6

Conclusion: challenges and opportunities for Australia

> *Alfred Hitchcock trained as an engineer. Margaret Thatcher trained as a chemist. People who combine deep learning in a discipline with the insight to think and work beyond it can catch opportunities that others miss. The same is true of teams in the modern workplace: they need to mix depth of expertise with breadth of perception and skills.*
>
> **Alan Finkel,**
> launch of SAF10 *Skills and Capabilities for Australian Enterprise Innovation*, 21 July 2016

Advice for an unknowable future

The interdisciplinary Securing Australia's Future research program, as synthesised in the preceding pages of this book, brought together researchers to identify Australia's distinctive strengths and advantages; it highlighted the contexts and policies required to encourage creativity, innovation, adaptability and resilience; and its 11 reports explored the natural, geographical, economic, social, cultural and scientific characteristics and capabilities that Australia needs to succeed and thrive. ACOLA's ability to pull together messages from across disciplines has provided a rich understanding of opportunities and challenges in Australia.

Securing Australia's Future drew on Australia's leading experts, scholars and practitioners across a wide range of disciplines from science, technology, engineering, mathematics (STEM), humanities, arts and social sciences (HASS). The characteristics of our environment, biodiversity, region, population and culture, and other attributes that define the unique domains where Australia can succeed in an evolving global environment, were examined thoroughly. In summarising this immense undertaking, we have aimed to identify the advantages Australia has and can build on to help the country enhance productivity, innovation, fairness and equity.

Admittedly, the future is unknown and, in many ways, unknowable. But we do know that the future will not simply be a more technologically advanced version of today. We need to prepare to make opportunities out of whatever happens in that unknown future. A decade ago, Australian agriculture was in decline; it is now showing renewed promise. Who knows what the growth industries of 2030 will be? It is important for Australia to look at education, technology, society and other factors to keep our options open.

The future needs more than just science, or just engineering. We need all research, working together in an interdisciplinary way. We need to draw on new knowledge and ideas, and consider what to continue doing, stop doing and what to do differently. We need strong leadership and proper policy foundations. Securing Australia's Future aimed to craft a national roadmap for decisions about the future and the conditions that can underpin achieving the nation's best, and achieve higher living standards, increased equity and greater sustainability.

Past performance ≠ future success

Australia performs well internationally in measures such as government-provided services (such as health and education), global engagement of government and business, economic freedom and workforce flexibility, life expectancy and education. However, our main employment, production and export sectors – agriculture, mining, manufacturing and services – need to prepare for the future in a rapidly changing global economy.

Agriculture, one of our oldest and most important sectors, has steadily declined in its proportion of economic contribution over the past 100 years. Thankfully it has seen dramatic increases in productivity in recent years due to increased technology use and innovation investment.

Similarly, the mining industry has been a leading contributor to Australia's economic growth and international impact. It represents Australia's largest export earner, and while economically it is in a period of decline, the volume of minerals extracted continues to be high and the mining sector will continue to be important to the future of Australia. It will also continue to be an innovative and globally connected industry.

In both mining and agriculture, we do not yet have much of an advanced, high-value-added approach. This leaves these sectors, and hence the Australian economy, vulnerable to global price changes. Historically, Australia has grown and sold produce, and dug up and exported minerals. We haven't had to excel at development and commercialisation as our land has been productive and prices high. While we need to continue to supply countries such as China with raw materials for their steel industries and other sectors, to secure our place as a 21st century knowledge economy we need to move away from an extract-and-export focus.

Historically, we have also built things. The manufacturing sector has played an important role in Australia's economy, but its contribution has also declined. The success of Australia's future manufacturing industries will depend on technological innovation, a shift to advanced manufacturing, integration with services, international connectedness and enhanced participation in global value chains.

It is Australia's services industries – encompassing anything other than agriculture, mining and manufacturing – that now dominate the Australian economy. In particular, well-established areas including post-school education, health services and financial services are renowned for their quality, resilience and outcomes, and could draw on innovation to drive Australia's productivity growth in all other sectors.

Smart farming, smart engagement

Agriculture will remain an area of strength for Australia, with our world-renowned clean, green, safe, affordable, sustainable and ethical agricultural products. But the domain's prosperity has partly been due to growing and exporting basic agricultural commodities

that play a low-value part in the value chain. Our focus on commodities instead of value-added products needs to change. Australian industries too rarely focus on adding value to products, even though that is what a highly developed country with a highly skilled workforce should be doing. Rather than aiming to offer commodities at globally competitive prices in the face of competition from lower cost international markets, we need to offer quality, environmentally friendly, clean and value-added products.

Not all innovations will be successful. But failure is an ever-present partner of inventing, of new technology, and of trying out a new policy. Acknowledging the possibility of failure, and dealing with it in an effective manner, is often a recipe for success. If failures arising from the development and adoption of new technologies were viewed as system flaws (to be fixed) rather than flaws in the characters of those involved, it could encourage people to try out new, and even risky, technologies.

Australia could capitalise on the growth in demand for high-value agricultural products in Asia. Even in the trade of basic commodities, our proximity to Asian countries provides a strong advantage in trading bulky primary products that are expensive to transport. However, many Australian businesses consider engagement with Asia too hard. Australia invests more in New Zealand alone than in China, Indonesia or all ASEAN countries combined. Australia needs to be smarter in its engagement with the countries of Asia to benefit from the global power shift towards Asia, which is the biggest economic trend and defining characteristic of the 21st century. For Australia to find its place in the region and maximise the opportunities presented by a growing Asia, we will need to address the cultural and linguistic barriers that – while improving – still remain. Advances in Australians' understanding and appreciation of cultural nuances and diversity are required if we are to realise business opportunities.

Australia's relationships with the countries of Asia and the Pacific have sometimes been distant and relatively cold, while most people in Asian countries lack detailed knowledge of a 21st century Australia and have impressions based on outdated stereotypes. To overcome this distance, the 19th and 20th century behaviour of Australia, which involved turning to the English-speaking nations and Europe for culture and trade, needs to evolve to meet the needs of a 21st century economy embedded in the Asia-Pacific region.

Smart engagement with Asia and the Pacific involves building relationships for the long haul. Our engagement with countries in our region has too often been short term, opportunistic and piecemeal. Smart engagement, by contrast, involves scaling up current activities and nurturing wide-ranging, long-term, mutually beneficial relations between Australia and the diverse countries of the region. Smart engagement promotes active interactions between Australians and Asians, through business associations, community groups, cultural non-government organisations, private foundations and philanthropists, individuals such as artists and sportspeople, and independent cultural, media and educational institutions. In particular, Asian diasporas – communities of people of Asian descent living in Australia – are a resource for linguistic skills, cultural knowledge and social networks that can help connect Australia with various parts of Asia. Australia could lead the world in developing policies and programs that encourage more effective engagement of Asian and Pacific business diasporas.

However, most Australian businesses have little board or senior management experience of Asia or Asian languages. The cultural ancestry of leaders in Australia's top companies is overwhelmingly white. Only around 4 per cent of Australia's top 200 publicly listed companies' board directors are of Asian descent. This should be a major concern for a country geographically positioned in the Asia-Pacific region and with a significant

percentage of its population represented by Asian and Pacific communities, especially one that should look to that rapidly growing region to plan for its economic future.

Educating the future workforce

People who speak only English are at a significant disadvantage when engaging in a multilingual world. Even a little familiarity with another language leads to greater sensitivity with other cultures, resulting in more effective social interactions and business relationships. Despite the promotion of Asian languages being an education policy goal since the 1990s, participation and interest in foreign languages has remained low. But the need for proficiency in Asian languages goes beyond the benefits to the economy. It would also benefit research collaboration, and would move Australia from being a country that projects an out-dated image of isolation to one embracing mutuality and cooperation with our regional neighbours.

But we are not just calling for more language education. We need improved science education to supply technical knowledge as well as cultural understanding to the future workforce. Australia needs to lift its performance in literacy, numeracy and maths, physics, chemistry and general scientific literacy. Participation in senior secondary science and mathematics has been declining for decades. Australia has too few science and maths teachers. We need to improve in all these areas if we want to keep pace with our competitors. Australia needs national coordination of its approach to encouraging science and maths participation.

Australia will need to train a future workforce to be equipped with skills to work with and maintain complex equipment and new technology in many sectors. An innovative workforce requires a strong education system that fosters academic skills across all disciplines. Technology is constantly changing the nature of our work. Old jobs disappear and new ones arise. The workforce needs to thrive with tomorrow's technologies; it needs to be adaptable. A skilled and productive workforce is essential for economic growth, and is one of the main contributors to productivity gains through innovation. Australia faces shortfalls in skilled workers due to developments in technology and an ageing population. For agriculture, energy, environment and other sectors, we will need a growing proportion of workers to be trained in scientific and technological literacy.

Furthermore, equipping students with scientific and technological knowledge, understanding and awareness provides the basis for participation in the most significant national and international debates of today, such as climate change, renewable energy and genetic modification. Many emerging technologies trigger debate about ethical, legal and social implications from invention to use. Understanding of, and participation in, these discussions will enable the next generation to better shape the course of their own lives.

However, education improvements are required beyond science, technology, engineering and maths: STEM is necessary, but not sufficient. It is not an either/or situation. The humanities disciplines are vital in helping us decide when, how and in what circumstances it is appropriate to use new technologies. Australia needs to revitalise education more generally in order to have the best opportunities to develop aptitude in students. Innovation is not just about commercialising technical products: all sorts of people can be innovative, beyond science technology.

Australian enterprises – and education and government institutions concerned with innovation – need to move beyond a focus on technical skills alone and consider what other sets of skills will be needed for successful innovation in the future. Important

workplace skills include creativity, problem solving, adaptability and preparedness to continue learning. Successful organisations need people with team-building capacity, emotional intelligence, market analysis ability and cultural sensitivity. Our future workforce needs to combine technological expertise with the ability to effectively and efficiently integrate various knowledge bases and skill sets, and deploy a range of communication capabilities and other 'soft skills' including team-building capacity, emotional intelligence, strategic visioning, market analysis and cultural sensitivity. Innovation now depends on a range of technical and non-technical skills, with people endowed with diverse sets of skills working in teams, and organisations working in alliances and networks that bring together different skills and experiences across different types of innovation and different activities in the innovation cycle. Building effective and productive interdisciplinary teams is not easy, but it is vital.

Building effective and productive interdisciplinary teams is not easy, but it is vital.

In addition, Australia needs to lift our performance in equity of opportunity and access for women and minority groups; inequity can lead to gaps in the workforce. A diverse and inclusive workforce is crucial to encouraging different perspectives and ideas that drive innovation. The participation rate of women in engineering professions was just 21.5 per cent in 2011, and women working in science remain hugely under-represented in leadership roles. For example, Australian boards and leadership appeared to be 'pale, male and stale', with there being more men named Peter in chief executive and chair positions in ASX 200 companies than there were women!

Also, despite improvements in the past decade, there is an unacceptably large gap between Indigenous and non-Indigenous educational outcomes – two culture-related issues act against Indigenous participation in STEM, including a mismatch between cultural beliefs about the world and science curriculum beliefs, and Indigenous students often having problems dealing with institutional cultures.

Exporting knowledge

As well as serving to prepare Australia for the future, education is also one of our biggest export earners. The provision of education to Asian students is already one of Australia's largest industries and international students are the source of substantial income through fees and other education-related services. In 2013 there were 410 925 international students studying in Australia, and the industry contributed $18.2 billion to the economy.

There is an opportunity for Australia to expand its international engagement through research partnerships. Such collaboration could enforce its position as a leader in education, and provide a base on which to increase research and knowledge exports. This would provide an increase in export potential of Australian-generated knowledge, and improve our research and development capability. There has been a lack of government initiatives in this area, and the strategic significance of international research collaboration receives little attention in Australian foreign policy. Improving attention to this area would provide another avenue for building relationships with Asian and Pacific countries, and countries further afield, through research diplomacy and collaboration. Indeed, climate change is a challenge that crosses international boundaries and is a research priority for many countries. If supported with appropriate policies, investment and commercialisation, our climate adaptation expertise could be applied to global advice and leadership in

innovation that supports adaptation to climate change (particularly in agriculture), and reduction in emissions through new and renewable energy sources. Australia's interdisciplinary research activities can contribute to sustainability goals around the world, including climate change, the security of food, water and energy, and an ageing and growing population.

Securing Australia's environment

Any consideration of securing Australia's future needs to include an understanding of the risks and costs of the impacts of climate change and other changes to the environment. We need to maintain our clean, green reputation to secure our future in agriculture, tourism and other areas. Environmental performance and sustainability are fundamental to the nation. They represent the legacy that the current generation will leave. We need to look after nature for future generations to ensure a sustainable environment, diverse plants and animals, and human wellbeing.

Instead of using coal for the generation of electricity, there is a range of energy alternatives; renewable energy sources and increased use of gas (including shale gas, one option examined by ACOLA's Securing Australia's Future project) would emit less carbon dioxide into the atmosphere.

Planning is required to prevent increasing population and urbanisation from causing significant congestion, which could harm liveability and quality of life. For example, a 'compact city' plan reduces urban sprawl by providing city centres that can be navigated on foot or by bicycle. This can be further encouraged through the establishment of areas such as innovation clusters, high-tech nodes and creative sectors. Furthermore, as broadband speeds increase and enable a growth in telecommuting and shopping from home, cities will have less need for a central business district, and may head towards a decentralised design that reduces our reliance on cars and road transport.

Australians rely on cars for transport, and we have a disproportionate reliance on heavy vehicles for goods transport. Therefore, it is surprising that Australia holds less than a month's supply of oil and refined fuels onshore. This leads to Australia having a significant fuel security risk. Research and new technologies can address the country's fuel security risk, as well as transport costs, inefficiencies in road transport, and environmental impact.

However, technology alone will not be enough to solve transport and urbanisation problems. Interdisciplinary research will be required to address problems such as social barriers to change. It is important to understand people's resistance to technological changes in the way we manage and interact with the environment, including our water, food and energy. Technology can be the catalyst for change, but is not always the answer to our problems. Prior to the introduction of technology, resistance to or uptake of new technologies needs to be seen in the social context of values and beliefs, as well as the environmental context. Many factors that will influence our future are entwined, and we require a holistic, interdisciplinary approach to unpick, understand and prepare for them.

Taking it home: key messages

How can Australia address these opportunities and challenges? While the Securing Australia's Future program did have some notable gaps – it lacked a significant focus on climate change and subsequent socioeconomic impacts (such as immigration policy), investigation of the specifics and details of other new and renewable energy sources beyond shale gas,

and addressing Australia's ageing population and changing demographics – the program did identify many important findings to consider for Australia's future. The following key findings distil the interdisciplinary evidence-based research from the 11 reports published as part of ACOLA's Securing Australia's Future project.

A. To position Australia for long-lasting improvements to growth and living standards:

1. Industry policy that relies only on past strengths will not provide the desired results unless complemented with new policies. This is due to the realities of globalisation, and the ongoing revolution in information technologies and other enabling technologies.
2. Lower value activities, such as extracting and exporting minerals and ores or growing and exporting basic agricultural commodities, cannot be a viable strategy for the longer term future. Instead, we should also focus on adding value to these activities through economic value-creating innovation.
3. Australia needs to have world-class infrastructure, not just in physical terms (such as roads, ports and utilities, and for research), but also digital infrastructure that supports large data transfers and high speeds. Infrastructure brings substantial economic benefits.
4. Australia needs to further develop its workforce's skills to increase productivity. We require multidimensional skills capabilities, where a strong STEM capability is complemented by capability in management, creativity and other humanities and social sciences.
5. Australia's taxation and legal system should be modified to encourage innovation and risk taking, and we need improved innovation finance arrangements.

B. To improve Australia's smart engagement with Asia and the Pacific:

1. Incentives are required to improve Australia's linguistic and intercultural competence at school, university, and in the workplace.
2. We need to increase Australia's soft power through cultural diplomacy that updates perceptions of Australia in the Asia-Pacific region, and brings into the 21st century the way we Australians see our place in the world.
3. Multinational research initiatives should be encouraged to promote collaboration between countries in Asia and the Pacific to address regional issues, as well as increase research diplomacy opportunities that add to Australia's soft power.
4. Australia needs to make the most of our regional proximity to the growing markets of Asia, building on current export strengths such as agriculture, exploiting niches created by our competitive advantage, and identifying new strengths, ensuring a strategic approach by government and industry through ongoing investment and clear policy directions.
5. Century-old corporate behaviour of turning to historical markets for trade needs to evolve to meet the needs of a 21st century economy located in the Asia-Pacific region. Australian business attitudes and preconceptions need to change to gain a better understanding and appreciation of how to do business with Asian cultures.

6. Governments, institutions and industry need to better support the activities of Asian and Pacific diasporas and better employ the invaluable resources (including language skills, cultural knowledge and global networks) presented by Asian and Pacific communities living in Australia. This includes the improvement of representation of people with Asian and Pacific backgrounds on industry councils and business associations and in trade discussions and delegations, to reduce the mismatch in particular between the large size of Asian diasporas in Australia and the small number of their representation on relevant boards and professional bodies.

C. To position Australia for productivity growth:

1. Increases in research and development lead to productivity growth. Australia needs to raise the levels of research and development in the medium term to at least the OECD average.
2. Institutional reforms coupled with increased government spending on infrastructure, on labour force participation, and on education and training would dramatically raise national productivity.
3. Countries that do better than Australia in innovation feature policy setting and programs that encourage a culture of innovation and collaboration.
4. Research translation and application need to be a key element of Australia's innovation strategy.
5. A skilled and productive workforce is essential for economic growth, with innovation requiring excellence and creativity across the range of disciplines.
6. Technology research and development support should be focused on technological areas, not on existing industry sectors.

D. To encourage Australian students to consider choosing STEM subjects and associated career choices:

1. The status of teachers in Australia needs to be lifted, they need ongoing support and training, and Australia needs to attract more science and mathematics teachers.
2. An innovative workforce relies on a strong education system that fosters academic skills across all disciplines, and analytic and social skills.
3. Mathematics and science experiences before the early middle years of schooling need to be positive and engaging. Mathematics could be made compulsory for everyone to the end of year 11 or even year 12.
4. Effective partnerships need to be fostered between civil and business organisations and education institutions that support innovation in school mathematics and science.
5. Australia would benefit from national coordination of approaches to improving participation in STEM.

E. To secure a clean, green and sustainable future for Australia:

1. We must protect the environment, servicing potential growth areas and industries to maintain our clean, green reputation and our global competitive advantage in agriculture and food, energy and minerals, tourism and other

industries; and also develop information systems and marketing strategies to understand consumers' views on 'clean and green' attributes.

2. The century-old model of electricity generation requires a more radical update, using current and future developments in local energy storage, low-power wireless energy distribution, smart grids and microgenerators to transform how electricity is distributed, drawing on alternative fuels such as shale gas and renewable energy sources wherever possible.
3. The structure of cities and their transport options need to be reconsidered, with sustainable urban planning and a new approach to urban transport, including the establishment of areas such as innovation clusters, high-tech nodes and creative sectors.
4. There is an urgent need to equip the workforce of the future with scientific and technological knowledge, and to communicate the positive prospects and technological future of the agriculture sector, focusing on skills and innovation and complementary skills in humanities and social sciences.
5. Innovative and interdisciplinary approaches by Australian researchers, underpinned by sustained public investment and supportive bipartisan government policies, could create opportunities for Australia to research, produce and deliver solutions – whether ideas, services or products, particularly for transport solutions and climate change adaptation – needed by countries around the world.

The Securing Australia's Future (SAF) program was underpinned by fundamental questions: what *sort* of future do we want for Australia, and *how* do we achieve that? With visionary political leadership, and if we (not only governments) act on the implications of the findings of the SAF projects, Australia has the opportunity to secure a future that will build on its advantages to further create a society characterised by cultural diversity and social wellbeing, as well as one that is strong economically and more innovative. While attention to these things will not guarantee success, it will help Australia to be more innovative, cope with technological change and regain world-leading competitiveness. This future Australia will be secure, confident of its place in the Asia-Pacific region, and able to balance the potential for growth with the protection of our environment and quality of life. It will be a place where future generations of Australians can thrive in a culture that appreciates diversity, values productive endeavour, and respects a unique environment. That is the future the SAF program has sought to secure.