and digital dividend* notes that the ABS and ATO are continuing to explore how they can provide data collected from businesses back to businesses, safely and securely, in order to add value (such as for performance comparison purposes via tailored reports). Other government agencies may also collect and hold data from businesses and consumers that could be aggregated and/or analysed and then provided back to businesses and consumers for benchmarking purposes, including in specific sectors such as ABARES is already doing for farm performance benchmarking (box 2.8). Further sector-specific opportunities for data sharing for benchmarking purposes could include APRA and ASIC data for financial services and ACCC data for various consumer products.

Benchmarking examples from the United Kingdom, Canada, and New Zealand demonstrate the potential to make benchmarking tools directly accessible online, including the ability to tailor the results based on some basic inputs provided by a business.[21] Efforts by Australian government agencies to provide data back to businesses for benchmarking purposes could be extended by creating similar accessible and tailored tools. The ABS initiative also highlights how existing points of contact between government and businesses can be leveraged to offer benchmarking tools with benefits for both parties. In this case, businesses are offered access to benchmarking, which also acts as an incentive for them to engage with government in other ways (in the ABS example, benchmarking reports will be provided as a direct benefit to businesses that use the new streamlined reporting application).

[21] For example, the UK Office for National Statistics' online labour productivity calculator and benchmarking tool (Office for National Statistics 2022); the Business Development Bank of Canada's productivity benchmarking tool (Office for National Statistics 2022); Stats NZ's business performance benchmarker (Stats NZ 2022).

The tools that are developed should offer meaningful insights and assistance to the businesses that access them, and specifically promote innovation. The Australian Academy of Technological Sciences and Engineering has noted that traditional indicators of innovation have become 'increasingly insufficient and misleading' (ATSE, sub. 98, pp. 2–3). The effectiveness of the tools may be improved by accompanying the benchmarking results with other analysis — for example, accessible and relevant case studies about how similar businesses have succeeded in adopting new technologies and processes could assist innovation-ready businesses that are unsure of where to begin with improving their own operations (Ai Group, sub. 179, pp. 16–17). Advice that highlights the possible underlying drivers of the benchmarking results and provides relevant actions for businesses could also help, and benchmarking services could link to other government programs and support for businesses.

One question, however, is whether businesses would recognise government as a competent provider of such advice (Nooteboom 1994, p. 343). This may suggest a need to involve third parties with more direct industry expertise, such as industry associations or business advisers. For example, the Ai Group noted that 'the development of case study material could also be an area for partnership with industry associations who are more familiar with the target market and less likely to be restrained by political considerations and objectives than government agencies' (Ai Group, sub. 179, p. 17).

Recommendation 5.5
Using government-held data for benchmarking purposes

Government agencies should use data they collect to help businesses benchmark their performance and provide insights that promote diffusion of best practice.

- Existing efforts to provide data collected from businesses back to businesses for performance comparison purposes, such as those by the ABS, ATO and ABARES, should be extended — for example, by making benchmarking tools with tailored results accessible online, or by accompanying benchmarking results with other analysis such as case studies on best practice.
- Other opportunities to use government-held data for benchmarking should be explored, including in specific sectors where applicable (for example, APRA and ASIC data for financial services and ACCC data for various consumer products).

Firms learn from their neighbours, but place-based programs are unlikely to yield a large diffusion dividend

A recent trend in innovation policy in Australian is an increased focus on place-based programs (ISA 2016, p. 82). Place-based innovation programs — measures to develop or enhance existing accelerators, incubators, clusters and technology parks and precincts (ISA 2016, p. 82) — can create additional opportunities for spillovers between participating firms — often firms operating at or close to the technological frontier. For example, proximity of research institutions to each other can create ecosystems where horizontal spillovers in the form of knowledge, skills and shared infrastructure can attract further investment and improve the diffusion of innovation.

Various Australian governments are already investing in co-location, for example in the Melbourne Biomedical Precinct (Invest Victoria 2022) and Sydney's Tech Central, which aims to stimulate technology uptake (NSW PC 2022, pp. 58–59). Indeed, placed-based programs are one of the key mechanisms for State and Territory Governments to facilitate information flows in the innovation system and encourage

spillovers (ISA 2016, pp. 23–24).[22] Place-based policies also play a role in regional development policy (PC 2017e, pp. 70–71).

For firms, the two key benefits of clustering are spillovers from job transitions and knowledge sharing. Job transitions within local clusters create a channel for diffusion, with employees carrying knowledge with them as they move between firms (Krugman 1991). Clustering may also promote collaboration and informal knowledge sharing, particularly when local firms are technologically close (Matray 2021, p. 396).

While there is empirical evidence of knowledge spillovers between co-located firms (for example, Matray 2021, pp. 405–409), empirical evidence on the effectiveness of cluster *policies* is less decisive. One meta-analysis of studies on accelerators and incubators found positive impacts on employment and access to finance (Madaleno et al. 2022, p. 290). Australian studies have found that clustering had a positive and significant effect on R&D expenditure amongst clustered firms, driven largely by increased competition (Bakhtiari and Breunig 2018). However, other scholars suggest the evidence is ambiguous (Bloom, Van Reenen and Williams 2019, p. 178).

Given that spillovers from place-based programs are localised to participating firms, declining rapidly with distance (Matray 2021, p. 403), and highly novel innovators are only a small fraction of Australian firms, these policies on their own may not yield a significant and wide-reaching diffusion dividend. Additional mechanisms may be required to expand the reach of information and expertise developed in a cluster. For example, collaboration with industry associations could facilitate broader knowledge transfer, as discussed above.

Finding 5.7
Policies to promote clusters have a limited impact on broader knowledge transfer

Clustering may promote innovation diffusion amongst participating firms through job transitions and knowledge sharing. But given that spillovers from co-location are highly localised, and most place-based programs focus on highly novel innovators, place-based innovation policies are unlikely to yield a significant and wide-reaching diffusion dividend.

[22] See DIIS (2018) for a list of place-based programs around Australia.

3. Innovation and diffusion in government services

Key points

- **Given governments' spending of about $880 billion — or more than 42% of GDP — even small gains from innovation and adoption can realise either better services or cost savings of billions.**

- **Innovative approaches in service delivery, policy and system design are evident throughout the public sector, and extend to regulation, tax and funding settings that also produce benefits for the private sector.**
  - But innovation is often slow, piecemeal, disorganised, and inconsistent across jurisdictions.
  - Benchmarking shows wide variations in the efficient provision of services across jurisdictions.
  - This reflects unique aspects of the public sector: measures of success are contested and ambiguous; funding models create opposing and perverse incentives; norms and regulations discourage innovative approaches; and competitive pressures and the threat of exit are absent.

- **Many of the approaches to achieving diffusion of new processes and approaches in government services are well-known but underexploited.**
  - Improved funding and procurement models could drive better quality care in health services, and increase the efficacy of government procurement in defence and public infrastructure. Potential improvements include applying more evidence, rigour and transparency to public investment (including via better use of cost-benefit analysis); and adopting longer-term, co-operative and citizen-centred approaches to funding service delivery.
  - Better data collection and program evaluation for government service delivery can uncover why there are differences in performance and how, when not justified, these differences can be narrowed.
  - Innovation could be more efficiently disseminated across government agencies and service providers by strengthening the role of existing diffusion bodies, like the Australian Education Research Organisation or the CSIRO, helping to eliminate practices no longer underpinned by adequate evidence.
  - Government can support greater use of regulatory technology ('regtech') by providing regulation in forms that lend themselves to regtech solutions (such as machine-interpretable regulation) and working with software companies to encourage the provision of compliant regtech solutions.
  - Facilitating access to existing knowledge by government-operated or funded service providers would support the diffusion of best practice. This includes eliminating the pricing of Australian standards that have high public good value, and reforming fair use provisions in intellectual property.

Like market goods and services, public sector innovation and its diffusion increases productivity by either raising output per unit of input at unchanged quality (for example, through improved procurement of defence equipment) or by improving quality and community wellbeing (such as better-quality aged care or more effective health care technologies).[23] While there are fiscal benefits for government from some forms of innovation and diffusion, an increase in the 'bang for a buck' of government spending does not necessarily generate savings: as service quality rises, so too does demand.[24]

All levels of government are direct providers of non-market services or, through contractual arrangements, the key agents for managing their provision by the private and not-for-profit sector. This includes services provided by local government (such as libraries and waste management), State and Territory Governments (such as health care, schools and public transport, the justice system, and emergency services) and the Australian Government (defence, higher education, and much of the tax and transfer system). As many non-government organisations supply services on behalf of governments, innovations in the way in which governments fund and regulate such organisations are particularly important.

The scale of government-funded and managed services is huge, and so the gains from even modest innovations and their wider diffusion can be large. In 2020-21, total general gross government expenses amounted to about $880 billion at the local, state and territory and Australian level, or about 42% of gross domestic product (ABS 2021a, 2022b). The biggest potential savings would arise from efficiencies in the delivery of government services to the community (whose value was $445 billion or 22% of GDP[25]).

This is a static picture of the role of governments. The expenditure per capita of government services will increase over time — particularly in areas like health and aged care, which are affected by population ageing and rising expectations about the quality of services as incomes rise (Commonwealth of Australia 2021). As emphasised in this inquiry's companion volume *Keys to growth*, just like services in general, further cost pressures will reflect that wage growth in government services will be strongly affected by the necessity to match the wages in higher productivity sectors (Baumol's 'cost disease'). Wages are a key component of government-funded services like age and disability care.

Public sector innovation and its diffusion have always been important, albeit downplayed in public policy. Notably, the Ferris performance review of Australia's innovation, science and research system acknowledged its importance, but it hardly figured in its policy analysis or recommendations (ISA 2016).

[23] As in private businesses, innovation relies on data, research and experimentation, acquired expertise and absorption of ideas from businesses and other governments (domestic and global). However, the measurement of public sector innovation and diffusion is much worse than for the private sector. The enumerated value of innovation — $2.3 billion spent by the Australian Government and the $1.3 billion spent by state and territory governments — solely relates to R&D, which is at the novel end of the innovation spectrum (ABS 2022d). Yet there are many activities where resources are spent on innovation, adoption and diffusion of the kind set out throughout this chapter that will be rarely captured by such metrics.

[24] An illustration is the growth of PBS-funded intravitreal therapeutic drugs for age-related macular degeneration (AMD), Ranibizumab and Aflibercept. Both treatments are more effective than alternatives, and led to a nearly ten-fold decrease in the incidence of age-standardised blindness due to AMD (Heath Jeffery et al. 2021) — a large quality improvement. Consequently, their use grew massively (zero scripts in 2006-07 to 530 000 in 2020-21), and notwithstanding a price reduction of about 40% from introduction, government expenditure rose by about 14% per annum from 2007-08 to 2020-21 to a total of nearly $640 million.

[25] The spending areas (before non-tax revenue) included are defence; public order and safety; environmental protection; housing and community amenities; healthcare; recreation, culture and religion; education, and transport. The residual expenses of government include some important services, such as R&D on general public services undertaken by governments, but the data to isolate the costs of such residual services are not available.

Yet the need for innovation and its effective diffusion will grow over the next 50 years in managing climate change, the growing burden of chronic disease, and population ageing, among many other issues. A need for effective innovation and its adoption and adaptation across different communities is central to the ambitions of Aboriginal and Torres Strait Islander people and Australian governments to close the gap. The greater the level of innovation and the more rapidly good ideas in any given area of government service provision can be diffused, the more productive and effective will government be in these vital areas.

Finding 5.8
Small changes — large gains

Australian, state and territory, and local governments spend hundreds of billions of dollars each year, mostly on government services. The scale of governments' activities means that even the smallest of reforms — if widely adopted — can generate large savings or improve the quality of services for millions of people.

3.1 Public sector innovation and diffusion occurs, but is variable

Innovative approaches to government services and their delivery, policy and system design are evident throughout government services, often in relation to service processes, but also in relation to regulation, tax and funding settings. Many of these have previously been examined by the Productivity Commission, such as innovative healthcare models for treating chronic conditions that have improved quality of care and led to cost reductions (PC 2021b), and alternative practices in the justice system that have achieved better outcomes at lower costs without jeopardising community safety (PC 2021a). Rapid changes to the delivery of some government services during the COVID-19 pandemic also demonstrated the potential for significant innovation. For example, while many are familiar with the expansion of MBS-funded telehealth in general practice associated with COVID-19, there was also rapid innovation in acute care over this period (Australian Commission for Safety and Quality in Health Care, sub. 9, p. 5).[26]

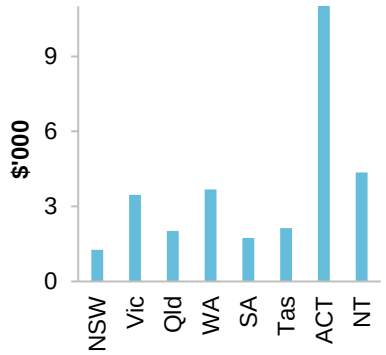
But the history of government initiatives is often typified by the gradual adoption of good ideas — for example, in 1993, Victoria adopted activity-based funding as the way to more efficiently fund public hospitals. It took 17 years before all of the large jurisdictions followed in adopting this innovation (Duckett 2018a, p. 355). This can contribute to variations in the performance of the basic functions of government, as revealed by the Productivity Commission's regular Report on Government Services (with figure 3.1 showing

[26] For instance, in 7 months during 2020, the Royal Prince Alfred Virtual Hospital grew its workforce from six nurses to a multidisciplinary service of over 50 medical, nursing and allied health teams. Patient use increased from 1000 to 7000 between May 2020 and January 2021 (Hutchings 2021). An economic evaluation suggested net savings of $13–18 million from avoided costs associated with standard care models in less than a year of operation (Shaw and Wilson 2021). And as another example, at the peak of the COVID-19 pandemic, Melbourne's Royal Children's Hospital was delivering 70% of its specialist clinic appointments by telehealth. It provided 11 200 telehealth consultations in April 2020 (up from 231 in April 2019). Average transport cost savings were $85 per consultation per family, while cost savings in caregiver time averaged $145 (Hiscock et al. 2021). Savings were significantly higher for families in regional or remote areas. While some types of consultations may have reduced accuracy of diagnosis or quality of communication with the family, for many families and many types of specialist appointments there would be little loss of quality, and in many cases the alternative would have been no consultation.

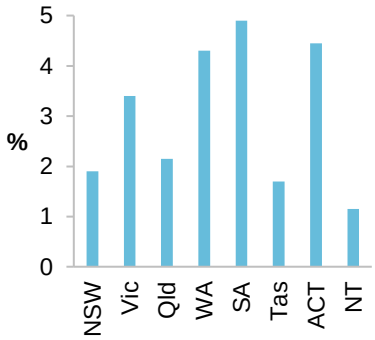
a diverse variety of metrics). These variations may sometimes reflect different circumstances or funding priorities, but many of them suggest that some jurisdictions are better at managing aspects of their services than others, which offers the scope for governments to increase the diffusion and adoption of better practice across public sector services. Notably, variations can sometimes be small — as in patient satisfaction with ambulance services — while others, like the cost of coroner's courts, show extraordinary differences. The variations within jurisdictions will be much greater than those shown here, so the chart will underestimate the scope for the diffusion of best practice.

Figure 3.1 – Performance in public services often vary markedly even across jurisdictions[a]

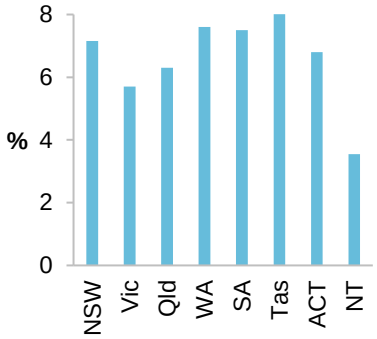
Real net recurrent expenditure per finalisation, coroner's court, 2020-21



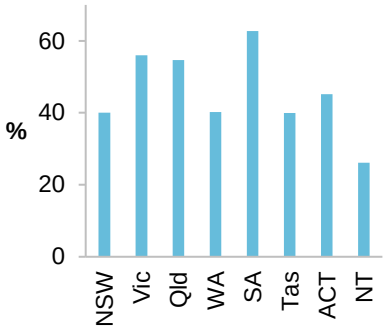
Proportion of public housing unoccupied at 30 June, average of 2018 and 2019



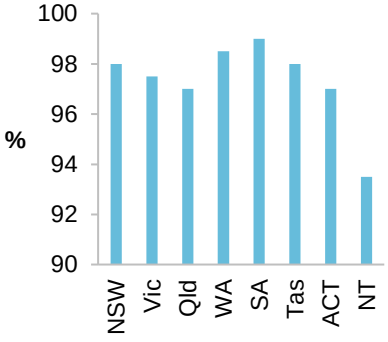
Adverse events per 100 public hospital separations, average of 2017-18 and 2018-19



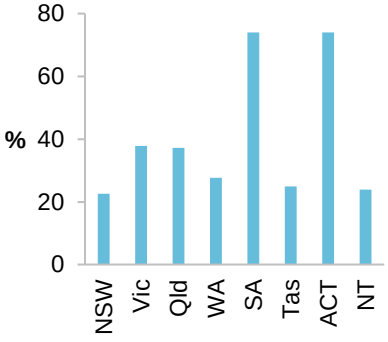
Closed (after exit) support periods for people experiencing homelessness with an individual case management plan where all goals were achieved, average 2017-18 and 2018-19



Patient experience of ambulances – share very satisfied/ satisfied, average 2017-18 and 2018-19



Prisoner education and training % of eligible prisoners), average 2017-18 and 2018-19



a. Pre-Covid-19 values were used where measures were affected by COVID-19.

Source: Productivity Commission (various issues), *Report on Government Services*.

Finding 5.9
Government innovation is not an oxymoron, but governments are slow adopters of best practice

Government at all levels can be highly innovative, as illustrated by initiatives in various services such as healthcare and the justice system, and rapid responses to the COVID-19 pandemic. In combination, these initiatives have the potential to improve resource allocation and deliver better quality services. But innovation and the uptake of best practice is often sluggish, patchy and inconsistent across jurisdictions. Benchmarking of governments' performance across multiple dimensions — such as patient experiences in hospitals and ambulances, prisoner education, support services for people experiencing homelessness — suggests many have failed to draw on the practices of better performers.

3.2 There are major obstacles to innovation and diffusion that need to be reformed or managed

Some obstacles are common to the public and private sector

The challenges for innovation and diffusion in the public sector share some features with the private sector.

Analogous to the business profile of Australia, which is characterised by many small firms, there are **many relatively small providers** or organisations that deliver government-funded services. These include GPs, schools, jobactive providers, aged care home support services, community centres, libraries and a host of other services that are geographically dispersed and therefore necessarily small or medium in size.

Even large organisations like hospitals, transport authorities, aged care facilities, universities, and prisons are spread across both urban and regional areas and have varying levels of government control and oversight.

This means that there are **large potential gains from experimentation and the sharing of successes and failures**. An example of these gains being realised more widely with the diffusion of improved practices can be seen in emergency services, with many people calling ambulances able to have their health needs met in other ways. Early research by the Australian Institute of Health Innovation found referral of low-acuity triple zero callers away from ambulances to alternative care arrangements lowered costs considerably with no adverse health impacts (Vecellio, Raban and Westbrook 2012). Such ambulance secondary triage care has now been adopted in all Australian jurisdictions, with proven beneficial outcomes (Eastwood et al. 2015).

However, **communication across small providers is difficult** as there is often a lack of visibility or forum for such discussions, no coordinating mechanism, and a lack of incentives to share past experiences. It can make diffusion and scaling of innovations more difficult (Albury 2005).

This is accentuated when ownership varies across government-funded services, with, for example, residential aged care provided by governments directly, by not-for-profit agencies and by private for-profit businesses. While ownership can affect the incentives to diffuse innovation, their **different cultures and practices can also hinder diffusion** (in the same way that cultures differ between family businesses, SMEs and large private sector corporations).

The highly decentralised nature of many government services is only one aspect that affects the capacity for adoption. Some government services are more akin to large (a state transport authority) or franchised businesses (Centrelink offices). In these activities, there is the potential for speedier diffusion of innovation

as their governance arrangements allow the head of the agency to *require* the adoption of a new approach. On the other hand, **large entities have big bureaucracies, and tend to be slow-moving**, hierarchical and risk averse, which is inimical to some types of innovation and adoption.

In addition, **slow diffusion may reflect the complexity of some innovations in services**: as noted in chapter 1, the gradual diffusion of innovative processes can be justified by the uncertain and contingent nature of their benefits. For example, coordinated care trials in healthcare — which aimed to get better outcomes for patients through a coordinated package of services — commenced in the late 1990s. The model had strong conceptual underpinnings, but results were varied. A succession of new trials of integrated care took place over the next 25 years, most recently in the large-scale trial of Health Care Homes (HCHs) — a model of integrated care that had proved successful in achieving better clinical outcomes and patient experiences in the United States (PC 2017b, p. 111). However, the evaluation of HCHs found that short-run clinical outcomes were no better than those of patients not enrolled in them (Pearse et al. 2022).

In part, the lacklustre results reflected the **problem of scaling up** a promising approach to large populations, and possibly the short period over which clinical assessments were made:

> A key issue for the HCH trial was that changes practices implemented during the trial lacked fidelity to the original aspirations for HCH as articulated by the PHCAG [Primary Health Care Advisory Group]. That is, while some practices introduced comprehensive changes to chronic disease management, others made few changes. Lack of change was mostly due to low levels of patient enrolment and/or relatively low levels of GP participation in HCH, resulting in insufficient scale to allow meaningful changes to be made. (ibid, p. 22)

Another example of difficulties scaling up effective practices can be found in mental healthcare. In 2017-18, about 40 000 consumers in community ambulatory mental healthcare services would have benefitted from participation in an Individual Placement and Support Program, yet only 4.5% of that group did so (PC 2020e, p. 949). This was despite firmly established evidence in favour of this approach, though it may be partly driven by the cost of treatment. The broader picture of Australia's mental healthcare system was that adoption of a best practice system would yield benefits of about $20 billion annually (PC 2020e, p. 2).

Outside of healthcare, scaling up successful programs can also be hindered by fragmented service provision. For example, in a case study from the criminal justice system, the Productivity Commission found that the South Australian Government reduced the likelihood of offenders returning to custody from 34% to 20% through the Home Detention Integrated Services Program, which offered wraparound support for a wide range of specific offender needs (Cale et al. 2019, p. 9; PC 2021a, p. 84). This created savings of about $54 000 per participant due to the lower cost of home detention and the reduction in return to custody (PC 2021a, p. 84). But adoption of such novel approaches is low in some other jurisdictions, reflecting the challenges of diffusing and scaling successful programs across relatively fragmented systems.

There are also obstacles unique to public sector diffusion

While there are commonalities, there are also major differences between the public and private sector that affect the capacity, methods and incentives for innovation and diffusion.

Objectives vary and success is hard to measure or even define

In the private sector, the ultimate goal is to maximise profits, which provides a transparent benchmark for the effectiveness of innovation. By the nature of governments' remit, consensus about the public good, the best actions to promote it, the key priorities, and acceptable trade-offs varies across and within governments. In the

public sector, **the objective is to improve the public good** with all the ambiguity that term entails, subject to the constraints imposed by the **sometimes-conflicting interests** of politicians, bureaucrats and lobbyists.

One of the starkest examples of this is that billion dollar public infrastructure projects are more politically saleable than a combination of less conspicuous projects (like better road maintenance), even if the latter have greater net benefits than the former (Ergas 2014, p. 13). Another example is the political challenges associated with phasing out stamp duties on property transfers in favour of a broad-based tax on unimproved land value. While the latter is widely acknowledged as a more efficient tax (and the Productivity Commission has previously recommended that all state and territory governments should make this transition (PC 2017d, p. 20)[27]), implementing such a change would have differential impacts on various segments of the population and economy.

Incentives are mixed

This is further complicated by the reality that a federal system of government — for all its benefits — leads to (sometimes) **overlapping roles and divergent goals**, which can frustrate the diffusion of innovation. A private business could change its corporate structure in parallel circumstances, but different levels of government must negotiate — sometimes over protracted periods — to achieve reforms that improve the overall public good.

As an illustration of the **complexities of federation**, some of the deficiencies of the health system stem from the fact that the Australian Government funds and regulates primary healthcare, while State and Territory Governments are the managers and predominant funders of hospitals. A few exceptions aside, state- and territory-run local hospital networks have a limited capacity to commission services eligible for MBS payments (under section 19 of the *Health Insurance Act 1973* (Cth)). The Tasmanian Government noted that the current funding model has inhibited innovation in integrated healthcare:

> A key barrier to reform for Tasmania has been the restrictions caused by section 19(2) of the *Health Insurance Act 1973* (Cth), which prohibits payments of Medicare benefits where other government funding is provided for that service. Unless there is an exemption, this requirement restricts services that require a mix of, for example, payments to GPs under the Medical Benefits Scheme (MBS) or to hospitals under the Activity Based Funding framework. This is a disincentive to developing integrated models of care that would support a reorientation of care away from hospitals and into the community. (Tasmanian Government, sub. 196, p. 11)

Moreover, while activity-based funding encourages efficiency by funding activities within hospitals, it provides no incentives for hospitals to make investments in out-of-hospital interventions that reduce those activities (PC 2017d, p. 52). Likewise, the Australian Government only captures a share of the dividends from investments in primary care that reduce long-run demand for hospital services and the staff and infrastructure underpinning those services.[28] This weakens governments' incentives for action. Even greater messiness ensues from the complex role of heavily government-subsidised and regulated private health insurance.

Housing policy suffers from some similar dilemmas given a mix of shared and competing roles by all levels of government, including funding deficiencies, which suggest significant benefits from a genuinely coordinated approach (PC 2022b).

[27] In 2012-13, the ACT Government implemented a 20-year transition to abolish inefficient stamp duties on property sales and move to rates. In July 2022, the NSW Government followed in the ACT's footsteps, though with the significant variation of giving homeowners the option of choosing to pay stamp duty or higher rates.

[28] In the medium run, the excess demand for hospital beds means that there are few savings as one group of patients is replaced by others. However, over the longer run, any lasting reductions in demand for hospitals can reduce the need for the highly costly expansion of existing hospital services (PC 2021b, pp. 30–31).

Universal supply to heterogenous groups means no one-size fits all

A major challenge for many government services is that there is an **obligation to supply** them to disparate and geographically dispersed populations across all of Australia. The variety of locations and the heterogeneity of customers mean that **services often must be tailored** to meet local circumstances. Many National Agreements between the Australian, state and territory governments identify priority groups (such as people with a disability or Aboriginal and Torres Strait Islander people) to recognise their specific needs. Service delivery can be very different in regional versus urban locations, especially in thin markets. There are many highly-specific programs aimed at closing the gap. The consequence of the variety and specificity of citizens' needs is that learning from one program or service delivery approach (diffusion) may not translate well to other contexts.

Heterogeneity between jurisdictions can limit diffusion of good practices not only in the design and delivery of government services, but also in the design and implementation of government policies and regulations. For example, notwithstanding the benefits of major re-zoning reforms in Australia's biggest cities (PC 2017d, pp. 145–146, 2022b), progress across most jurisdictions has been slow. This is partly because each state or territory has its own, distinct statutory planning frameworks, lexicons and professions, which makes knowledge sharing between jurisdictions challenging. This inquiry's companion volume *A competitive, dynamic and sustainable future* includes recommendations on how State and Territory Governments could further improve planning and zoning regulation, including by standardising business and industrial zones across local government areas and reducing the number of zones (where possible) while broadening the range of permissible activities.

Local monopolies abound and cannot go broke

Many government-owned or funded services **face little or no competition** from rivals given they are the monopoly provider or meet the needs of different regions. For example, many state schools have restrictive arrangements for out-of-area enrolments, which limits parental choice to a local school. And unlike private (and even not-for-profit) businesses, there are relatively few exits and entries by government-owned service providers, nor much risk of them. This reduces the pressure for innovation and adoption of best practice. In some public services, there is no permitted competition (generally for good reasons) — as in policing, prisons, and the Australian Tax Office.

Norms and regulations discourage innovation

Government services are often **subject to higher levels of prescriptive regulation** and have **risk-averse norms** (ANZSOG 2019). These may be justified for safety, ethical or other reasons, but high levels of regulation and risk aversion can limit the scope to change deficient prescribed practices, require resources to meet regulatory reporting requirements and can reduce the capacity of lower managers to autonomously make changes.

Regulations eat time, and time is a scarce input into innovation and adoption. For example, teachers face high levels of administrative work reportedly due to government and school level bureaucracy, making up 8% of a 'typical' working week (Hunter, Sonnemann and Joiner 2022). This is time that could be spent on better lesson preparation and professional development — this inquiry's companion volume *From learning to growth* included several recommendations that could lead to more effective use of school teachers' time. These included replacing manual administrative processes with technology-based and automated solutions, and more curriculum implementation support such as through centralised provision of high-quality and government-endorsed lesson plans and classroom tools.

Likewise, norms about the desirability and capacity for innovation (whether new altogether or new to the agency) vary across the public sector. In the Australian Public Service, all agencies participate in an annual

census that includes questions about staff attitudes to innovation. While many staff believe one of their key roles is to innovate, far fewer believe this is rewarded and indeed, a minority believe that their agencies accept that failure is sometimes an inevitable feature of innovation or the adoption of new ideas (table 3.1). Other data show that there is considerable variability across agencies in their ratings of innovation and management.

Table 3.1 – Attitudes to innovation in the Australian Public Service
2020-21

Statement	Positive (%)	Neutral (%)	Negative (%)
I believe that one of my responsibilities is to continually look for new ways to improve the way we work	93	5	2
My immediate supervisor encourages me to come up with new or better ways of doing things	82	13	4
People are recognised for coming up with new and innovative ways of working	67	21	11
My agency inspires me to come up with new or better ways of doing things	54	30	17
My agency recognises and supports the notion that failure is a part of innovation	34	38	27

Source: APSC (2021a, p. 11).

In many cases, the barriers to innovation include both norms and regulations. Some of the largest barriers to workforce innovation in key areas of public service delivery, especially healthcare, include funding constraints, regulations, and long standing workplace practices and cultures (Pharmacy Guild of Australia sub. 67; PC 2021b, p. 68). Scope of practice restrictions can frustrate different care models and access to services. The Australia Healthcare & Hospital Association observed:

> With evidence that the current organisation of health professionals and their associated scope of practice is not suited to meeting the needs of the Australian health system […] [w]ithout an overarching strategy to achieve an integrated, multidisciplinary health workforce that works to their top of scope, there will continue to be barriers in the redesign of models of care. Opportunities to develop new models of care with flexible use of the health workforce and innovative funding models should be leveraged. (AHHA, sub. 27, p. 2)

Increased use of electronic records, big data analysis and AI offer scope for some human tasks to be performed by software, as in radiology, though any application requires regulatory approval (van Leeuwen et al. 2021). An emerging technology is model-informed precision dosing, which provides decision support to clinicians that takes account of the unique aspects of patients (age, co-morbidities, sex, ethnicity). But its widespread use in healthcare requires data from electronic health records (which governments typically maintain and develop), funding models, regulatory acceptance and changing norms:

> The challenge for Bayesian dosing moving forward is clinical acceptability. Indifference from the medical and healthcare community is understandable. Pharmacometrics is completely absent from medical school programs. Commercial providers rely largely on marketing to sell the concept. Until Bayesian dosing is accepted by the healthcare community as decision-support tools for some drugs, until funders see the economic and clinical benefits, and until regulatory agencies clarify the status of these systems from a regulatory/legal perspective, the future remains uncertain. (Darwich et al. 2021, p. 231)

Australia has made some steps to implement predictive analytics in healthcare, but some evidence suggests it lags many countries, with only 55% of health leaders claiming that they have already adopted this technology or are about to do so (Philips 2022, p. 19). The rate is 66% in the United Sates and 92% in Singapore.

Finding 5.10
Structural flaws in government frustrate innovation and its diffusion

While slowness partly reflects divergent views about what amounts to best practice or innovation across different governments, there are also major structural flaws in government processes that frustrate innovation and diffusion. Uncoordinated actions of governments and agencies that share overlapping roles, siloed services, clashing funding incentives and risk averse cultural norms tend to work against experimentation. Few publicly operated services experience the risk that poor performance will lead to their closure, unlike businesses.

3.3 What is to be done?

Governments and their agencies often innovate and adopt best practices, as already highlighted in examples throughout this chapter. The challenge is to accelerate these and diffuse learnings about effective approaches across governments and agencies that have yet to adopt such improvements. Many of the ingredients for achieving this are well-known, but underexploited. Governments can use their funding and procurement processes as levers to encourage the adoption of best practices, and also have opportunities to improve diffusion in the ways they run their agencies and deliver services through better use of data, technology, skills and knowledge.

Improving funding and procurement approaches can drive diffusion and innovation

Regular review and update of how government funding is allocated

Given the significant amounts of funding allocated to various government services (discussed above), it is important that these funds are spent on practices and policies that have been proven to deliver desired outcomes. Moreover, these should be periodically reviewed to ensure that funding continues to be allocated based on the most effective approaches, and reflects changing population needs.

For example, public transport fare setting in most jurisdictions suffers from policy inertia (PC 2021c, p. 24). Fare structures are often based on historical settings without much review, with most jurisdictions using simple and ad hoc approaches to setting fares and subsidies that do not systematically address equity or efficiency goals. A superior approach to pricing developed by the Independent Pricing and Regulatory Tribunal has been operational in New South Wales for some years (PC 2021c, p. 18), while Infrastructure Victoria has undertaken considerable research on pricing reforms (Infrastructure Victoria, sub. 10, p. 1), though this is not yet reflected in policy. No other jurisdictions have moved to more sophisticated approaches, but there may be opportunities for governments to adopt more efficient pricing mechanisms and fare structures. This inquiry's companion volume *A competitive, dynamic and sustainable future* includes a recommendation to improve public transport pricing by implementing pricing reforms that have been

suggested by independent bodies and better diffusing learnings about efficient pricing mechanisms across different jurisdictions.

In primary healthcare, the Australian Government is the major funder and a source of clinical guidelines and advice, but it has often struggled to contain unwarranted variations in clinician practice. According to the ACSQHC (sub. 9, p. 7), 'if clinical variation does not reflect a difference in patients' clinical needs or preferences, it is unwarranted and can present an opportunity for the system to improve'. Large variations in healthcare can reflect different rates at which new practices spread through the health system or, worse, the persistence of outdated and sometimes harmful practices (ACSQHC 2019, p. 46, 2021b, 2021a; Duckett 2017, pp. 15–17; OECD 2017). Some examples include:

- Over-prescription of antibiotics by GPs can lead to antibiotic resistance. A large percentage of patients are being prescribed antibiotics for conditions for which there is no evidence of health benefits from antibiotic use such as non-infant acute tonsillitis (85% of patients) and bronchitis (82% of patients) (ACSQHC 2021a, pp. 79–80).
- Before changes to the Medical Benefits Schedule (MBS) in 2020 in response to COVID-19, GP telehealth services were very limited, though the technology (the telephone) existed. Payments for telehealth were restricted to only rural or remote areas and aged care facilities, and before mid-2011 were further confined to psychiatric and radiology services (PC 2017d, p. 56; Tran and Haddock 2021, p. 6) despite evidence of their benefits (Moffatt and Eley 2010).
- There are other technologies — such as wearables that gather and communicate health indicators to clinicians in a timely, efficient and unobtrusive manner — that are not supported by the clinical model underpinning MBS funding (MTAA, sub. 33, pp. 5–6).

The striking variation suggests opportunities for improvement through more guidance, monitoring, education, and for some contexts and procedures, de-funding. The MBS was first introduced in 1984 and before 2015-16 had never been subject to a comprehensive review despite substantial changes to medical practice (Medicare Benefit Schedule Review Taskforce 2020, p. 1).

The government should regularly update the MBS so that funding is only provided to treatments that reflect medical best practice, based on medical research both domestically and from overseas. Comprehensive reviews take significant amounts of time — for example, the comprehensive MBS review that started in 2015 was completed in 2020. As research and feedback on medical best practice is constantly emerging, updates to the MBS should occur more frequently and on a rolling basis where there is evidence that questions the efficacy or cost effectiveness of existing treatments. A systematic mechanism for this to occur would be for the Medical Services Advisory Committee (MSAC) to undertake an annual review of selected MBS items to determine whether they should continue to receive government subsidies. The list of items to be reviewed each year should be targeted based on:

- treatments where emerging Australian and/or international evidence questions the efficacy or cost effectiveness of existing procedures, including treatments that international bodies (such as the UK's National Institute for Health and Care Excellence) have recommended de-funding or replacing with new treatments
- treatments that MSAC has received clinician feedback on doubting their effectiveness
- highly costly treatments that receive large government subsidies through the MBS and have not been reviewed in the past 10 years.

While MSAC's remit already includes considering amendments to existing services funded by the MBS, much of its current activities focus on assessing new MBS items rather than re-evaluating existing ones. More prominently incorporating such annual assessments as a standing function of MSAC may require the Australian Government to provide higher levels of funding to MSAC so that it has the resources and capabilities to undertake regular targeted reviews.

Overcoming funding models that undermine innovation and best practice

Healthcare funding models

Funding models should reward increases in the quality and efficiency of outputs and encourage cost reductions for government service bundles, whether that service is ultimately delivered by government or an external service provider. The word 'bundle' is important because many existing government-funded services are unbundled (or siloed) and then provided or managed separately by different arms and levels of government.

The prime example of such siloing is healthcare with its fractured funding and governance mechanisms. The customer is equally fractured by unbundled services. They are a customer of a pharmacist, a patient to a GP, an admission to a hospital and a case to an outpatient service — four different people through the eyes of the current system. It makes sense to re-assemble them into one human being and provide them integrated care at whatever point they touch the system.

Healthcare funding, delivery and oversight should be managed *as if* there was only one level of government holding responsibility for it, recognising that creating this single virtual agent requires re-configuration of existing government funding models, changes in regulations (such as the *Health Insurance Act 1973* (Cth)) and greater data sharing between different parts of the health system. The latter is discussed in this inquiry's companion volume *Australia's data and digital dividend*, which recommends that the government implements improvements to My Health Record so that it can be the foundation for a comprehensive health data sharing system across all parts of the healthcare sector.

Various capitation models, such as the Victorian HealthLinks program, are promising contenders for wider application for chronic disease management and preventative care, as are bundling payment models for conditions (such as hip and knee replacements) that need predictable coordinated care spanning the whole health sector. The ideas of the Consumers Health Forum of Australia (2020), various reports from the Productivity Commission (PC 2017d, 2020e), the Grattan Institute (Breadon 2022; Duckett 2017, 2018b; Swerissen and Duckett 2018) and others have set out reform directions that could apply at a greater scale, even if the details vary.

The institutional and funding models to support reform of hospital funding are much better developed than under the previous health agreement between the Australian, State and Territory governments. Under the 2020 addendum to the National Health Reform Agreement, the Independent Hospital Pricing Authority (now the Independent Hospital and Aged Care Pricing Authority — IHACPA) has the capacity to reimburse hospitals for their participation in state-sponsored innovative fixed-term funding trials (First Ministers 2020; IHPA 2022). IHACPA will advise governments on any trial that might be nationally applied, yet there is no formal transition path to any Australia-wide systemic change to hospital funding.

The advantage of new funding models is not just that they bring to fruition ideas that have long been advanced and used overseas, but that they underpin the diffusion of other innovations. Were a hospital given appropriate incentives, there are hundreds of novel ways of preventing unnecessary, or shortening the duration of, hospitalisation that it could be motivated to introduce. Similarly, new funding models for improved primary care — even if not directly coordinated with hospitals — can better manage and prevent chronic disease, as shown in the case studies examined by the Productivity Commission (PC 2021b). The main problem is not a lack of appetite for changes in funding models, but the slow pace of scaling up promising initiatives. The rapidity of health system adaptations to the COVID-19 pandemic suggests that there should be scope for acceleration.

Contract lengths for human services

Contract terms set by governments can frustrate innovation and diffusion through excessive prescription (PC 2016b, p. 32) and limit the capacity for user choice to encourage best practice and innovation among service providers. Funding contracts for community organisations delivering government-funded services are often too short (sometimes only 12 months) and with low certainty of renewal. This limits the capacity for community organisations to set up, develop their skills and processes, learn from experience, and invest in innovation. Re-tendering can also take up considerable resources and management time better spent on raising the performance and capability of the agency.

While shorter-term contracts may seem to control risks, there are other ways of doing this without stifling innovation. In its assessment of various government services, the Productivity Commission concluded that contract durations should be longer than the usual default. The Commission recommended default contract lengths of a minimum of seven years for providers of children and family services in the Northern Territory (PC 2020b, p. 37), which is consistent an earlier finding of seven years as an appropriate contract length for human services generally (PC 2017c, p. 24). The appropriate contract length may vary depending on several factors, such as the type of service being provided and the location of provision; for example, the Commission's mental health inquiry recommended that funding cycles for psychosocial support services should be increased to a minimum of five years (PC 2020e, p. 843). Suitable contract lengths could be reconsidered for contracts that are retendered upon their expiry.

A citizen-centred approach to funding

Funding models for government services centred on consumer-directed control underpin a different kind of diffusion and innovation — the capacity for consumers to engage imaginatively with mainstream providers, and for providers to compete based on their ability to service consumers' needs. On the one hand, contract and funding arrangements can diffuse best practice among providers for *that* model of service provision. But in many cases, best practice is to let the citizen decide how to arrange the services that meet their preferences, subject to an appropriate budget limit. Citizen-centred funding models are particularly beneficial for delivering human services, as they allow service providers to receive signals from citizens about what they value most, with the flexibility for providers to implement innovations that can meet these needs in either a specialised or general way depending on the citizen's preferences. This applies both for human services delivered by government and those funded by government and delivered by an external provider.

An example of this from a previous Productivity Commission inquiry (PC 2011) was of a young person with Down's Syndrome who used to receive services from specialist disability providers, being picked up by a bus for people with disabilities and taken to activities that might or might not interest them. When given a budget for services, the person learned how to take public transport, to go the cinema and to buy her favourite meal from McDonalds, which she loved. Best practice was not the achievement of the most efficient allocation of resources *within* an enterprise, but the meeting of the preferences of the person.

Governments can much better diffuse this different way of organising resources in some of its other services. For instance, in the housing policy space, the Commission noted that financial assistance to people in need should be user-centred and enable them 'to have a genuine choice over where they live [which] would improve the responsiveness of the social housing system to the requirements of tenants by increasing competition between housing providers' (PC 2017c, p. 15). It also found in the 2022 *Housing and Homelessness Agreement Review* that delivering housing assistance through government subsidies tied to properties can lock renters into homes that do not meet their needs, as should preferences and circumstances change they are unable to move without losing the assistance (PC 2022b, p. 281).

There are also other human services where governments could encourage provider innovation and improve resource allocation via a more citizen-centred approach. This includes end-of-life care, where governments should initially prioritise ensuring wider availability of high-quality services that place users' interests at the centre of delivery and, in the long term, offer users choice of provider where feasible (PC 2017c, p. 138). And in public dental services, 'giving users greater choice over their dental provider can also generate incentives for providers to be more responsive to patients' needs as they are only funded when users choose them' (PC 2017c, p. 387). And healthcare is another policy area where governments can shift to a more person-centred funding approach to foster innovation and improve patient outcomes. More co-operative funding mechanisms would enable more integrated healthcare centred on a patient's needs, such as by encouraging longer-term and/or preventative care, which are not well supported by the current health funding system (PC 2021b, p. 145).

Recommendation 5.6
Using health and human service funding approaches to improve diffusion

Governments should use their funding and procurement approaches to drive improved efficacy, innovation and diffusion in health and human services that they deliver or contract external service providers to deliver. This could include:

- improving the diffusion of good practice in primary healthcare by regularly updating the Medicare Benefits Schedule (MBS) to reflect effective treatments. The Medical Services Advisory Committee (MSAC) should be required to undertake an annual rolling review of selected MBS items, focusing on treatments where emerging evidence or clinician feedback questions their efficacy or cost effectiveness. The Australian Government should assess the need for higher levels of funding for MSAC to undertake these annual reviews as a standing function
- implementing funding models that support the diffusion of innovation in healthcare, including preventative care, and a more patient-centred approach by aligning incentives across different parts of the health system. This includes by accelerating and scaling up long-term co-operative funding mechanisms that align the incentives of primary and hospital providers to avoid costly hospital admissions and support integrated care, such as capitation models that have demonstrated success and other mechanisms supported by the Independent Hospital and Aged Care Pricing Authority. Governments should also seek to overcome obstacles to implementing co-operative models, such as changing the *Health Insurance Act 1973* (Cth) and improving data sharing
- encouraging human service providers to innovate and compete to meet consumers' needs by providing citizens with more control over how government funding allocated to these services is spent. This could apply to the allocation of housing assistance to people rather than properties, end-of-life care, public dental services and healthcare
- increasing default contract lengths to 5–7 years for government-funded services delivered by community organisations to support innovation and diffusion. Suitable contract lengths will depend on the type of service provided, and the lengths of contracts that are retendered could be reconsidered upon their expiry.

More broadly, funding models and regulatory settings for health and human services have tended to be focused on inputs rather than outcomes. For example, fixed labour ratios are a feature of many of these services, including in hospitals and child care provision, and activity-based funding — while leading to efficiency gains in the past (discussed above) — can lead to providers limiting the design and delivery of their services to the specific activities that are funded. These approaches often exist for good reason. In

government-funded human services, consumers may have incomplete information about the quality of providers, are often vulnerable (due to age or disability) and have fewer incentives to properly hold providers to account (as they do not face the full cost of their service).

However, these input measures can inhibit service providers from adopting innovations that would deliver the same, or better, outcomes for consumers. The benefits of regulating for quality assurance therefore need to be balanced against the costs from discouraging productivity-enhancing innovation. Shifting towards outcomes-based approaches to allocating funding and regulating quality would give providers more flexibility to adopt innovations that allow them to meet their obligations in the most effective and efficient way possible. Such a shift could also include exemptions from input measures if a provider can demonstrate that they have achieved quality in other ways. This should be a longer-term reform direction pursued by governments at all levels, to incentivise innovation, competition and productivity gains in these government-funded services.

One prerequisite for doing this is improving data collection about the outcomes that matter in health and human services and better understanding the factors underpinning differences in performance (so that outcomes-based funding can be implemented to account for these factors, where they are not within the control of service providers). This is discussed further below and in recommendation 5.9.

Finding 5.11
Funding models and regulatory settings based on input measures can stifle innovation

While input-based approaches to funding models and regulatory settings (such as fixed labour ratios and activity-based funding) can have benefits for quality assurance, they can also limit the potential for innovation in government service delivery. Shifting towards outcomes-based approaches to allocating funding and regulating quality would give service providers more flexibility to adopt innovations that allow them to meet their obligations in the most effective and efficient way possible.

Infrastructure and equipment procurement

Outside of human services, there are other ways in which government procurement could encourage best practice. Procurement of public infrastructure like roads, bridges, hospitals, and prisons has often preserved out-of-date approaches that have constrained collaboration and innovation and missed opportunities for deferring upgrades and replacements. For example, it has been estimated that 37% of requests for proposals in public infrastructure projects suffer from unclear project objectives (DAE 2015, p. ii). Some 45% of professional service firms commissioned by the public sector for infrastructure projects say their clients were unresponsive to innovative suggestions during tender processes (ibid p. vi).

For their part, current key users and constructors are pessimistic about government and industry's overall uptake of best practice procurement approaches. Roads Australia (sub. 25, pp. 3–4) argued that the state and territory pipeline for new infrastructure has been overly ambitious given that governments and industry struggle with 'outdated, inflexible commercial frameworks', notwithstanding superior options. The Civil Contractors Federation considered that adoption of best practice in government procurement had been weakened by the loss of in-house technical capability in procurement agencies (sub. 38, p. 3). This highlights that one of the key determinants of adoption of best practice are the skills of government agencies. Moreover, all states are undertaking large complex projects with major exposure to risks of cost blowouts, design flaws, delay and uncertain patronage, but without (it seems) sufficient knowledge sharing between them about the contractual and other ways these risks may be mitigated.

One approach that has the potential to drive better quality and productivity outcomes in public infrastructure is the use of collaborative construction procurement models, in which contractors are involved early in the planning and scoping stages of the project (Australian Constructors Association, sub. 73, p. 8; IA 2022). This will require strengthening expertise in public sector procurement agencies, as well as greater understanding of alliance and collaborative contracting models.

There are a small number of recent examples of public infrastructure procurement with more collaboration between the government client and contractor, including Transport for New South Wales and Victoria's Major Transport Infrastructure Authority (which oversees the Level Crossing Removal Project) trialling Incentivised Target Cost contracts (Roads Australia, sub. 151, p. 2). The Australian Constructors Association commented that the use of relational contracting in the Level Crossing Removal Project has led to higher productivity and enhanced innovation. Contracts were structured to allow construction teams that achieved minimum standards on a crossing removal to be employed for future crossing removals, thereby 'reducing the churn of people and maintaining that knowledge base on the job' (ACA, trans., p. 84). However, some stakeholders have highlighted that there are still areas for improvement (Roads Australia, sub. 151, p. 2).

Recommendation 5.7
Collaborative procurement on major projects to increase productivity

The Australian, State and Territory Governments should improve the quality and productivity outcomes of public infrastructure projects by increasing the use of alliance contracting or collaborative contracting for major projects, so that contractors are involved earlier in the planning and scoping stages of a project. This could also include building incentives into contracts for the achievement of certain targets or standards.

In some instances, best practice procurement is not to procure at all because the dollars could be spent elsewhere on better outcomes for the public. The oft-repeated admonition to apply genuine, disinterested, rigorous cost-benefit analysis (CBA) of major projects suffers from its forgettability. Everyone says it is a good idea. All jurisdictions and many agencies have developed guides about how to do it (see, for example, ATAP 2018; Infrastructure Australia 2021). Essential elements of best practice CBA include independent evaluation of assumptions and inputs (such as cost estimates and demand or benefit forecasts, involving external experts where required), transparency (for example, showing breakdowns of cost and benefit calculations and being clear on how different scenarios were selected) and accountability (by governments as to how CBA outcomes have been used — or not used — in their project decisions).

But compliance with best practice is piecemeal, and the outcomes of the analysis may not have any effect on project choice. The consequence is that big public infrastructure projects routinely suffer from optimism bias, with large cost blowouts and long completion delays. In 2020, the Grattan Institute estimated that cost overruns on transport infrastructure in the preceding two decades totalled $34 billion in government expenditure, and that at the time of writing six current projects (including Inland Rail, Melbourne's North East Link and the Sydney Metro City & Southwest) had already accrued cost overruns of $24 billion (Terrill, Emslie and Moran 2020, p. 3). More recently, many infrastructure projects involving substantial public funds were committed to by governments before Infrastructure Australia had completed an assessment (Terrill 2022, p. 28). Even if improving the use of CBAs only leads to a slight shift in government decision making and a small reduction in cost overruns in percentage terms, this would amount to substantial improvements in resource allocation and efficiency gains in dollar terms given the size of these projects.

Governments should therefore commit to institutional and governance arrangements that adopt the aforementioned elements of best practice CBA. An example of such an institutional arrangement is the Washington State Institute for Public Policy (WSIPP) in the United States. WSIPP is a non-partisan public research group that applies a consistent CBA model across multiple state-level policies to provide 'policymakers and budget writers with a list of well-researched public policies that can, with a high degree of certainty, lead to better statewide outcomes coupled with a more efficient use of taxpayer dollars' (WSIPP 2019). It uses a standardised set of measures to promote comparability, including a normalised approach to meta-analysis that generates consistent (but context dependent) measures of effect sizes (WSIPP nd, pp. 2–4) and a prescribed method for conducting sensitivity analysis on costs and benefits (WSIPP nd, p. 2). This improves transparency by giving the public reliable and comparable measures to gauge the effectiveness of a range of policies.

In Australia, the government has committed to establishing an Evaluator General, which aims to improve the measurement of policy and project outcomes and work with other government departments to conduct high-quality program evaluations (Leigh 2018, 2022). Such an entity could be a starting point for improving CBA practices (for example, by providing independent evaluation of CBA assumptions and inputs), noting that the proposal is at the Commonwealth level, so efforts would still be required to increase the quality, consistency and comparability of CBAs undertaken at the state and territory level.

While improving the quality of CBAs is important, whether government officials select projects in line with the results of robust CBAs is another matter. At a minimum, CBAs should be provided to government decision makers before an investment decision is made, so that the results can be factored into project choice. The Grattan Institute previously recommended that before government funds are committed to an infrastructure project valued at $100 million or more, independent infrastructure advisory bodies in the states and at the Commonwealth level should have a legislated role to independently assess the quality and assumptions underpinning the project's business case, costs and benefits, and publish this assessment. Although ultimately the project decision would still be made by an elected government official, 'the scrutiny on cost management and infrastructure investment decisions would be increased. This scrutiny would serve to better align politicians' incentives to the public interest' (Terrill, Emslie and Moran 2020, p. 34).

While harder to do, and probably more open to manipulation, CBA also has strong relevance to other government activities like defence, social programs, and healthcare. Dobes (2008) argued that the traditions and expertise of these areas of government predisposes them to use other tools for assessment, like cost effectiveness studies, which provides less guidance to governments about how to allocate finite budgets across projects that are very different in their nature. That assessment remains relevant. Notably, an assessment by the Productivity Commission of programs for Aboriginal and Torres Strait Islander people found CBA and other tools to measure outcomes were rarely used (PC 2020a). But while billions seem to be on the pavement for the picking, a proven tool is neglected. There is a strong need for practical solutions to this predicament.

Recommendation 5.8
Improving the efficacy of public expenditure through better investment decisions

Governments can improve the efficacy and productivity outcomes of public expenditure through institutional and governance arrangements that address the systemic absence or disregard of rigorous cost-benefit analysis (CBA) for both major infrastructure projects and in other government activities, such as defence and social services. Such arrangements should include:

- independent evaluation of the assumptions and inputs used in a CBA, which could be undertaken by a single institution across the State, Territory and Commonwealth levels to support consistency and comparability across different projects and programs. The proposed Evaluator General at the Commonwealth level could be a starting point for this improvement
- transparency about the analysis, including on cost and benefit estimates and forecasts and scenario selection, with independent assessments to be published and provided to government decision makers before an investment decision is made
- government officials aligning their investment decisions with CBA results, and being held accountable for how the CBA outcomes are used — or not used — in project selection.

Defence procurement has long been a contentious issue, bedevilled by concerns about mixed and often inconsistent objectives (defence capability *and* assistance to industry), cost overruns, technical failures, and the weighting given to Australian exceptionalism (‘we have unique needs’).

Some problems arise from the extraordinary complexity of much defence equipment, systems, and software. Complex defence equipment and associated software involves sophisticated manufacturing, information technologies and a highly-skilled workforce. These are slow and risky to develop for bespoke and specialised capabilities. Such capabilities also require other specialised inputs, such as training systems, facilities, and documentation, and involves costs to integrate the new technology into existing ones (Hellyer 2022).

It is not feasible for Australia to develop expertise or domestic capabilities for all such equipment and software. Moreover, attempting to undertake multiple defence projects can slow down the production of any single one, which lowers productivity. It can also pay to wait if government plans to produce equipment already in production overseas, as there can be learning economies as global production ramps up (Markowski, Hall and Wylie 2010, p. 91ff). The early adoption of complex equipment may require adaptation to remedy design and production flaws that only become clear after commencement of production.

Depending on the context, buying an already proven technology from overseas and not quickly, if ever, developing a domestic *production* capability is likely to be optimal in many contexts. A sophisticated domestic capability to use, store and maintain equipment would still be required regardless of where it was sourced from but would involve lower costs than domestic production and assembly.

The Productivity Commission has catalogued instances of large defence procurement projects that involve effective rates of assistance for domestic production of up to 300% (PC 2019, p. 34). This is an extraordinary rate in the context of the other industry assistance, which has dwindled to between 0 and 5%. The transparency that would normally apply for many other procurement activities is lower because of security concerns, though this does not justify the present level of opacity. The Australian National Audit Office, for example, was prevented from publishing its conclusions on the effectiveness and value for money of the $2.2 billion acquisition of the Hawkei vehicle (PC 2020i, p. 17).

The ambitious Collins class submarine program provides an example of what can go wrong and what might be done to shift the procurement mindset. At conception in 1982, the goal was to acquire 10 boats at $100 million each (1982). By December 1999, the cost of the fewer planned boats was $850 million each (Woolner 2001). Of the five boats in the water in 1999, none were performing adequately (McIntosh and Prescott 1999). The problems stemmed not just from the inevitable difficulties in acquiring highly complex products, but from the unique design, the contracting model, the decision to build locally, and project oversight among many other things. Not all aspects of the Collins program were disastrous, but defence acquisitions are so costly to taxpayers and so important for effective defence, that the returns from getting closer to best practice procurement and management would be worth tens of billions of dollars. (Defence spending is anticipated to be about $270 billion over the next decade (Department of Defence 2022, p. 9).)

Defence procurement is ripe for deep and disinterested scrutiny of its processes. There are strong grounds for re-thinking defence procurement, drawing on advice from those outside defence. The independent Defence Strategic Review has been tasked with 'identify[ing] and prioritis[ing] the estate, infrastructure, disposition, logistics and security investments required to provide Australia with the Defence force posture required by 2032-33' (Australian Government 2022a, p. 2), including outlining future investment, mobilisation and funding needs. It provides an opportunity to consider the issues outlined in this report and will deliver its recommendations to government no later than March 2023.

Finding 5.12
Defence procurement has often had mixed goals, used imperfect processes that have led to cost-overruns and failed to achieve the desired capabilities

Defence procurement has often had the mixed goals of achieving a defence capability and providing industry assistance. Imperfect processes have led to cost-overruns of billions of dollars and failed to achieve the desired capabilities. The productivity and efficiency benefits of better practices are large given the $270 billion of anticipated defence spending over the next decade.

Other opportunities to improve public sector diffusion

Data, benchmarking and accountability

Benchmarking can provide good incentives for public sector services to adopt best practice. Governments are already sophisticated at benchmarking their performance with reporting across many services — as in the Productivity Commission's *Report on Government Services*, MySchools, MyHospitals, the Australian Atlas of Healthcare Variations, and publication of sentinel events in hospitals. State and territory governments have developed (and continue to refine) measures of the comparative performance of the more than 550 local governments providing municipal services (with a Victorian benchmarking tool shown in figure 3.2). The benchmarking tools improve the accountability of local governments to their citizens and provide incentives for them to improve their practices. This is buttressed by a range of non-government agencies that provide benchmarking models that pool data from local governments to deliver individualised advice on improvements (Smith 2021).

Figure 3.2 – Benchmarking local government performance

Source: VAGO (nd).

New assessment instruments, such as Patient Reported Experience Measures (PREMs) and Patient Reported Outcome Measures (PROMs) have been developed to get better feedback on outcomes from patients and are in tune with the re-orientation of healthcare to a patient-centred model. At August 2022, there were 275 validated condition-specific PROMs (ACSQHC 2022). The Productivity Commission has previously noted that putting greater emphasis on reporting such patient-centric outcomes, as well as indicators on clinical outcomes such as hospital readmission rates, would further encourage self-improvement across the healthcare sector (PC 2017c, p. 53). This would also assist in reducing variation in health service delivery across different providers (section 3.2).

There are pitfalls in benchmarking than can undermine its credibility, such as the risk that parties have incentives to manipulate embarrassing data. This occurred in the ACT when 11 700 records were found to have been falsified for Canberra Hospital over a three-year period (ACTAO 2012, p. 11). It has been alleged that some schools — wary of the reputational damage of poor NAPLAN results — discouraged some students from sitting the exam, though there is little evidence of the extent of the issue (EERC 2014, p. 17; McGaw, Louden and Wyatt-Smith 2020, p. 78). Audits and whistleblowing can help limit these risks, but so too can deeper analysis of data.

As data gathering and linking by governments increase, the scope for deeper analysis of why there are variations in performance will grow and provide a stronger evidence base for scrutinising the performance of government-funded or operated organisations. For example, school performance depends on funding,

student background and traits, and teacher and leader quality among other things. Without controlling for such aspects, a school might appear to perform poorly despite being a high performer given the characteristics of its students. Evidence about what works in the classroom needs observation and data linked across students and schools. The Commission's assessment of the National School Reform Agreement (PC 2022c) highlighted that a unique student identifier for school students nationwide would open up the capacity for richer understanding of the determinants of school and student performance. As discussed in this Inquiry's companion volume on digital technologies, *Australia's data and digital dividend*, the ongoing creation and integration of government datasets will be a major source of value.

Accordingly, the next big and ambitious step for benchmarking data across all significant government services is to provide more like-with-like comparisons that enable a publicly funded or delivered service in any given area to grasp how far away they are from the frontier and why that is so. For example, the benchmarking comparisons of local government garbage collection costs in figure 3.2 would be enhanced if it controlled for the population of the area and its density. And the Commission has previously recommended that in healthcare, reporting at the individual practitioner level (for instance, individual specialists and allied health professionals) should include both clinical outcomes and details such as location, activity levels and out-of-pocket charges, to facilitate better comparisons and more targeted performance improvements (PC 2017c, p. 53).

Recommendation 5.9
Using performance data on government services to diffuse best practice

Governments should collect and use data on service outcomes and provider performance to benchmark their own service delivery and diffuse best practice. This should go beyond simple descriptive performance comparisons by providing more like-with-like comparisons, so that governments and service providers can understand what is driving differences in performance and how, when not justified, these differences could be narrowed.

Skills in the public service workforce

The Thodey review (PMC 2019) found many flaws in the Australian Public Service in which skill and leadership deficiencies were predominant. (Some of these problems are manifest in the results shown in figure 3.1.) Similar issues will affect public sector organisations across all levels of government and functions, especially considering economy-wide skill pressures.

The vast numbers of people employed in the public sector — about 250 000 in the Australian Government, 1.7 million in state and territory governments and 190 000 in local government (ABS 2021b) — means that there will be natural variation in people's aptitudes. While overall performance can be raised, there are limits. Nor is it unambiguously beneficial to attract more of the 'best and brightest' into the public sector. They are also critical in the business and not-for-profit sectors. In teaching, for example, the appropriate aspiration may be to attract the *good* (and those best suited to the role) and to better use pedagogy, coaching and software to maximise their effectiveness as teachers.

But one area where skills could readily be augmented without significant cost is through a reformed immigration system. As discussed in chapters 1 and 2, the movement of people between different organisations is an important conduit for transferring ideas.

While this inquiry's companion volume *A competitive, dynamic and sustainable future* discusses improvements to Australia's skilled migration policy more generally (many of which are as apt for public services as they are for the business sector), there are specific restrictions to recruiting people from outside Australia in the public sector that are stifling innovation and diffusion of global best practice in government agencies. These include antiquated security, citizenship and residency requirements; in particular, Australian citizenship is a usual requirement for permanent appointments to the Australian Public Service. Across public service agencies, there are processes to gain exemptions, but they are unduly bureaucratic.

Lowering the transaction costs of attracting people outside Australia to be in the public sector would raise skill levels, but above all bring new ideas from countries with different models of public sector services. One way of implementing this could be to have expedited security approval processes for overseas workers that have already obtained similar levels of clearance in their home country, where Australia has a security or intelligence agreement with that country (for example, the Five Eyes alliance). For example, some stakeholders have proposed that as part of the AUKUS agreement, there could be an accelerated security clearance process whereby UK or US workers who have been vetted in their home country could be considered for security clearance to work on defence projects in the Australian Public Service, regardless of Australian citizenship (PwC Australia, American Chamber of Commerce in Australia, and Australian British Chamber of Commerce 2022, pp. 25–26).

Recommendation 5.10
Recruiting public sector workers from overseas to bring in global best practice

Improve the diffusion of global best practice in the public service by loosening the security and citizenship requirements, and overly bureaucratic processes, which currently limit the recruitment of workers from outside Australia who bring innovative ideas and different models to the public service. This could include expedited security approval processes for overseas workers who have already obtained similar levels of security clearance in their home country, where Australia has a security or intelligence agreement with that country (for example, the Five Eyes alliance).

Diffusion bodies and innovation funds with a charter for diffusion

Good ideas often languish because they are lost in the quagmire of other information, are poorly communicated, have not been validated, but above all, require costly changes to the recipient organisation. Those costs arise due to crowded agendas, time poverty, limitations in skills, incompatible software, resistant cultures, and lack of clarity about effective implementation. Moving people with the ideas into the recipient organisation is one avenue because they can gain trust and know the details about implementation — for example, staff secondments from one government department to another enable learnings about designing and implementing programs to be transferred between different (but related) policy areas (APSC 2021b). But this will rarely be an option if the innovation comes from one organisation without adequate resourcing for this diffusion function, as was evident in many of the Productivity Commission's case studies of innovative practices in managing and preventing chronic disease.

There are several options to reduce these problems.

- Show how a potential recipient's organisation is faring compared with similar organisations to motivate adoption (see benchmarking, discussed above).

- Demonstrate concretely the value of a new way of doing something, supported by evaluation, and showing that scaling up of the idea is feasible.
  - Just publishing evaluations is a good step. In the area of Indigenous program evaluation, the Productivity Commission found that of 509 Australian programs from 2016-17 to 2019-20, only 44% were public (PC 2020d, p. 104). More publication of evaluations could be a focus of the government's proposed Evaluator General (discussed above).
  - Innovative new approaches adopted by one service provider can be used as case studies that others can learn from. For example, in healthcare, Monash Watch is a Victorian telephone outreach program that identifies people at risk of repeat hospitalisations and supports continuous health checks and support services through Care Guides who call consumers regularly, and Health Coaches who triage the calls and arrange necessary health services. Interim results show that Monash Watch is achieving a 20-25% reduction in hospital acute emergency bed days compared with usual care (PC 2021b, p. 61). Monash Watch has already expanded from its original location in Dandenong with a second team operating in Cranbourne. Moreover, the initiative is being incorporated into Monash Health more broadly and the approach is expanding to other health services across Victoria.
- Exploit the reputation of existing longstanding institutions with strong brand names that already act as repositories of best practice to be more active disseminators using the now established principles of implementation science.
  - For example, this includes the Australian Commission on Safety and Quality in Health Care for healthcare; the CSIRO for science and research; and the Australian National Audit Office for public administration. Newer bodies such as the Australian Education Research Organisation for school education and Aged Care Research and Industry Innovation Australia for aged care could also play a significant role in diffusing best practice in the future.
- Use existing networks. Regulators and service providers across jurisdictions often meet (for example, competition regulators, liquor and gambling licensing bodies, primary health networks). The norm — encouraged by government — should be consideration of adopting innovations developed in one organisation to another.
- Encourage open standards so that software compatibility problems reduce over time.
- Appoint dedicated diffusion champions to diffuse best practice and new technologies from around Australia (and global peers). These champions would generally be in the longstanding institutions described above.

A challenge in some areas of the public sector is that there is **no obvious body to act as a diffuser**. In some instances, it may be worthwhile establishing a generic innovation fund that supports public sector innovation and then diffuse it. The Victorian Public Sector Innovation Fund is an example, though its effectiveness is unknown. In its Mental Health Inquiry, the Productivity Commission proposed a Mental Health Innovation Fund to trial and evaluate innovative service delivery, system organisation and payment models (which so far, has not been implemented). Where there are material gaps, there may be grounds for similar bodies.

This is especially so where government-funded services are delivered by smaller and highly decentralised organisations (as in employment service providers, disability and childcare) that have little expertise in diffusion, few resources and little individual motivation to invest in activities whose returns are spread over the whole industry.

A hazard in some efforts to diffuse ideas is that they are based on **loose networks with insufficient focus and funding** to sustain them. The Public Sector Innovation Network had lofty goals for diffusing best practice

methodologies and a place for developing networks between experts in the Australian Public Service. But it appears to have vanished (DISR 2020), though ghosts of its presence still linger on the web (Australian Government 2022b). There may be grounds for encouraging new diffusion networks, but only if they are sufficiently focussed, involve practitioners in the relevant area, and have a clear goal of diffusion.

In some instances — such as (virtual and physical) communities of practice — there are often strong enough incentives for participants to sustain the network and to share their knowledge because they obtain day-to-day benefits and share a direct interest in the knowledge being exchanged (Mullan et al. 2022; Shaw et al. 2022). But networks that lack those features and involve **discretionary efforts by busy people** across agencies and service providers rarely survive because the enthusiastic people move on or because urgent tasks displace longer-term goals.

Recommendation 5.11
A bigger role for diffusion bodies

Expand or strengthen the role of existing diffusion bodies — such as the Australian Commission on Safety and Quality in Health Care, Aged Care Research and Industry Innovation Australia, Australian Education Research Organisation, CSIRO and Australian National Audit Office — with the aim of disseminating best practice, including the elimination of practices no longer underpinned by adequate evidence. Trial innovation funds in selected public services where there is no existing body for diffusing best practice, such as in mental health service delivery.

Foundations for diffusing regtech

Governments can facilitate more use of technology and diffusion of best practice in many industries through its use of and support for regulatory technology, or 'regtech'. Regtech can be a more efficient way of designing and implementing regulation for both businesses and government, as well as improving the quality of regulation and opening up new opportunities for streamlined regulation (PC 2020h, p. 9).

For example, in the agriculture industry, the Australian Government is providing grants for regtech initiatives that can assist in streamlining compliance obligations, improve traceability across agricultural supply chains and ultimately increase regulatory efficiency in the sector (DAFF nd). And the single touch payroll (STP) system has enabled businesses to automatically report their pay, tax and superannuation data to the Australian Tax Office via their STP-enabled payroll accounting software, resulting in lower compliance costs and greater speed and accuracy. (The benefits of this initiative, including providing rapid monitoring of the economic impacts of COVID-19 (Andrews, Hambur and Bahar 2021; PC 2020h, p. 10, 2022a, pp. 48–49) and stimulating the take-up of technology by small businesses, are discussed in further detail in this inquiry's companion volume *Australia's data and digital dividend*.)

Regulations can be implemented in a way that lends itself to developing regtech solutions, such as through the coding of regulatory rules into machine-interpretable formats (PC 2020h, p. 24), which makes the details of complex regulation easily accessible to regtech software providers. Creating regulatory 'rules as code', such as the NSW Government's machine-readable version of the *Community Gaming Regulation 2020* (NSW), 'allows industry and government to embed digital rules directly into their IT systems to streamline compliance and automate any changes in the future. In addition, consumers are able to navigate this digital version of the regulation easily via an interactive questionnaire' (ACMA 2021, pp. 12–13). When new regulations are likely to be amenable to a regtech solution, governments should implement them in a

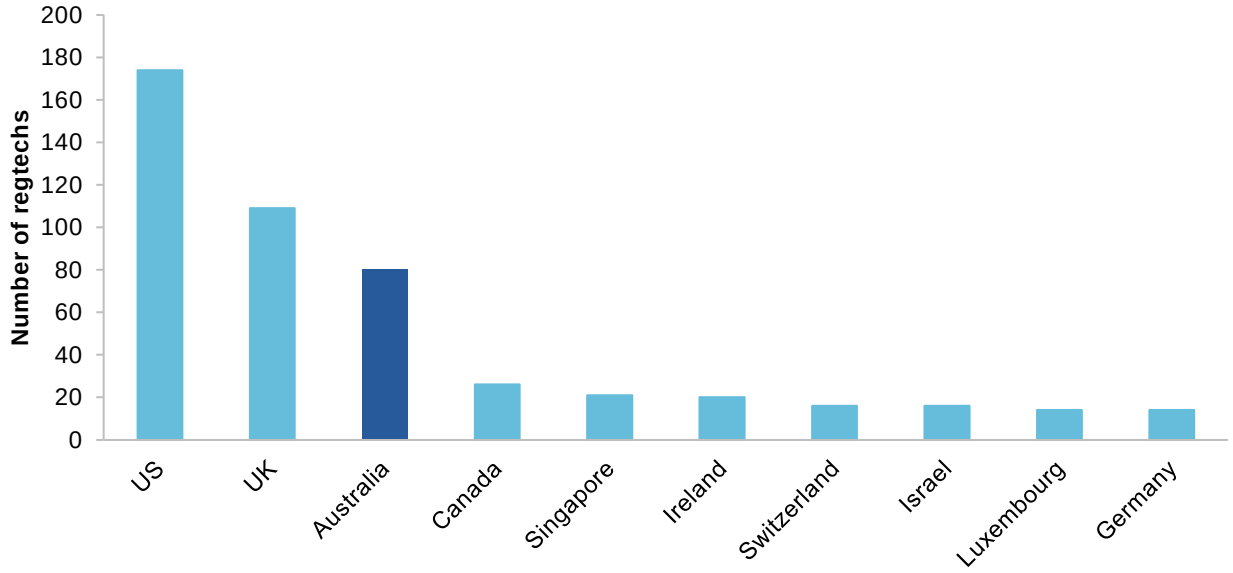
machine-interpretable format at the outset, so as to avoid the need to go back and codify such regulations in the future (which may be more costly).

Relatedly, the government has an important role to play in promulgating consistent data fields and formats that can be used in regtech, such as work the ATO has done through the Digital Partnership Office (see this inquiry's companion volume *Australia's data and digital dividend*). For example, in the case of Standard Business Reporting, the Australian Government's taxonomy and list of data fields allowed digital service providers to build new compliance solutions to automate regulatory reporting for businesses (PC 2020h, p. 23).

Software providers can use existing databases to create regtech solutions; however, by adopting a 'rules as code' approach and consistent data standards, governments make it easier for industry to design compliant solutions. Working with providers of regtech solutions can assist in identifying areas that would benefit most from these approaches. There were about 80 regtech providers headquartered in Australia in 2020, which compared favourably relative to other developed countries (figure 3.3), suggesting there is scope for government and industry to collaborate in rolling out regtech solutions. This can improve regulatory compliance and efficiency; for example, in implementing Single Touch Payroll, the ATO worked closely with digital service providers to ensure that payments could be reported directly from payroll software in a way that met regulatory requirements (ATO 2019, pp. 2–3).

Figure 3.3 – Australia is a hub for regtech companies

Number of regtech headquarters by country, 2020



Source: Wray et al. (2020).

One area with potential for greater diffusion of regtech is workplace relations. Numerous companies already offer payroll software solutions with automated award interpretation; that is, software that automates payroll changes when changes to modern awards occur. The process could be further streamlined, with the Fair Work Commission currently developing an application programming interface — co-designed with software providers, peak bodies and unions — that will enable software providers to connect directly to its modern awards pay database as a 'source of truth' on wages and entitlements (Hendry 2022). This would mean that, should the government make future changes to modern awards, it would be easier for software providers to access information about the changes and accurately integrate them into their regtech solutions.

Recommendation 5.12
Encouraging regtech development and diffusion

Governments should support greater use of productivity-enhancing regtech by:

- providing regulation in forms that lend themselves to regtech solutions, such as coding regulatory rules into machine-interpretable documents, like the NSW Government's machine-readable version of the *Community Gaming Regulation 2020*. New regulations that are likely to be amenable to a regtech solution should be implemented in a machine-interpretable format at the outset, to avoid the need to go back and codify such regulations in the future
- working with software providers to identify areas where they could improve foundational settings to encourage industry to design compliant regtech solutions. The Fair Work Commission's efforts to develop an application programming interface that enables software providers to directly access its awards database, in co-design with stakeholders, is an example of such an improvement.

Exploiting the special features of knowledge

Much knowledge is like a 'free lunch' hidden in a vault. By its nature, the consumption of knowledge by one person has no effect on the capacity of another person to consume it (knowledge is 'non-rivalrous'). However, while some generators of knowledge cannot prevent others from copying it for free (for example, the *idea* of a smartphone), in many instances, it is feasible to exclude use through contractual provisions like non-disclosure agreements and intellectual property regulations. Some such commercial protections can be justified to the extent that they allow a creator to benefit from, and thereby motivate, their inventiveness.

However, such rights can be overly expansive and destructive to the diffusion of ideas. While some of the concerns relate to diffusion of knowledge that predominantly affects private businesses (like patents), others have a special significance to government-operated or funded activities (like education and social services) and best practice regulation (such as safety regulations).

Access to publicly-funded research

Much of the academic literature funded by governments in Australia is refereed for free, but hidden behind paywalls by journal publishers, diminishing the free flow of ideas at the frontier (PC 2016a, pp. 465–471). This hampers the diffusion (and further creation) of ideas not only to businesses, as discussed in chapter 2, but also to government-funded service providers like clinicians, and public sector organisations like universities, public hospitals, research agencies and many parts of the public service. While official evidence about the parties that use academic research is limited to the business sector, it suggests that industries with significant government funding are the most common users of this important source of ideas (table 3.2). Recommendation 5.3 discussed above in this report could therefore have significant benefits for the public sector, in addition to the potential productivity gains for businesses.

Table 3.2 – Select sources of ideas for the Health Care and Social Assistance Industry
Two years ending 30 June 2021[a]

Source of idea/information	Share of entities using this source (%)	Relative use compared with all industries (multiple)	Rank of source among 17 industries
Academic conferences	11.7	4.3	1
Universities or other higher education institutions	17.8	3.3	1
Journals, research papers and publications	11.0	2.9	2
Government agencies	13.2	2.4	2

a. The Health Care and Social Assistance industry includes a mix of private and not-for-profit organisations that are highly regulated by governments and that depend significantly on their funding, such as GPs, aged care, and disability facilities. The table relates to the sources of knowledge that are either directly sourced from the academic literature or where the sources of ideas are themselves likely to depend on access to that literature. For example, among the 17 industry divisions covered by the ABS Business Characteristics Survey, the number two user of ideas from journals, research papers and publications was the Health Care and Social Assistance Industry, with about one in five entities in this industry sourcing ideas from the academic literature, which is a usage rate 2.9 times higher than the all-industries total. The relevant ABS survey excludes public sector enterprises (like public hospitals, universities, the public service and public research institutions) that would have a relatively high level of use academic literature. Accordingly, the table will underestimate the importance of the academic literature to public sector functions.

Source: ABS (*Characteristics of Australian Business*, 2020-21 financial year, Cat. no. 8158.0).

Fair use

Australia also has weak fair use provisions compared with countries like the United States, again potentially stymieing knowledge diffusion in activities run or funded by government — universities, schools, libraries — as well as businesses (PC 2016a, pp. 165–198). There are strong grounds to re-visit fair use provisions, and a fair use exception could be developed and implemented in Australia in a way that complies with international copyright law (PC 2016a, p. 184).

Standards

Standards are widely seen as a major formal mechanism for the codification and diffusion of practical knowledge (Blind, Ramel and Rochell 2022; CIE 2006). Standards can enable the dissemination and coordination of both local and international practices; for example, the Australian Mobile Telecommunications Association observed that having consistent standards in areas such as wireless access supports investment decisions as they 'ensure support globally by large and small vendors, global economies of scale are leveraged… [and] harmonised deployments between market participants' (AMTA, sub. 163, p. 8). Moreover, standards are not just relevant to for-profit businesses, with many relating to government-owned and funded organisations (like child, disability and aged care, community organisations) and regulation (such as safety and data rights).

Standards are a perfect example of a non-rivalrous good with high public benefits. Recognising this, some standards are open, as in geospatial data. Many other standards are not. For example, IWA 18 016 is a 'framework for integrated community-based life-long health and care services in aged societies' and downloading this from the Standards Australia store costs $260.06. And Master Builders Australia submitted that:

> In the building and construction industry, the prescription of expensive regulatory texts which contain mandatory regulations is made even more frustrating by the practice of referencing a

> veritable warren of linked standards which may also need to [be] consulted – and not for free. (Master Builders Australia, sub. 190, p. 5)

In Australia development of such standards by a not-for-profit entity, Standards Australia, relies on the voluntary engagement of technical committees comprising government, business, community, academic and consumer participants.

Despite the public benefits of standards, they are not free to many users, or if so, the ways in which free access can be obtained may not be obvious. This can entail significant costs for activities where many and changing standards apply. For example, the Australian Competition and Consumer Commission (ACCC) observed that the National Construction Code references over 100 standards that a building and construction business would be required to purchase to understand their legal obligations. It drew a link between the barriers to compliance arising from the costs of access to standards and the major safety incidents that arose from the use of non-conforming combustible aluminium cladding (ACCC 2019, p. 3).

Some standards are mandated in legislation, and some are voluntary. Pricing for the mandated standards risks non-compliance, while pricing for voluntary standards limits the efficient diffusion of knowledge. The arrangements for licensing and paying for Australian standards has been controversial for many years. In the main, this reflected the pricing strategies of a private business that was given exclusive distribution rights for the standards by Standard Australia in the early 2000s. That right ceased in late 2018, but many standards are still sold by Standards Australia to meet its costs.

The ACCC has put forward the view that standards required by legislation should be available at zero charge, while many organisations formally petitioned Parliament in 2022 to abolish any fees. That standards should be free for mandatory standards has merit, given the risks of non-compliance and the fact that many have been developed by government agencies as part of their normal operations. But free or lower-fee provision of voluntary standards would require funding by the Australian Government (and potentially industry associations), and therefore further consideration of optimal funding models.

Recommendation 5.13
No-cost or low-cost access to ideas that have large public good value

To support the diffusion of best practice and knowledge that has already been generated by innovative businesses, not-for-profits and government organisations, the Australian Government should:

- make mandatory standards freely available and look at new funding models for Standards Australia to reduce or eliminate the pricing of voluntary standards that have high public good value
- require open access to research principally funded by governments (see recommendation 5.3 of this report for further detail)
- reform fair use provisions in intellectual property regulations to adopt a principles-based fair use exception.

Appendix

A. Stylised simulations of economy-wide effects

Potential productivity benefits of diffusion[29]

The Productivity Commission used a whole-of-economy model to examine the potential productivity benefits of better diffusion of new ideas, knowledge, business models, technologies, and management capabilities, as well as increased data use. The potential benefits were demonstrated in a stylised manner by simulating scenarios in which all production inputs (labour, capital and intermediate inputs) could be used more efficiently, such that an industry is able to produce 1% more output using the same inputs. This assumption was applied in 16 separate simulations across each of 16 broad industries in the model (excluding the 'ownership of dwellings' industry).

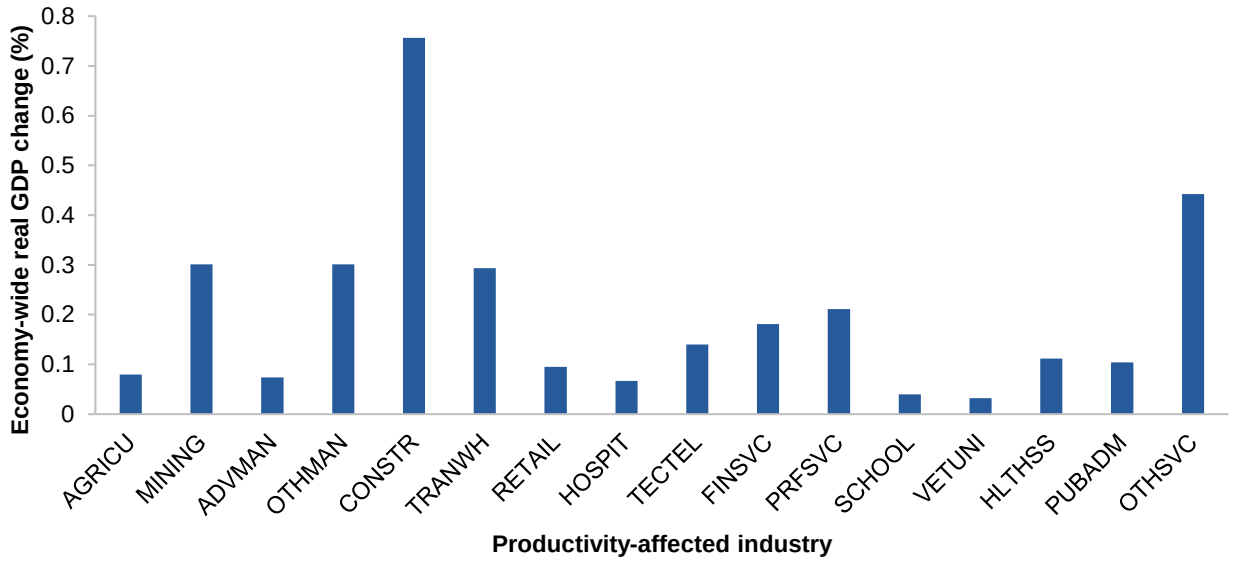
There is a high level of uncertainty in the potential size of productivity improvements arising from the recommendations to improve diffusion in the Australian economy proposed in this report, as well as other model assumptions. As such, the 1% productivity improvement has been simulated for illustrative purposes, so that the simulations can provide insight on how potential productivity improvements could flow through the economy's structure and the differential impacts across the economy. Further details of the model, simulations and effects of sensitivity testing are contained in this inquiry's companion volume *Whole-of-economy modelling*.

Under each simulation, the improved productivity of the affected industry led to a fall in prices of that industry's outputs relative to the economy-wide consumer price index (CPI), as more output could be produced per unit of input. This, in turn, increased demand for that industry's goods from households, government and the rest of the world. Economy-wide, real GDP increased across all simulations, with the size of the increase varying from about 0.03% when the productivity effect was applied to the 'technical, vocational and tertiary education' industry, to 0.76% when applied to the 'construction' industry (figure A.1).[30]

[29] Referred to as simulation 1 in this inquiry's companion volume *Whole-of-economy modelling*.

[30] Another way of examining the relative real GDP impacts across simulations is to adjust the economy-wide real GDP effect by the relative change in output for the simulated industry. In doing so, it was found that the shocks to 'construction', 'technology and telecommunications', 'professional, scientific and technical services' and 'other services' industries led to real GDP effects that were proportionally larger than changes in the quantity of outputs produced by those industries. While the 'construction' industry effects were likely largely due to its effect on investment and the capital stock (described below), the outputs of the other industries were among those that were most heavily used as intermediate inputs in the production of goods and services. Therefore, productivity improvements in these industries were better able to flow through to other industries through lowering their production costs, leading to larger economy-wide real GDP effects.

Figure A.1 – Estimated change in real GDP from 16 diffusion simulations[a,b]



a. Each column represents the economy-wide real GDP change from a separate simulation. **b.** Industry abbreviations: AGRICU – agriculture, forestry and fishing; MINING – mining; ADVMAN – advanced manufacturing; OTHMAN – other manufacturing; CONSTR – construction; TRANWH – transport and wholesale; RETAIL – retail trade; HOSPIT – hospitality; TECTEL – technology and telecommunications; FINSVC – financial services; PRFSVC – professional, scientific and technical services; SCHOOL – school education; VETUNI – technical, vocational and tertiary education; HLTHSS – health and social services; PUBADM – public administration; OTHSVC – other services.

Source: Productivity Commission estimates.

The different economy-wide real GDP impacts across different simulations varied based on two aspects of the economy's structure:

- the size of the industry experiencing the increased diffusion and resulting 1% productivity improvement — increasing the productivity of industries that were a larger share of the economy led to larger GDP impacts.
  - For example, the 'other services'[31] and 'construction' industries accounted for relatively large shares of economic activity (about 13% and 8% of gross value added, respectively) before the simulation, so simulating a 1% increase in productivity in these industries had larger economy-wide GDP effects in the model.
  - The 'advanced manufacturing' industry, while often a focus of government policy attention, accounted for only 1.5% of gross value added, and as such the economy-wide GDP impact was relatively small after simulating a 1% productivity increase.
- the extent to which the industry's outputs were used in investment — increasing the productivity of industries that were relatively more used in investment supported the growth of the capital stock and led to cheaper rental costs of capital. This, in turn, enabled all industries that use capital to reduce their production costs.

[31] 'Other services' include energy and utilities, rental and real estate services, administrative and support services, arts and recreation, repair and maintenance, and personal services. These services were grouped together for the model because they were not separately considered to be key industries of interest for the simulation scenarios (companion volume *Whole-of-economy modelling*).

- The investment sector relied most heavily on ‘construction’ commodities, which constituted close to 60% of the total value of investment before the simulation. Simulating increased productivity in the ‘construction’ industry increased the capital stock by 0.9%.
- Non-market services, such as education, ‘public administration’ and ‘health and social services’, were least directly relevant to the investment sector, and are also produced with relatively little capital. The capital stock increased by less than 0.1% when productivity improvements in these industries are simulated.

There were also different effects on labour use in productivity-simulated industries. In some industries, increased productivity led to a fall in labour used by that industry because less labour was required to produce each unit of output, which more than offset the need for more labour arising from increased demand for goods and services (due to the aforementioned relative price falls). In other industries, particularly those for which overseas demand was more responsive to price changes (such as ‘mining’, ‘advanced manufacturing’, ‘other manufacturing’ and ‘technical, vocational and tertiary education’), the increase in demand for these industries’ commodities was large enough to drive an increase in labour used by that industry.

The capital stock increased under all simulations. Although some productivity-simulated industries used less capital in production after the productivity shock, this was more than offset by increased demand for capital from growth in other industries, as well as lower relative prices of investment and capital rental in some scenarios.

The overall wellbeing of households (as measured by a combination of how much they consume and how much leisure they enjoy) increased across all simulations. This was largely due to real wage rates (that is, wages relative to the economy-wide CPI) rising across all age groups, genders and education levels. Other than in the simulations that increased productivity in ‘school education’ and ‘health and social services’, households chose to spend slightly less time on leisure and increased their hours of work (which facilitated an increase in consumption).

While household wellbeing increased in all simulations, the effects were not enjoyed equally across different groups. Industries such as ‘retail’ and ‘hospitality’ tended to employ more younger and lower-educated workers who had lower wage rates. Productivity improvements in these industries led to these industries reducing their use of labour. While this labour was absorbed by other industries, overall real wage rate rises were still smaller for younger and lower-educated workers compared with older and more educated workers, leading to greater consumption inequality. Conversely, productivity improvements in industries such as ‘financial services’ and ‘professional, scientific and technical services’, which tended to employ higher-earning more educated workers, led to a fall in consumption inequality because real wage rises were relatively smaller for these workers than for the younger and lower-educated workers who were more likely to be employed in other industries.

In addition to simulating 16 separate diffusion scenarios across each of the 16 industries in the model, the Commission ran an overall simulation that applied the 1% productivity improvement to all 16 industries at once. Improving productivity in all 16 industries by 1% in a single simulation led to an increase in real GDP of about 3.3% and an increase in real gross national income of about 3.5%. These increases were slightly higher than the combined increases from each separate simulation, due to interaction effects across the economy. Sensitivity testing found that the real GDP increase ranged from about 1.6 to 4.9% across different assumed shock sizes, indicating the uncertainty of effects (chapter 4 of this inquiry’s companion volume *Whole-of-economy modelling*). The overall improvement in household wellbeing was worth about $1850 per person per year in 2018-19 dollars, and the benefits were more evenly spread across different individual groups, leading to a reduction in consumption inequality.

Abbreviations

ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
ABS	Australian Bureau of Statistics
ABSF	Australian Business Securitisation Fund
ACCC	Australian Competition and Consumer Commission
ACSQHC	Australian Commission on Safety and Quality in Health Care
AI	Artificial intelligence
APRA	Australian Prudential Regulation Authority
ASIC	Australian Securities and Investments Commission
ATO	Australian Taxation Office
CBA	Cost-benefit analysis
CPI	Consumer price index
CSIRO	Commonwealth Scientific and Industrial Research Organisation
FDI	Foreign direct investment
GDP	Gross domestic product
IHACPA	Independent Hospital and Aged Care Pricing Authority
MBS	Medicare Benefits Schedule
MSAC	Medical Services Advisory Committee
NAPLAN	National Assessment Program – Literacy and Numeracy
OECD	Organisation for Economic Co-operation and Development
PC	Productivity Commission
RTO	Registered training organisation
SME	Small and medium enterprise
STP	Single Touch Payroll
VET	Vocational education and training

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