ACOLA SAF 10: Securing Australia's Future - Capabilities for Australian enterprise innovation: The role of government, industry and education and research institutions in developing innovation capabilities:

Issues arising from key informant interviews and matters for policy consideration

Dr John Howard, Howard Partners

ABSTRACT

It is widely accepted that Australia needs an innovative, flexible and creative workforce with the capabilities to enable the country to maximize its opportunities. While technical and scientific capabilities are recognised as critical, there is a growing awareness that innovation also requires people who understand business, systems, culture, and the way society uses and adopts new ideas. Business innovation and productivity therefore requires the interaction of a broad range of technical and non-technical capabilities. International studies have found that while building capabilities is a high strategic priority for companies and the required capabilities have evolved, the methods for building those capabilities have not. This project seeks to examine the way that Australia's high-performing enterprises identify, manage, build, and mix the capabilities to succeed.

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About the Author

John Howard is a highly experienced policy analyst and management consultant with a track record of achievement in the areas of science, research, and innovation policy, program and project performance review, and regional development. He is managing director of Howard Partners, a business he founded in 1998 as a specialist public policy research and management consulting firm.

As an adviser and project leader John has been at the forefront of facilitating collaborations and strengthening relationships between universities, business and government. He has advised businesses and government on the tools and techniques for assessment of research impact, the management of innovation, knowledge transfer and translation, and business transformation.

John's career portfolio includes over 200 policy review, program evaluation and management consulting assignments for research organisations, government, business, and industry bodies.

Between 2008 and 2011 John was Director and later Pro Vice-Chancellor (Innovation and Engagement) at the University of Canberra. In that role he was responsible for promotion of innovation and knowledge transfer at the University, engaging with Government and industry, and representing the University in industry forums and networks. He also led teams in the preparation and submission of applications for grants under major higher education funding programs and attracted over $50m in grant funding for the University.

In 2011 John returned to full time consulting through Howard Partners. He retains an academic connection through appointments as Adjunct Professor at the Centre for Management and Organisation Studies in the UTS Business School, and as Adjunct Professor and Academic Fellow in The Institute for Governance and Policy Analysis at the University of Canberra.

John has published widely in the academic and professional literature on public policy, management practice, and innovation. He holds a PhD from The University of Sydney (innovation and knowledge transfer), a Master of Arts from the University of Canberra (public policy) and an Honours Degree in Economics from the University of Tasmania (applied economics and public administration).

John can be contacted through:

Email: john@howardpartners.com.au
LinkedIn: https://au.linkedin.com/in/drjohnhoward
Website: www.howardpartners.com.au

Project aim

This project is part of SAF10.4, which aims to compile a review of evidence relating to the roles of government, industry and education and research institutions in supporting the development and dynamic mixing of technical and non-technical capabilities that enable business innovation. The Project is the last of four research projects initiated for the preparation of a final report for the *SAF10 Project – Capabilities for Australian Enterprise Innovation*.

The *underlying premise* of SAF 10.4 is:

> It is widely accepted that Australia needs an innovative, flexible and creative workforce with the capabilities to enable the country to maximize its opportunities. While technical and scientific capabilities are recognised as critical, there is a growing awareness that innovation also requires people who understand business, systems, culture and the way society uses and adopts new ideas.
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> Business innovation and productivity therefore requires the interaction of a broad range of technical and non-technical capabilities. International studies have found that while building capabilities is a high strategic priority for companies and the required capabilities have evolved, the methods for building those capabilities have not. This project seeks to examine the way that Australia's high-performing enterprises identify, manage, build and mix the capabilities to succeed.

The scope of SAF 10.4 broadly mirrors the broader SAF10 research aims. It seeks to address the following questions:

(i) What is the role of government, industry and education and research institutions in fostering investment in technical and non-technical skills for innovation?
(ii) What mechanisms are used to generate or foster investment in optimal skills for innovation in other jurisdictions?
(iii) What are the policies currently implemented in Australia (and possibly in other jurisdictions) to foster investment in technical and non-technical skills for innovation and what are other potential options?
(iv) What are the challenges for policy to foster investment in skills mixing and what policy mechanisms do experts see to address these challenges?
(v) Are there, in other jurisdictions, new and innovative ways to support the development of technical and non-technical capabilities and how effective are they?

This Project aims to complement the findings of the other projects in SAF 10.4 - literature review, statistical analysis of Australian data from the ABS, and case study analyses of "best practice" innovative firms - by reporting on the outcomes of 34 interviews with 38 experts and thought leaders on potential policy and strategic options for business, universities and government. The detailed project brief is at Attachment B.

The primary focus of the interviews was on current innovation policy initiatives implemented in Australia (and other jurisdictions) and to explore additional options for how policy instruments may foster optimal investment in, and the dynamic mixing of, technical and non-technical capabilities of Australian enterprises[1]. The project also involved a desktop review of international evidence.

The guiding questions for the interviews is provided in Attachment C. Interviews were undertaken across the following categories:

- Business enterprises (4 interviewees)
- Business incubators, innovation advisers, and regional innovation ecosystems (3)
- Business and industry associations (5)
- Technology investors (1)
- Tertiary education institutions (7)
- Tertiary education peak bodies (3)
- Tertiary education research organisations (3)
- Public Research organisations (1)

[1] A detailed inventory of current innovation policy initiatives in Australia (including State and Territory Governments) is covered in a report for SAF 09, *Translation of Research for Economic and Social Benefit: Measures that facilitate transfer of knowledge from publicly funded research organisations to industry* (Howard, 2015). Following completion of the report the Prime Minister launched the National Innovation and Science Agenda (Australian Government, 2015)

- Government Science, Research and Innovation Agencies (3)
- Science, Research and Innovation Policy analysts (4)

The Project Brief suggested the following starting point questions:

- How obvious is this need for our understanding of innovation to embrace not only technical and scientific capabilities, but also capabilities in business, systems, culture, and societal uptake?
- How would you characterise Australia's level of understanding and implementation of this perhaps more holistic understanding of innovation?
- What are the strengths/weaknesses of the Australian innovation system? Where do skills and skills mixing fit into the current innovation system?
- What is the role of specific initiatives, such as the Growth Centres, in the innovation system?
- How would you compare Australia to other countries/regions' approach to this more holistic understanding of innovation?

The interviewees are listed in Attachment D. Interviews were recorded and transcripts prepared. A number of these are publicly available and can be accessed at www.expertinterviews.acola.org.

This report provides a context for reporting interview findings, in terms of the nature and extent of capabilities for enterprise innovation and the Australian business and industry landscape. It provides a framework for considering the 'dynamic skills mix' for enterprise innovation and entrepreneurship. It then goes on to identify a number of matters for further policy consideration.

The report is presented in three parts: An extended Executive Summary; an analysis of issues and matters for policy consideration (Part I); and a summary of interview discussions and observations regarding capabilities for enterprise innovation (Part II).

The project commenced on 16 November 2015, and a report was submitted to the Expert Working Group on 22 February 2016. A final report was presented on 1 April 2016.

The time made available by interviewees is greatly appreciated. Comments provided by the Expert Working Group, the Project Working Group, and in particular Dr Max Theilacker, and others in the innovation policy community including Professor Mark Dodgson, Professor Roy Green, Professor Ron Johnston, and Ms Narelle Kennedy, are also greatly appreciated.

Executive Summary

The overwhelming conclusion of this report is that the capabilities for Australian enterprise innovation require *a broad mix* of science, technology, engineering and mathematics (STEM) skills, knowledge derived from the humanities, arts and social sciences (HASS) disciplines, business and management skills, and entrepreneurial skills (motivations to start and grow a business to meet customer and end user demand).

The Government's most recent *Australian Innovation System Report* (Department of Industry Innovation and Science, 2015) finds that Australia ranks highly for public research and innovation inputs, but lags in 'innovation efficiency', which is a measure of the ability to translate research into commercial outcomes. This has been a matter of ongoing policy concern. The capacity to translate research into commercial outcomes has been given a great deal of attention particularly in relation to funding for research 'translation', including prototyping, product development and market testing.

More recently attention has been focussed on building closer collaboration between research organisations and business. But comparatively little attention has been given to the *human capabilities,* or the skills required to translate ideas, whether generated from research, invention or ingenuity, into practical application and use that will create value for business, the economy and the broader community.

Skills, capabilities and the creation of economic and business value

People interviewed for this project considered that the key to lifting productivity was not only in developing (STEM) based skills and capabilities, but also in the development of a wide range of entrepreneurial, business, management, and service skills – skills required to start in the world of work, and skills for transitioning start-up businesses into robust and sustainable commercial enterprises. This is also borne out by international research and reporting.

In our knowledge economy the value generated by 'making things', or physical production, represents a decreasing source of business value – and broader national economic value. The higher order sources of value are in research and new product development, consumer analytics, sales, marketing, branding, packaging, distribution, and post sales services areas. These areas call for high level skill sets drawn from both STEM and HASS including the application of sophisticated digital technologies. Often the actual production component is outsourced to domestic contract manufacturers or to overseas[2].

Moreover, the process of creating value is becoming increasingly *complex*, calling for a wide range of skills and capabilities across different business functions and different business organisations. In turn, this multitude of capabilities reflects a broad 'skills mix' that adds value on the 'supply side' by including more knowledge based inputs, and on the 'demand side', by understanding and responding to growth and shifts in end user needs, changing preferences, and new market opportunities made possible by advances in technology[3], international trade, and expectations of service content. These demand side skills are also increasingly knowledge based.

As a nation, Australia's economic complexity[4] has declined over the last 25 years. In 2012 Australia ranked 53 among all countries. The top three were Japan, Switzerland and Sweden - also countries that happen to have a very low resource base (Roos, 2015). It follows that for sustained growth Australia must move away from its commodity approach to industrial development and towards a higher 'value added' strategy that involves greater complexity in the application of skills and capabilities in generating economic output.

[2] Large companies specialising in preparing tax returns on a high volume basis contract with oversees accountants to actually prepare the returns. Established suburban and regionally based accountants can only compete by offering more value added and personalized services, requiring a broader mix of skills.

[3] For example, the 'key enabling technologies' identified by the EU as micro and nanoelectronics, nanotechnology, industrial biotechnology, advanced materials, photonics, and advanced manufacturing technologies.

[4] The *complexity of an economy* is related to the multiplicity of useful knowledge embedded in it. For a complex society to exist, and to sustain itself, people who know about design, marketing, finance, technology, human resource management, operations and trade law must be able to interact and combine their knowledge to make products. These same products cannot be made in societies that are missing parts of this capability set. Economic complexity, therefore, is expressed in the composition of a country's productive output and reflects the structures that emerge to hold and combine knowledge (Hausmann, Hidalgo, Bustos, Coscia, Chung, Jumenz, Simoes, & Yildirim, 2008).

The wine industry can be cited as a sector that has achieved success through this value added approach (research and development, quality and consistency, packaging, branding and product positioning, participation in global supply chains, and so on), and the red meat industry has made a great deal of progress[5].

It is also important to keep in mind that Australia is predominantly a services economy (around 80 per cent of national economic output). Whilst a great deal of attention is given to increasing complexity in manufacturing by incorporating a string services component, the services sector itself has opportunities to introduce greater complexity by capturing a broader skills mix to add business and economic value[6]. Research, teaching and vocational education institutions have an important role in introducing complexity by educating and training people in advanced services skills and capabilities that can be applied in business and industry contexts.

It is a central argument of this report that Australia's large cohort of small to medium firms that dominate the industrial landscape, must be able to acquire a broader mix of skills and capabilities for innovation to be able to enhance the complexity of their business and operations. There is a range of sourcing options, which are discussed below.

The nature and extent of the skills for innovation

Discussions with interviewees tended to be rather wide-ranging and sometimes lacking in specificity regarding the nature of the skills for innovation. Interviewees were asked to focus on the definition of innovation as *ideas successfully applied*. Interviewees understood that there is no lack of ideas or people who have the skills to come up with technical ideas, but there is a shortage of skills to put these ideas into effect in business, social and environmental contexts. In the language of the previous section, the interviewees gave a great deal of attention to the demand/customer side of the value creation framework.

During the course of the interviews a framework was developed to classify the skills and capabilities for enterprise innovation in terms of requirements for success in the *adoption, application and use of ideas*:

- *Basic skills* – covering literacy, numeracy, and problem solving, particularly in technology intensive environments.
- *Employability skills* – covering communication, teamwork, problem solving, initiative, enterprise, self management and learning.
- *Knowledge skills* – in areas such as biotechnology, information and communications technology, and advanced manufacturing (on the STEM side) and financial modelling, analytics, market analysis, and consumer behaviour (on the HASS side).
- *Creativity and design skills* – ability to question the *status quo*, observe and suggest new or different ways of doing things, network, experiment, and associational or integrative thinking. These skills encompass ingenuity, resourcefulness, and a willingness to use initiative.
- *Entrepreneurial skills* – to understand a potential business opportunity and develop the opportunities through creation of a product or service that will be provided to customers. Entrepreneurs secure resources, design organisations, establish sales and distribution channels, and develop a strategy to exploit the opportunity profitably.
- *Business and resource management skills* – abilities to grow and sustain a business, covering general management, new product development, sales, marketing, communication and engagement, project management, finance, accounting, contract and corporate law, human resource management, purchasing and procurement, digital technologies and governance. As organisations grow the requirement for these skills increases, as does the level of specialisation and the knowledge component.

[5] Significantly, these industries, and several other primary industries have benefitted from broad industry funded research, with government matching contributions through the Rural Research and Development Corporations.
[6] For example, in the global chartered accounting firms, the value of compliance work (e.g. *producing* audited financial statements and taxation returns) is now around 20 per cent of total business value. The balance is sourced from complex value added services in areas such as consulting, corporate finance, tax, legal, and property services.

- *Digital skills and digital literacy* – an ability to work with software applications and digital devices including machinery, computers and tablets (increasingly digital literacy is considered to be an element of basic skills).
- *Management and leadership skills* – covering requirements to set objectives, organise activities and people, motivate and communicate, create systems for monitoring and performance measurement, and ongoing staff development.

Particularly Australia's understanding of management as a capability and a resource is seen to be far less sophisticated than it is in the US, the UK and Europe. This may reflect our economic history, our commodity culture, and the low level of complexity in industrial outputs. Management is often seen as an unnecessary cost or wasted overhead. Furthermore, Australia does not generally celebrate management performance, and management biographies tend to focus on 'rogue entrepreneurs' rather than Australians who have built global businesses. In the US, management has long been regarded as the *visible hand* that guides organisations to commercial success (Chandler, 1993).

Business associations, business schools, professional organisations and leaders in regional innovation ecosystems have a role to lift the profile of management as a critical element in driving Australia's innovation future. This report advocates a greater commitment to management education to build management capacity and capability, particularly in entrepreneurial and potentially fast growing businesses.

Issues for business in building skills and capabilities for innovation

Interviewees in business were very well aware that innovation involves a broad suite of knowledge, skills, and capabilities drawn from a range of academic disciplines including but not limited to science and technology. Skills drawn from the social sciences, arts and humanities are called upon to address many of the functions required for business success and sustainability - including financial management, market research, communication and public relations, human resources management, protection of intellectual property, enforcement of contracts, and regulatory and statutory compliance.

Almost universally, people with business backgrounds referred to a range of skill requirements beyond subject matter knowledge and technical proficiency. These covered *basic skills* (literacy and numeracy), 'employability' (communication, teamwork, problem solving, initiative, self management, and willingness to learn), and an understanding of the nature of business itself. Business people also commented that with rapidly changing technology they were not only interested in employing people with high level knowledge capabilities and technical skills, they were also interested in people who could learn and adapt to changes and developments that were occurring in those knowledge domains and technologies.

Interviewees reported a mismatch between skills supply and demand. Although a great deal of popular attention is being given to shortages of skills in the STEM area, interviewees referred to studies that indicated STEM graduates were finding it hard to get jobs. This contrasts with studies undertaken by AIGroup and data included in the *National Innovation System Report* that point to skills shortages in a range of *technical* areas. There was strong agreement that there is a skills shortage in the areas of computer science and software engineering.

Interviewees drew attention to the important role of company boards in leading and shaping innovation strategy, the importance of developing a national culture of entrepreneurship, and developing an understanding in the academic and broader community that *business enterprises* are the vehicles by which commercial returns on research and development are realised. Business leaders think that it is not generally appreciated *that it is businesses* that source funds for investment and manage the technological, market, and other risks involved in bringing products and services to market. Unfortunately, success is often put down to good luck and good fortune, rather than hard work, dedication, and the commitment of individuals and teams over extended time frames.

Interviewees pointed to the importance of developing leadership skills, and a need to think beyond the boundaries of the organisation they are working in and address change that is occurring in their business environment – locally and globally. Leadership skills are becoming more important as the workplace relations environment shifts from a centralised system of workplace relations to an enterprise system, and the follow-on requirement for managers to deal directly with employees, and

to lead, inspire and motivate. There were strong views about the need to improve the quality and relevance of management education and training.

Businesses generally work well with vocational education and training (VET) institutions in the training arena, but are keen to work more effectively with universities. Reference was often made to difficulties of engaging with university 'academics', although CEO relationships with senior university executives are often well developed. Universities are seen to be making a greater commitment to education and training in innovation and entrepreneurship, particularly around start-up businesses. There is a view that business education and training should be seen in a longer term 'career, or life-long' learning context which would involve an ongoing level of interaction between business and both the higher education and VET sectors.

Interviewees connected with new, emerging and high growth businesses saw a need to extend capabilities beyond *entrepreneurial skills* (an ability to start, or create, a business) into the broader *management and business skills* necessary to grow and sustain a business in a competitive and global market environment.

Small to medium sized businesses are often hard pressed to make payroll and regulated business commitments, and are not necessarily focussed on building relationships with universities to access education and training, or assess science, research and technology capabilities that may be relevant to their business. The Commonwealth Entrepreneurs Programme, and State based Innovation Voucher Schemes are directed towards increasing such connections – but the focus is not necessarily around access to the full range of capabilities for enterprise innovation. Innovative small businesses may have stronger relationships with the VET sector through registered training organisations (RTOs) and access to training packages.

Business is concerned about the impact of the university demand driven system and community attitudes that tend to place a higher value on obtaining a university bachelor's degree rather than a VET qualification. It considers that the current university business model has lifted participation in higher education, but it has not worked well enough to deliver the education and skills that individuals and the nation require. Many of these skills are delivered in whole, or in part, through the VET system. Business would like to see an integrated tertiary education system with choices and pathways that meet business capability requirements, individual career expectations *and* achieve national economic outcomes.

Interviewees also pointed out that there were differences in skill and capability requirements across industry sectors and the way in which developing capabilities for innovation are being addressed. Businesses have a range of options to source these skills and capabilities, which are addressed below.

Sourcing innovation skills and capabilities

It was clear from interviews and discussions that skills acquisition and development cannot be looked at simply in terms of a traditional view of an industrial firm that encompasses all of the necessary capabilities required to produce goods and services. As indicated above, production and distribution is highly complex, requiring the input of a broad mix of knowledge based on technical, business, and management capabilities.

Moreover, skills and capabilities change and evolve, and specialisations develop further. It follows that businesses, and particularly small businesses, require efficient and effective access to required skills capabilities across a broad range of functions. In a competitive environment, with pressures on cost and productivity, businesses would also want access to the best. Managers therefore have to consider whether to develop those skills and capabilities internally, or source them externally.

There are several broad capability and skill sourcing options available, with implications for cost and productivity:

- A 'make' (train) decision – the traditional 'industrial organisation' approach to the development of human capital. For a small business this approach can be expensive, and high risk if trainees leave during or after training is completed.
- A 'buy' (recruit) decision – employ 'job ready' employees who are educated and trained by third parties, including other businesses, education and training organisations, and NGOs. Businesses are currently indicating a strong preference for 'job ready' employees.

- A 'contract' (procurement) decision - source capabilities through contracts, service agreements, temporary 'labour hire' and/or tapping into the 'freelancer' economy. This is a growing segment of the economy, with training provided by the contracting organisation, or by individuals making their own investments in skills, and 'managing oneself' (Drucker, 2008).
- A 'collaborate' (capability sourcing) decision - engage skills and capability by working with firms of specialist professional advisers, experts, and researchers in the rapidly growing professional services sector. This has been recognised for some time as an important way of sourcing innovation, particularly where firms undertake their own research programmes.

Issues arise when inappropriate sourcing models are selected, and in particular, where firms reduce their commitment to training and lose capability in important strategic domains for the business. This happened in the ICT area where firms contracted out all ICT functions, and overlooked the strategic importance of digital technologies, business analytics, and 'big data' to their businesses.

There are also significant workplace relations issues emerging in the freelancer-contracting economy which, to several interviewees[7], are not being adequately addressed.

Meeting the demand for skills: the role of tertiary education providers

Interviewees expressed concern about the imbalance in policy focus between higher education and vocational education and training sectors, and the resourcing between them in the development and delivery of capabilities and skills. The demand driven funding system, and the university business model which encourages universities to maximise student enrolments, in whatever courses they choose, has meant that many graduates who have completed the courses of their choice have found it it very difficult to find employment in the professions that they had set their sights on due to a shortage of employment opportunities.

Universities have an important role to deliver knowledge capabilities for adoption and application in business R&D divisions, problem solving (strategic) roles, technology operating areas, and in new technology-based start-up businesses. Business organisations pointed to the importance of the VET sector in delivering technical skills and practice oriented business and management skills. There is a view that if the VET system is not working for business as well as it should, the higher education sector will probably continue to move into it by providing more vocationally oriented training through their RTO subsidiaries or partners. This is not something that business would support.

Universities have a long-standing responsibility to deliver education in a context of 'self-leadership'. This involves developing a range of skills, and not just imparting knowledge contained in a textbook or in a lecture. Teaching people how to work in teams, how to be creative or to harness their creativity is very much part of education. VET institutions have a responsibility to deliver practical and relevant skills that meet the needs and requirements of industry in a rapidly changing workplace environment. That environment calls for knowledge as well as competencies. Training packages, which are tightly written and subject to audit in delivery, must also provide some flexibility in scope to allow for innovation by delivery organisations and students.

Universities, in collaboration with business organisations are making an extensive commitment to work integrated learning (WIL) programmes to embed workplace experience in their curricula. WIL is seen as giving graduates an edge in their employability credentials and universities are promoting their WIL commitment and graduate employment performance. While the commitment to WIL is picking up in some areas there needs to be better integration in others. Internationally, WIL is picked up in broader coverage of apprenticeship systems (as in Germany) and the introduction of apprenticeship degrees (as in the UK).

Several interviewees called for better information for parents and students about demand and opportunities across different skill sets. While this information is available from counsellors and careers advisers, interviewees indicated that students have a preference to hear about opportunities directly from employers.

Many graduates or near graduates have a preference to create a start-up business in the digital economy. As mentioned above, universities are making a big commitment to education and training

[7] Kate Carnell, from ACCI, for example.

in innovation and entrepreneurship, across all faculties and schools, and support is being provided to student oriented incubators and accelerators. The recent emphasis on entrepreneurship is driven by a combination of student demand, the policy attention being given to start-up businesses, and the reported successes of university incubated enterprises[8].

Interviewees also made reference to the need for start-up businesses to develop a better understanding of business and management, and ways for acquiring these capabilities – other than 'learning by doing'. Universities have opportunities to develop these capabilities in their business schools, and a number are making significant commitments.

Many universities participate in and support the development of 'innovation ecosystems' where a broad mix of skill and capability requirements are available for start-up and growing businesses, and connections between people and organisations are made easier. This may include academic staff and students who can provide value added services and people can find out about relevant and appropriate business courses and programmes.

Innovation ecosystems can also include 'for profit' professional services firms who see opportunities for building relationships[9]. For businesses, the environment can help avoid the costs and risks associated of 'trial and error' by being able to 'ask around', connect with mentors, and create a network of friends and trusted advisers. Web-based resources have also reduced the risks of trial and error and are allowing access to information and expert capabilities.

Many micro businesses and SMEs look to the VET sector for developing businesses skills – and the business training packages are the ones most widely sourced[10]. There are opportunities to develop collaborative teaching programmes between universities and VET providers where people in business can combine academic learning with occupational learning as their business evolves and requirement for knowledge, skills and capabilities develop into more challenging management and leadership roles.

School sector and community roles in building skills and capabilities for innovation

Interviewees suggested that workplace and business related skills such as communication, teamwork, confidence and resilience cannot solely be taught in academic environments, but should be developed from a young age in families, schools, and the wider community.

Several interviewees were critical of the current focus of schools and teachers on testing and test results, and competition between schools on the basis of those results, which worked against developing leadership, collaboration and other soft skills. Community organisations and NGOs are increasingly being called upon to provide that capability.

Role of governments

Government is an important enabler in the innovation system. It cannot drive innovation, but can assist in ensuring that framework conditions are in place. Most OECD countries have innovation and business development agencies that support research translation and to a lesser extent, skills and capability development. These are reported in SAF 09, *Securing Australia's Future - Translating research for economic and social benefit - Country comparisons* (Bell, Dodgson, Field, Gough, & Spurling, 2015).

The Government's National Innovation and Science Agenda (NISA) released in December 2015, is based on the principle that "Government supports innovation by investing in enablers such as education, science and research, and infrastructure; incentivising business investment; and removing regulatory obstacles such as restrictions around employee share ownership or access to crowd sourced equity funding" (Australian Government, 2015). The statement sets initiatives in the areas of:

[8] Data indicates that start-up businesses in the ICT industry achieve a growth of around 40 per cent over a three year period and micro start-ups have a survival rate of between 40 and 50 per cent after five years (Hendrickson, Bucifal, Balaguera, & Hansellb, 2015). Start-up growth in the professional, scientific and technical services industry is slower (21-25 per cent) but survival rates are between 41 and 50 per cent.
[9] Interview with Ian Cox, Executive Director, Innovation, Trade and Investment, ACT Government.
[10] Interview with Patricia Neden from the Innovation and Business Skills Council

- Culture and capital
- Collaboration
- Talent and skills
- Government as an exemplar.

The Agenda compliments a range of other Commonwealth policies and initiatives that support innovation, some of which have a training agenda. These include the Entrepreneurs Programme and the Industry Growth Centres Programme.

NISA does address the *skills* for innovation in relation to STEM in schools and preparation for university, it does not address the wider skills and capabilities for innovation discussed in this report. It is well understood, of course, that a key enabler of labour productivity is the capacity of businesses to develop and apply new knowledge and ideas through the skills of employees, particularly higher education or vocational education graduates. It follows that future iterations of NISA should give priority to developing the skills for innovation by addressing the business, education and community issues identified in this report.

Summary of matters for policy consideration

The report identifies a number of issues that warrant consideration by policy advisers, and leaders in business and tertiary education. These are listed below with references to the place in the text where the issue is identified and elaborated on in more detail.

System wide policy matters

1. In the light of the strong views about the need for higher education and the vocational education sectors to be working much more closely to develop the skills for innovation across education sectors, buisness, tertiary education providers and government (Commonwealth and State/Territory) should consider collaborarting with the aim of developing a *tertiary education and training system framework* that promotes education and training diversity and makes available the broad range of skills and capabilities required for business and enterprise innovation. This should be an ongoing and inclusive commission over a five-year period with members having a capacity to build a high level of engagement with all sectors. 32
2. There is broad awareness that university-business collaboration occurs through a range of governance, organisational and management frameworks including but not limited to the CRC framework. Tertiary education institutions and business leaders should consider working together to design a range of collaborative models and structures that can deliver both capability development and research outcomes efficiently and effectively. The Industry Growth Centres may provide a forum to address this in the first instance. 32

Matters for business consideration

3. There was a strong view coming through interviews that Australian businesses had not addressed innovation well. To lift the focus on innovation and capability development, including the skills for enterprise innovation, peak industry associations might consider encoraging businesses to appoint an *innovation director* in a senior executive role to be responsible and accountable for lifting innovation performance. That role would include developing relationships with universities and research organisations. 33
4. In the current innovation environment that gives priority to formation of new businesses, it is important that boards are constituted by people who can add value in building a business as well as assuring that regulatory and compliance obligations are met. It is also important that the 'pool' of potential directors be extended. Business associations and the AICD could address this matter by developing corporate governance education and training for current and potential board members of start up and high growth businesses. 33
5. There are indications that small to medium businesses are under investing in human resource management (HRM) capability, with the flow effect that the skills for enterprise innovation and talent management are not being well addressed. Business associations and enterprise development agencies could address this by devising an information and awareness programme about the importance a strategic HRM function that can spot talent trends and

1 Context

1.1 The 'skills mix' in businesses and organisations

A national science and innovation policy focussed on building capabilities in science, technology and mathematics addresses the clearly established historical link between advances in science and technology and economic progress. But, the way in which advances are adopted, applied and used in business and organisational contexts to create commercial, economic and social value is complex and contingent. In policy terms the commitment to business development is much less significant to the commitment to science and research. Of the $9.7 billion allocated to science, research and innovation in the Commonwealth budget in 2015-16, less than $100m is spent on enterprise development initiatives (Green & Howard, 2015).

A critical element in the project brief is the statement:

> While technical and scientific capabilities are recognised as critical, there is a growing awareness that innovation also requires people who understand business, systems, culture and the way society uses and adopts new ideas.

Innovation policy analysts and researchers are fully aware of this requirement, or 'skills mix' and people in established businesses have a fundamental understanding of it, although not necessarily using the same words and agreeing on definitions. However, business interviewees were concerned that their *broad* skill requirements are not being met, or difficult to source. Gaps in skills and capabilities were identified particularly in relation to cognitive and social skills, capacity to learn, and digital literacy, and *customer focused* skills such as building relationships and trust, service and quality.

There is a good understanding by most businesses and national business associations that for Australia to grow as a vibrant knowledge based economy, business strategies must be directed towards having a better understanding of customers, meeting their needs efficiently and effectively, expanding internationally, and achieving a greater integration in global value chains. But while there are many stories about, and support for, start-up businesses there are challenges in understanding how to move from an emerging *entrepreneurial culture* of starting a business, to *a management culture* of growing and sustaining a business.

Jack Steele, from CSIRO, pointed out that the implied logic of science, research and innovation policy has been that if you spend heavily on R&D then 'magic occurs' and economic, industry, and social outcomes are generated. The 'middle panel of the cartoon' is a black box, although sometimes loosely referred to as a 'valley of death'. There is a view that Science has failed to think about the complexities of translation and the multiple strands that need to be addressed. There is possibly an assumption that a strong science and technology push will overcome all other impediments.

Recently there has been a small shift in thinking that 'research translation' is not just a supply issue or a failure, or an inadequate supply problem. There is an acknowledgement that there is actually a demand-supply connection, but there is still not a lot of confidence that there is a holistic understanding of how that all fits together. Those connections are seen as necessarily sector dependent, which is an important part of the rationale for the formation of the Industry Growth Centres (IGCs).

It is nonetheless the case, however, that a large proportion of Australian public research is undertaken in areas where industry 'receptors' are absent. This makes 'translation' particularly challenging in the Australian domestic context. QUT DVC-R Professor Arun Sharma summarised the position in an op-ed piece in 2013:

> In 2010 businesses spent 52 per cent of their R&D outlay on engineering, while universities spent 9 per cent. Businesses spent 28 per cent on ICT and universities spent 4 per cent. On the other hand, while universities spent 38 per cent of their research expenditure on medical and health sciences and biological sciences, the comparable figure for business is 6 per cent.
>
> Universities and businesses do not have to be totally aligned in their research investment, but the disparity in the Australian context is serious. It almost appears the research capacity in universities has evolved independently of the innovation needs of the economy (Sharma, 2013).

The characteristics of the research environment impacts directly on the capacity to develop skills for the translation of research outcomes into application, particularly where industry knowledge is

required. Whilst Australia performs adequately in the translation of biomedical research, there are limited opportunities for translation in other areas – the research simply isn't being done on sufficient scale and intensity to meet potential industry demand.

In recent years, Governments in many countries have undertaken significant efforts to increase the amount of STEM (science, technology, engineering and mathematics) graduates produced by their national education systems. This has been a focus of attention in Australia. But while employment trends generally corroborate the importance of these efforts (particularly in areas like software engineering), it is apparent that the potential net job creation in absolute terms in the STEM field alone will not be sufficient to absorb strains on other parts of the labour market (World Economic Forum, 2016).

1.2 The Australian business landscape

The Australian business landscape is dominated by micro, small, and medium sized businesses. These businesses account for a high proportion of employment growth, whilst employment in larger businesses is falling. There is also a very high level of new business formation, accompanied by a high rate of 'churn' as growth in new business formation is offset by a high rate of business closures.

Net job creation by start-ups that survive at least three years represent 4.9 per cent of overall employment. In other words, for every 100 jobs in Australia in any given year start-ups will, on average, add five jobs within the following three years (Hendrickson et al., 2015). Sectors with very high start-up rates (greater than 35 start-ups per 1,000 employees) include:

- Building construction and construction services
- Non-store retailing and retail commission-based buying and/or selling
- Internet publishing and broadcasting
- Insurance and superannuation funds
- Property operators and real estate services
- Creative and performing arts.

Australia's average post-entry business growth rate is low compared to most other OECD countries examined to date (ranging from 10 per cent to 140 per cent). Average post-entry growth has been declining over the period 2003-2009. Most firms that survive three years either grow marginally or retain their staff numbers at entry levels. In some sectors, if they manage to survive, there is a significant *reduction* in employment. This is pronounced in Motion picture and sound recording activities, and Creative and performing arts activities.

The survey data does not shed light on the reasons for business growth or closure, and in particular, whether there is a connection to management capacity and capability, business skills and the broader skills for innovation.

Project interviews with the VET sector, including the Innovation and Business Skills Council (IBSC), suggest that survival rates can be higher when businesses commit to training. Business training packages are the IBSC's 'best sellers'. At Hunter TAFE, the Director has said that young people in the building trades have enrolled in business courses to set up, grow and sustain their businesses.[11] Many young people complete their apprenticeships and go into business (with their spouse), working with 'trusted contractors'. They also subcontract to the larger developers.

1.3 A broader approach to understanding skills and capabilities for innovation

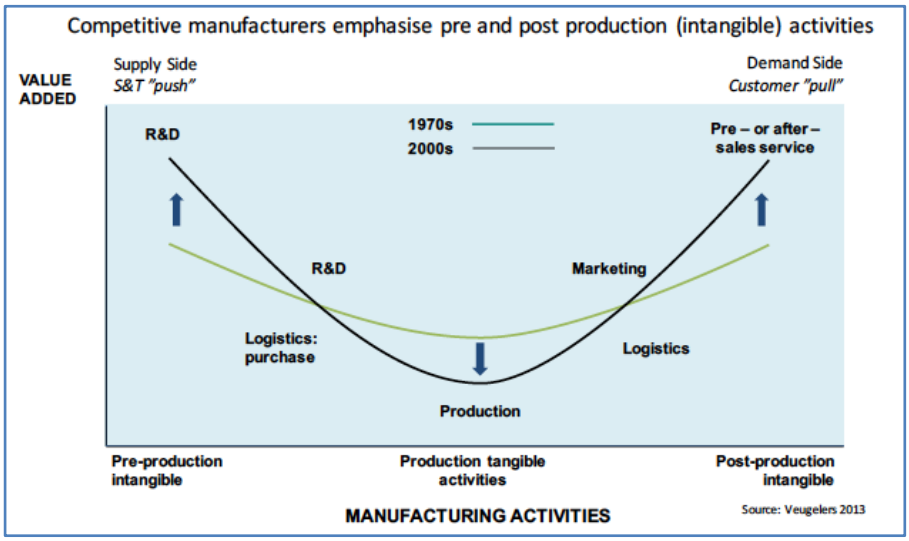
People interviewed for the project considered that the key to lifting productivity was not only in developing science and technology based skills, but also in the development of a wide range of entrepreneurial, business, management, and service skills - skills required to start in the world of work, and skills for transitioning start-up businesses into robust and sustainable business enterprises. This is borne out by international research and reporting across a range of media.

It has been recognised for some time, for example, in the manufacturing sector, and particularly in advanced, or smart, manufacturing, that the source of value is shifting away from factory based

[11] Interview with Acting Director, Hunter TAFE, in connection with the RDA Hunter Regional Smart Specialisation Strategy Project (Regional Develpment Australia Hunter, 2016).

production undertakings to pre-production and post-production activities. This is represented in Figure 1 below.

Figure 1: Skills and the creation of value



Source: Advanced Manufacturing Industry Growth Centre

Whilst this framework has been developed for the manufacturing sector, it applies across a broad range of goods producing industries. It also has relevance in the service industries where, for example, providing international tax advice (*production* of a definitive briefing or report), calls on a great deal of knowledge developed through research, and fostering and sustaining relationships with clients who use that advice in their businesses[12]. That calls on a very wide and multifaceted range of skills and capabilities.

The 'value' of production, or actually making things, is a low order value, and is often outsourced to domestic contract manufacturers or to overseas[13]. In many industries, including manufacturing, the higher order value activities may be undertaken in separate and often highly specialised business. Internationally, manufacturing businesses source R&D externally from universities and research organisations through collaboration where that capacity exists. In Advanced manufacturing there is a strong focus on technology development and participation in global supply and distribution chains.

There are, on the other hand, many small manufacturers, particularly those that have owners with strong engineering backgrounds, that focus on R&D and production and contract with sales and distribution companies, particularly when there is interest in entering global supply chains. Distribution is a complex process and calls on a range of skills and digital technologies that a small firm may not be able to afford to develop internally, or is unwilling to take a risk of a long term commitment.

Consultations by the Advanced Manufacturing Industry Growth Centre with over 80 businesses indicated that the Centre should focus on:

1. Improving engagement with international markets and access to (almost universally digital) global supply chains.
2. Improving managerial and workplace skills.
3. Increasing engagement between research and industry, and within industry, to achieve commercialisation outcomes.
4. Removing unnecessary and over burdensome regulations.

Respondents did not identify a priority for more science and engineering research, however engagement with universities for applied R&D was important, but only as a third order priority.

[12] Professional services firms record 'production' in their time and cost ledgers as time actually spent 'on the job'. The cost of that advice reflects the cost of the R&D, training, and other front end services components. This is generally double, or more, of the the direct staff input cost committed 'on the actual project.

[13] Large companies specialising in preparing tax returns on a high volume basis contract with oversees accountants to actually prepare the returns. Established suburban and regionally based accountants can only compete by offering more value added and personalized services, requiring a broader mix of skills.

From the interviews for the Project it is clearly apparent that creating strong global engagement and a robust service culture are essential for sustainable business success.

1.4 A note on the 'skills shortage'

Skills shortages were a major area for discussion in the interviews for the project. The current skills shortages identified by the Department of Employment are highly concentrated in the health, medical and building trades occupations. This is no doubt reflective of the growth in the health industry and the current boom in civil construction and residential housing, which is strongly influenced by currently high levels of immigration. Shortages in the STEM area cover surveyors and automotive and engineering trades workers.

The *Australian Innovation System Report*[14] indicates high demand for skills in marketing, business management, financial, IT professional and IT support technicians. Higher education and VET completions are not meeting demand for these skills by innovators and exporters, and this may represent a significant future limitation to Australia's international competitiveness if skilled migration cannot make up the shortfall.

There is also a view that the skills shortage is overstated, or unproven. This was pointed out by the BCA and several others in interviewees. The Grattan Institute has concluded that there is an excess supply of STEM graduates.

STEM the wasteful write-offs

by Andrew Norton

The Australian, Wednesday 20 May, 2015

Far from being urgently needed by employers, new science graduates have long had below average rates of full-time employment.

While employment levels improve across time, compared with other graduates a smaller proportion of people with science degrees work in professional or managerial jobs or say their qualification is neces-sary or relevant for their job.

Working under a similar misapprehension about the need for science graduates, when Labour was last in power it cut science student contributions and introduced a more limited HELP debt write-off scheme.

Domestic undergraduate science enrolments went up by 35 per cent between 2008 and 2013. Preliminary 2014 data suggests another big increase, despite student contributions being put back up again in 2013.

Unfortunately, the never-great employment outlook for science graduates is now very bad. They have been hard hit by the downturn in graduate employment. This year, less than half of graduates in the life sciences who were looking for full-time work had found it four months after completing their courses. This is 20 percentage points below the graduate population as a whole.

Graduates in information technology and engineering do better than science graduates, although they too are finding jobs are scarcer than a few years ago.

Where there are genuine skills shortages, we have better ways of responding than HELP debt write-offs. For the most part, the demand-driven system of funding bachelor degree places achieves this without further action from Government. In a report I co-authored on the demand-driven system, we examined how it responded to skills shortages. In most cases, demand for and the supply of places increased in courses related to occupations in shortage, which included engineering disciplines from the STEM fields.

https://grattan.edu.au/news/stem-the-wasteful-write-offs/

Reports from Australia and the UK suggest that there are significant STEM skills shortages in the *digital technology* area. According to the *Australian Digital Skills and Salary Survey*, reported in April 2015, a quarter of Australian businesses are finding it difficult to source digital employees. A survey of 150 small to large Australian businesses revealed 70 per cent are finding the digital skills gap taking a moderate or heavy toll on their business[15].

A 2014 Australian Industry Group survey of workforce development needs reported that almost 44 per cent of employers continue to experience difficulties recruiting *STEM qualified technicians and trade workers*. The main barriers are a lack of qualifications relevant to the business (36 per cent) and a lack of employability skills and workplace experience (34 per cent) (Australian Industry Group, 2015). To meet the skills shortage there is a heavy reliance on filling jobs with Section 457 visa applicants.

It is clear that the matter of shortages of skills for innovation is far more nuanced than headline claims might suggest. It may also be reflective of the way that businesses source skills, their expectations of 'employability', and their commitment to training and development.

[14] (Department of Industry, 2014)
[15] http://www.cmo.com.au/article/573527/report-reveals-australia-faces-digital-skills-shortage/

1.5 Management *does* matter

What has been missing in recent innovation system discussions is how to address Australia's poor record in *management capability.* Research for the *Management Matters* report (Green, Agarwal, & others, 2009) found that the quality of management practices has a measurable impact on labour productivity, as well as sales and the number of employees in firms. Australian management practices rate as only moderately above average when benchmarked globally, leaving significant scope for consistent and sustained improvement across key areas.

The Management Matters report finds that the paucity of management skills in medium and large businesses is directly linked to Australia's poor productivity and growth performance.

These messages are consistent with earlier reports on Australian management capacity and capability including the *Karpin Report* (Australia. Industry Task Force on Leadership and Management Skills, 1995)[16], the *Ralph Report* (Ralph, 1982) and the *Cyert Report* (Cyert, 1970), several reports from the National Board of Employment, Education and Training, PMSEIC (PMSEIC, 2002), and the Department of Industry (Samson, 2010).

Overall, the findings in the reports above indicate that national debate about the productivity performance should include thinking about how effectively Australian firms and organisations are managed. But none of these reports have led to tangible changes in practice or policy. The openness of domestic and international markets, the role of infrastructure and the quality of the training and education systems are all vital, but so too are the management practices of organisations in adapting to and shaping future opportunities (Green et al., 2009).

It is understood that future Department of Industry Science and Innovation *Innovation System Reports* will give attention to management capabilities.

1.6 Conclusion

While there is awareness that innovation requires people who understand business, systems, culture, and the way society uses and adopts new ideas, there remain a number of challenges for successful and sustained innovation. These challenges stem in large part from a lack of management and business capability – an inability to execute and implement, or to translate knowledge and ideas into commercial or societal adoption, application and use.

Innovation and technology management is a well-established stream in management research. It has created a substantial knowledge base and there are internationally acclaimed Australian scholars in the field (Dodgson, 2000; Dodgson, Gann, & Phillips, 2014; Dodgson, Gann, & Salter, 2005). Their material is used in postgraduate courses and executive programmes in management, entrepreneurship, and innovation.

There are also some highly regarded innovation management text books, including *Managing Innovation: Integrating Technological, Market and Organisational Change*, (Tidd, Bessant, & Pavitt, 2013) now in its third edition. Danny Samson's *Management for Engineers* (Samson, 2010) is well regarded as is the BCA text *Managing the Innovative Enterprise* (Carnegie, Butlin, Barratt, Turnbull, & Webber, 1993). The material is used widely in undergraduate courses in entrepreneurship and innovation.

There is a problem in absorbing this material into application. This points to a poor appreciation of the role of management in business, and weaknesses in building management capacity and capability in education and training institutions across professional disciplines, and in business itself. At the same time, innovation and entrepreneurship does not have a high priority in the curricula of business schools[17].

An issue for consideration concerns the way that managers and aspiring managers can effectively absorb innovation management knowledge and apply it in business contexts, particularly for businesses with high growth potential. It was discussed in interviews concerning the role and performance of Australian business schools, and the opportunity for industry funded scholarships.

[16] The Karpin report provided important insights into the way Australia prepares its managers for work and leadership. It gave particular attention to the need for an enterprise culture, globalisation, diversity, lifelong learning and enterprise and education institution best practice.
[17] Interview with Professor Mark Dodgson

2 The nature and extent of capabilities for enterprise innovation

The purpose of this Section is to develop a profile of the capabilities required for enterprise innovation to provide some clarity in discussions and analysis about capability and skills development. Drawing on a number of reports and papers, including the World Economic Forum report *The Future of Jobs* (World Economic Forum, 2016), and interview discussions for this report, a classification of capabilities required for enterprise innovation is as follows:

- Basic skills – numeracy, reading and comprehension, written expression (literacy), active learning, oral expression, problem solving, critical thinking, self awareness, and digital literacy. These basic skills are sometimes referred to in the business community as *employability skills*.
- Knowledge skills – covering knowledge drawn from science, technology, engineering and mathematics (STEM) *and* the humanities, arts and social sciences (HASS). Knowledge skills lie at the foundation of 'knowledge organisations' which are now essential features of businesses in manufacturing *and* in the mining, agricultural and service industries.
- Technical skills – covering areas such as equipment maintenance, installation, repair, operation and control, machine programming and software maintenance, quality control, technology and user experience design, troubleshooting.
- Creativity and design skills – idea and opportunity creation (which may or may not be sourced from science and technology), problem solving, integrative thinking, ingenuity, and end user (customer) orientation.
- Entrepreneurial skills – abilities related to starting a business, whether as a 'start-up' company, or as a new business venture in an established organisation, including an ability to focus on satisfying customer needs and end user wants.
- Business skills – covering implementation and administration of critical business systems and processes including, sales and marketing, accounting and finance, materials procurement and supply, project delivery, recruitment and motivation of employees and contractors, and management of time.
- Management skills - including judgment and decision-making, communicating and coordinating with others, emotional intelligence, negotiation, persuasion, organisation culture, training and teaching others.

These capabilities cover the ability to translate discoveries, inventions, *and ideas* into products, services, and new ways of organisation that create business value and value for the economy in lifting overall productivity performance and international competiveness. In a public sector context, the skills outlined have the potential to create *pubic value* for citizens in social, cultural, environment and national security contexts.

Capabilities for enterprise innovation are acquired through a combination of learning through families, the school system and the broader community, learning on the job (experiential learning) and through post secondary formal education and training. The tertiary education system (higher education and vocational education and training) has a critical role in developing skills, but the role must be seen as <u>complementary</u> to learning in community and workplace contexts.

In addressing these issues it became apparent in the interviews that it was important to differentiate between skill requirements at various stages of business growth. In particular, the skill requirements relevant to the following categories of business differ markedly:

- Technology based start-ups, particularly those flowing from commercialisation of university research, covering drug discovery, medical and other applications and devices based around scientific discovery.
- Start-ups based on novel ideas, but exploiting existing knowledge and technologies and using them in new ways – a characteristic of many Internet and Application based start-ups.
- Fast growing businesses – with established product lines and possibly with little current connection to the research and education system.
- Mature businesses, including national and global corporations, that are finding it difficult to access skills and capabilities, and also with potential to build relations with the research and education system.

The mix of skill requirements varies, of course, across industry, organisations and sectors.

2.1 Basic skills

The absence of basic skills can be a major inhibitor of innovation. Interviewees expressed concern about the paucity of basic literacy, numeracy skills among school leavers, graduates, and even PhD graduates. Future jobs will increasingly require an ability to leverage the digital technologies that underpin business and the economy. This means that people must be digitally literate, with digital literacy being seen as a basic skill.

Digital literacy relates to an ability to locate, organise, understand, evaluate, and analyse information using digital technologies across a broad range of platforms, including but not limited to mainframe, desktop and laptop computers, digital devices (smart phones, tablets, laptops), production machinery and equipment (including robots), transportation vehicles, and even point of sale devices. Digitally literate people can communicate and work more efficiently, especially with those who possess the same knowledge and skills.

Most of the important enabling technologies being developed in research organisations and business require knowledge and skills in digital technology and the capacity to develop and/or apply software and interrogate very large administrative and processor generated databases. Digital literacy is also an important aspect of social and industry inclusion in securing the benefits of technology and growth (Green & Howard, 2015)[18].

A recent OECD report on basic skills indicated that 10 per cent of Australian 16-19 year olds had low literacy levels (below level 2), and 18 percent had low numeracy skills. This compared with 21 per cent and 29 percent for the UK (Kuczera, Field, & Windisch, 2016). The survey pointed to a connection between literacy and numeracy skills and strong problem solving performance in technology rich environments. The OECD data also indicated low level of literacy and numeracy in university students and graduates, particularly for those with shorter post secondary education.

Australia's National Foundation Skills Strategy sets demanding goals for the future

The 2006 Adult Literacy and Life Skills (ALLS) survey revealed that 44% of Australia's working age population (aged 15-64 years) had literacy levels below Level 3, considered to be the level needed to meet the complex demands of work and life in modern economies. This equated to 40% of employed Australians, 60% of the unemployed, and 70% of those outside the labour force.

It was estimated that an improvement in literacy and numeracy skills from level 1 to level 3 would increase the likelihood of labour force participation by 15 percentage points for women and 5 percentage points for men and raise hourly wage rates by 23% for women and 32% for men. In 2011-12 Australian Governments developed the National Foundation Skills Strategy for Adults a 10-year strategy aiming to develop and maintain adult foundation skills. Australian Governments set as an aspirational target that by 2022, two-thirds of working age Australians will have literacy and numeracy skills at Level 3 or above, using as a benchmark the results of PIAAC. In 2013, the OECD Survey of Adult Skills (PIAAC) revealed that 12% of adults in Australia had low literacy skills and 20% low numeracy skills, (below level 2).

Source: Windisch, H. C. (2015), "Adults with low literacy and numeracy skills: A literature review on policy intervention", OECD Education Working Papers, No. 123, OECD Publishing, Paris. http://dx.doi.org/10.1787/5jrxnjdd3r5k-en. In Kuczera, M., Field, S., & Windisch, H. C. (2016). *Building Skills for All: Policy Insights from the Survey of Adult Skills*. Paris: OECD.

A vital dimension of Australia's future innovation and creative labour force, across most occupations and industries, will be proficiency in basic skills, including skills relating to the development, adoption, and application of digital technologies

2.2 Knowledge skills

In the framework of the knowledge economy, *knowledge workers* are regarded as having a critical role in improving business performance and lifting productivity. There is a very extensive literature on knowledge in organisations, and knowledge management, reflecting strategic, organisation development, and information technology perspectives. Knowledge workers have a key role in providing capabilities for enterprise innovation.

In the contemporary policy setting there has been a tendency to think that knowledge workers are predominantly people educated and trained in science, technology, engineering and mathematics

[18] Interview with Peter Noonan – reference to PhDs who do not know how to format a word document or work with an Excel spread sheet.

(STEM) and attached to a university or a research and development division or group in an organisation. Several recent reports have advocated investing more in teaching higher education STEM disciplines, particularly in areas considered relevant to Australia's growth priorities[19]. STEM skills are regarded as critical to the success of R&D projects as well as the day-to-day operations of competitive firms (Office of the Chief Scientist (Professor Ian Chubb), 2014).

STEM skills are seen to build a broader base of capabilities that link to innovation and creativity, by including many of the basic skills mentioned above such as problem solving, critical thinking, and digital literacy. This is reflected in the scope of STEM skills identified by the former Chief Scientist.

The scope of STEM skills

- STEM skills are the lifeblood of emerging knowledge-based industries—such as biotechnology, information and communications technology (ICT) and advanced manufacturing—and provide competitive advantage to established industries—such as agriculture, resources and healthcare.
- An education in STEM also fosters a range of generic and quantitative skills and ways of thinking that enable individuals to see and grasp opportunities.
- These capabilities—including deep knowledge of a subject, creativity, problem solving, critical thinking and communication skills—are relevant to an increasingly wide range of occupations. They will be part of the foundation of adaptive and nimble workplaces of the future.
- Australian firms that actively embrace change as a normal part of business are around twice as likely to use engineering skills, twice as likely to use science and research skills, and three times more likely to use ICT skills.
- International research indicates that 75 per cent of the fastest growing occupations now require STEM skills and knowledge.
- The demand for STEM will only continue to grow as we compete in the emerging global economy.

Source: Office of the Chief Scientist (Professor Ian Chubb). (2014). Science, Technology, Engineering and Mathematics: Australia's Future http://www.chiefscientist.gov.au/wp-content/uploads/STEM_AustraliasFuture_Sept2014_Web.pdf

The scope of STEM defined above covers 'deep knowledge of a subject, creativity, problem solving, critical thinking and communication skills' that are relevant to an increasingly wide range of occupations'. This may help to explain why many STEM graduates work in non-STEM occupations in business and in the services sector (The Royal Society, 2009) and are well represented in the global management consulting industry where superior problem solving skills are sought.

Discussion about the delivery of STEM skills is most often directed towards the higher education sector, professional occupations, and connections with the research sector. It has tended to neglect the many para-professional and technical jobs that require considerable STEM knowledge acquired through a post-secondary certificate, diploma, or associate degree (Rothwell, 2013). Certification bodies often require VET based qualifications as a condition to work in a wide range of specialised occupations.

In a more contemporary view of a knowledge organisation, everyone's knowledge counts, regardless of their roles. Every team member contributes, shares knowledge, and participates in making decisions, whether he or she is designing products, servicing customer accounts, creating tactical marketing plans, or determining long-term strategy. In this view, knowledge is derived not only from STEM disciplines, but also from a very broad of range disciplines in the humanities, arts, and social sciences (HASS).

2.3 Technical skills

The 2014 *Australian Innovation System Report* notes that:

> Just like higher education, the vocational education and training (VET) sector is an important adjunct to the national innovation system. Skills that are attuned to vocational situations and the actual needs of the workforce are required to ensure that new and improved products and processes have technical and commercial applicability. Workers often need a combination of knowledge acquired from higher education and vocational education to realise workforce gains (Department of Industry, 2014).

Skilled technicians are the people who produce, install and repair the products and production machines patented by professional researchers and R&D divisions, allowing firms to reach their markets, reduce product defects, create process innovations, and enhance productivity. Most of the

[19] Reflected in the industry growth centres strategy (Department of Industry and Science, 2015).

important enabling technologies being developed in research organisations and business require a capacity to develop and/or apply software, programme machinery and devices, and interrogate very large administrative and processor generated databases.

Because of the way the knowledge economy has been defined, policymakers have mainly focused on university based education in the STEM disciplines. However, ABS data indicates that of the STEM qualified population, seven per cent had a Postgraduate degree as their highest level of STEM qualification, 29 per cent a Bachelor degree to Graduate diploma, 16 per cent a Diploma or Advanced diploma, and 48 per cent a Certificate III or IV (Australian Bureau of Statistics, 2014)[20].

Over 80 per cent of people qualified in Engineering and related technologies held a vocational level qualification as their highest level of education attainment. However, in the Natural and physical sciences, the proportion is 14 per cent, 50 per cent in Information technology, and 64 per cent Agriculture, environmental and related studies.

In the US, the Brookings Institution has pointed out that *technical* qualifications are in demand and offer attractive wage and job opportunities to many workers without bachelor's degrees (Rothwell, 2013).

Box 1: The hidden STEM economy

Workers in STEM (science, technology, engineering, and math) fields play a direct role in driving economic growth. Yet the Brookings Institution has estimated that in the USA half of all STEM jobs are available to workers without a four-year college degree, and these jobs pay $53,000 on average—a wage 10 per cent higher than jobs with similar educational requirements.

Half of all STEM jobs are in manufacturing, health care, or construction industries. Installation, maintenance, and repair occupations constitute 12 per cent of all STEM jobs, one of the largest occupational categories. Other blue-collar or technical jobs in fields such as construction and production also frequently demand STEM knowledge.

http://www.brookings.edu/research/reports/2013/06/10-stem-economy-rothwell

Similar considerations apply in the HASS area, where technical skills drawn from business, finance, accounting, and the law, design and creative practice, health sciences, and human communication are also important capabilities for achieving innovation outcomes in business.

2.4 Creativity and design skills

Enterprise innovation skills and capabilities related to problem solving, critical thinking, and communication are closely connected with creativity and design' skills. This skill set is closely linked with innovation, and sometimes overlaps in the range of innovation definitions (Howard, 2008). That is:

- Creativity is the *generation of new ideas* – either new ways of looking at existing problems, or seeing new opportunities, perhaps by exploiting new technologies or changes in markets.
- Innovation is the *successful exploitation of new ideas*. It is the processes that carry them through to new products, new services, new ways of running the business, or even new ways of doing business.
- Design *links creativity and innovation*. It shapes ideas to become practical and attractive propositions for users or customers. Design may be described as creativity deployed to a specific end.

Although popularly associated with art and literature, creativity is important in many other fields, such as business, economics, architecture, industrial design, and science and engineering. Creativity skills are acquired and developed through practice, education and training, and research.

[20] The ABS adds that those with higher level qualifications in Natural and physical sciences were weighted much more towards the university level with 72 per cent having a Bachelor degree as their highest qualification in that field and a further 15 per cent a Postgraduate degree. Those qualified in Information technology were more evenly split between vocational and university level, with 47 per cent having a Certificate III to Advanced Diploma as their highest qualification in that field, 37 per cent a Bachelor degree, and the remaining 16 per cent a Postgraduate degree.

Findings published as *The Innovators DNA*, a research project involving hundreds of innovators and thousands of entrepreneurs, managers and executives from around the world, 'the formula' of innovation was identified in five key skill areas (Dyer, Gregersen, & Christensen, 2011):

The skills for innovation

- Questioning - allows innovators to challenge the status quo and consider new possibilities.
- Observing - helps innovators detect small details — in the activities of customers, suppliers and other companies — that suggest new ways of doing things.
- Networking - permits innovators to gain radically different perspectives from individuals with diverse backgrounds.
- Experimenting - prompts innovators to relentlessly try out new experiences, take things apart and test new ideas.
- Associational thinking — drawing connections among questions, problems or ideas from unrelated fields — is triggered by questioning, observing, networking and experimenting and is the catalyst for creative ideas.

Source: Dyer, Jeff, Hal Gregersen, and Clayton M. Christensen. *The Innovator's DNA: Mastering the Five Skills of Disruptive Innovators*. 1 ed.: Harvard Business Press, 2011.

The study notes that innovation starts with a question, and involves inquisitiveness, ingenuity, and often taking an initiative to resolve a problem or capture an opportunity (Homer-Dixon, 2000; Howard, 2012) . Formulating the question (problem definition) will have an impact on an innovation outcome (problem solution).

Design contributes to business performance through branding and marketing and by enhancing the aesthetic and symbolic appeal of products and services. Good design differentiates products and establishes brand premiums. Design moves innovations that deliver 'functionality' as generic commodities to innovations that create product and service value.

An important aspect of skills development is *design thinking* - a methodology to solve complex problems, and find solutions through logic, imagination, intuition, and systemic reasoning, to explore possibilities, and create outcomes that benefit the end user. These tie in with the workplace skills identified in Section 1.3, and were discussed by a number of interviewees for this project.

While design has gained some attention in the Australian context (Buculo & King, 2014), little policy commitment has been evident. Internationally, innovation support agencies have given a high priority to design with exemplars being Denmark and the UK since the adoption of recommendations of the *Cox Review of Creativity in Business* (Great Britain. Treasury, 2005).

There are a number of design centres and initiatives in Australia, but there is not an equivalent of a UK Design Council, an organisation dedicated to the use of design, or the initiatives being supported by NESTA[21]. The issue has been raised before, and remains a gap in developing innovation skills capability (Green & Howard, 2015; Howard, 2008).

2.5 Entrepreneurial skills

The development of innovation capability requires knowledgeable and engaged entrepreneurs who can structure relationships between knowledge, technology, professional talent, creative insight, and business outcomes. In undertaking these tasks entrepreneurs adopt and apply knowledge, skills, and experience in areas such as finance, economics, statistics, psychology, sociology and cultural studies.

The *entrepreneurial process* starts with a perception of a potential business opportunity, or a situation where resources can be recombined for potential profit. An entrepreneur will develop these opportunities through the creation of a product or service that will be sold to customers. Entrepreneurs secure resources, design organisations (or other modes of opportunity exploitation) and develop a strategy to exploit the opportunity for a financial return (Shane, 2004).

US business researchers Rita McGrath and Ian MacMillan in *The Entrepreneurial Mindset* (Mcgrath & Macmillan, 2000) identify five characteristics of *habitual* entrepreneurs:

[21] Interview with Benton Caffin, Director Innovation at NESTA

Characteristics of Habitual Entrepreneurs

- They passionately seek new opportunities. They stay alert, always looking for the chance to profit from change and disruption in the way business is done. Their greatest impact is where they create entirely new business models.
- They pursue opportunities with enormous discipline. They are not only alert to identify new opportunities; they maintain an 'inventory' of unexploited opportunities.
- They pursue only the best opportunities and avoid exhausting themselves and their organisations by chasing after every option.
- They focus on execution – and specifically adaptive execution, including the ability to change directions as the real opportunity and way to exploit it evolves.
- They engage the energies of everyone in their domain.

Rita Gunther Mcgrath, Ian Macmillan. *The Entrepreneurial Mindset: Strategies for Continuously Creating Opportunity in an Age of Uncertainty*. Harvard Business Press, 2000.

These qualities are observed not only in start-up businesses, but also in established businesses. The material is covered, for example, in Gary Hamel's *Leading the Revolution* in the context of ideas and options (Hamel, 2000). The approach is also reflected in various manifestations of more formal stage gate approaches to new business opportunities and commercialisation (Jolly, 1997).

To entrepreneurs, new technology is not necessarily a product differentiator. A breakthrough in product technologies may never end up being applied by entrepreneurs in a competitive market situation, or they may be short lived. Entrepreneurs understand that differentiation occurs on the *demand side*, through design, product positioning, marketing, distribution channels, and service content – all of which go towards establishing a sustainable customer base.

2.6 Business and resource management skills

Whereas *entrepreneurial skills* focus on what is required to start a business (either as a stand alone start-up or within an established corporation), *business skills* are required to sustain and grow a new venture. They can be taken to cover, at a minimum, capability in the following business *functions*.

Typology of business and resource management skills

- General management - strategy, structure, resourcing (including capital raising and borrowing), coordination and collaboration, monitoring and control, M&A, major projects, deal making.
- Innovation and new product development – new business development, product development and improvement, professional development.
- Marketing, communication, and engagement – seeking and retaining customers – the 4 Ps, tendering and quoting, building brand, CRM systems, websites and social media, business and professional networks.
- Project management – design and delivery of projects, including managing teams, meeting milestones, delivering on time and on budget.
- Finance, accounting, performance reporting - basic book keeping (recording financial transactions, GST, etc.), banking and cash flow, working capital, billing and debtor management, management accounting, payroll, taxation (GST, payroll, company, licenses and fees).
- Human resources management – recruitment, staff development, training, OH&S, equity, workplace/enterprise agreements.
- Purchasing and procurement – order and inventory management, logistics and supply chain, management, creditor management, policies and procedures, employee credit card controls.
- Digital technology – business systems, standards, security, informatics, automation.
- Governance *and compliance* – board membership and roles (innovation vs. compliance), risk management, licenses and approvals, statutory reporting, asset portfolio, insurance portfolio, conflicts of interest, ethics.

These functional areas represent the essential 'corporate infrastructure' of a business. They have their own *specialisations, bodies of knowledge, proficiencies, and competencies* - acquired through education, training, published articles in professional magazines, and business journals, books and reports, conversations with trusted advisers, on the job experience, and through contracting and 'outsourcing' to specialised service providers – many of whom work in the 'freelancer' economy[22]. They represent a diversity of skills mixing which are developed and adapted to specific business situations.

Of the categories listed above, innovation and new product development, and marketing, communication, and engagement, are probably the highest priority capabilities for enterprise

[22] Issue raised by Kate Carnell (ACCI) in interview.

innovation for start-up businesses to acquire and develop. *Without products, services, and customers there cannot be a business*[23].

Even businesses in the early stages of growth must learn how to manage finance, and particularly cash flow. An interviewee commented that 'one of the hardest things to get engineers to understand is that they must spend something in a timescale so they can invoice by the end of the month and get the money into the bank account so they can pay suppliers and salaries for the month after. They don't understand that at all.'[24] A major cause of business collapse is due to cash flow problems, particularly when cash flow is the predominant form of working capital.

Many businesses develop business skills through 'learning by doing' and through networks, mentoring and consultancy advice[25]. But eventually, a more structured solution is required. These skill and capability requirements point to a range of sourcing strategies – not all of which involve direct hiring. Many start-ups and high growth businesses tap into local innovation ecosystems where people can build trust based relationships and acquire necessary general management, financial management, and HRM capability support.

When a business reaches an establishment of around 20 employees, there is generally a need for a 'step change' investment in business infrastructure. However, many businesses, particularly in the creative sector are not easily scalable and continue to rely on informal networks to access and acquire skill capability. For businesses that are financed through cash flow, an expansion strategy can also be risky. It follows that most businesses tend to grow slowly (Bhidé, 2000) unless they meet the criteria for venture capital investment (Zider, 1998). Others prefer to stay small and specialised focussing on core capabilities.

It has been recognised for some time that many small businesses, with turnovers of up to $5m, are highly successful in international markets and global supply chains (Howard Partners, 2001). They have specialised and niche markets, and come in 'under the radar' of larger multinationals.

2.7 Management and leadership skills

Management, and managers are the elements that hold a business together and make it work. At a very early stage in the growth trajectory of a business there will be a requirement for management and managers. Entrepreneurs must become managers, or if they don't they will be replaced, or the business will most likely fail to survive (Drucker, 1994). The high rate of new business failures in Australia strongly suggests a need for a greater commitment to management capacity and capability.

Entrepreneurial skills are essential to start businesses on the basis of market opportunities, whereas management skills are essential to grow a business into a sustainable organisation that achieves goals and objectives.

As businesses grow the tasks of management become more diverse and demanding – and despite some contemporary rhetoric, it is not possible to keep running a business with a start-up philosophy. Research and practice has demonstrated that large organisations can be agile, flexible and responsive to changes in technology, markets and consumer wants – as with the case of IBM (Gerstner, 2002).

Interviewees pointed out that to succeed in growing a businesses chief executive officers (CEOs, sometimes referred to as general managers) require domain, or industry knowledge[26]. They also require a capacity to collaborate, build trust within innovation ecosystems, and integrate capabilities from a number of sources to create sustainable business models. 'People skills' are considered to be absolutely critical. A venture capital investor commented that 'it is about people 'people, people'[27].

[23] Unless the business is financed by a continuous stream of government grants. There is a flourishing industry of grant writers who assist business get government grants.
[24] Interview with Neville Sawyer, former CEO of Ampcontrol
[25] Interview with Hamish Hawthorn, ATP Innovations.
[26] Interview with Arun Sharma, John Dyson, Starfish Ventures
[27] Interview with John Dyson

The scope of management skills

Management skills cover the work of a manager in areas such as:

- *Setting objectives*: Deciding on the objectives and goals for the business and units within the business; deciding what should be done to reach objectives and achieve goals; and communicating them to people whose performance in needed to attain them.
- *Organising*: Analysis of the activities, decisions and relations required to achieve goals; Classifies and divides work into manageable activities, units, and jobs; Groups work units into an organisation structure selects people for the management of units.
- *Motivating and communicating*: Making a team out of people responsible for various jobs through building relationships, providing incentives and rewards, promotion policy, and constant communication.
- *Measurement*: Deciding what measures are available; Ensuring that measures reflect performance of the whole business and at the same time hep people do their jobs; Undertaking analysis of performance, conducting appraisals, and making interpretations; communicates meanings to subordinates and superiors.
- *Develops people*: How well or how poorly subordinates develop themselves in their work depends directly on the way a manager manages

Drucker, Peter F. *People and Performance: The Best of Peter Drucker on Management*. Oxford: Butterworth Heinemann, 1995.

Running through these skill areas is the *capacity to make effective decisions.* Managers are also expected to have capabilities such as leadership, ability to listen and take advice, mentoring, coaching, fairness, and honesty. *Ability to retain the confidence and trust of boards, CEOs, and other senior mangers is fundamental*. Management skills also cover traits like aggressiveness, prudence, follow-through, and speed – traits related to decision-making and execution.

Implementation of innovation initiatives, particularly business model innovation in larger organisations, also requires skills and capabilities in *change management*. New challenges are emerging, in the *management of risk*, such as cyber security and management in a transparent world (Austin & Upton, 2016). There was a view emerging from the interviews that boards and management might be overly focussed on risk avoidance to the detriment of innovation.

Management capability may be nurtured in people with science and technical capabilities who start businesses through learning by doing, mentoring, 'asking around', training, and management development support. Graduate Schools of Business have an important role in developing management capabilities in collaboration with industry and professional organisations.

There has been a concern that Business Schools are too academic and theoretically oriented. This was addressed in the report of the Council of Business Deans, with recommendations for more case study based learning and work based projects and attention to 'softer skills' (Australian Business Deans Council, 2014). There are indications of change for the better. It is also a concern internationally[28].

2.8 Conclusion

This Section has pointed to a wide variety of capabilities and skills required for enterprise innovation. These capabilities cover STEM skills in addition to HASS-derived knowledge, entrepreneurial skills and management skills. The discussion has sought to highlight the fundamental importance of business and management skills as the necessary capabilities to give effect to knowledge and creative capabilities.

It follows that there is a need to give a greater recognition to a broad range of skills and capabilities, and particularly business and management skills, to ensure that the current policy commitment to building innovation and entrepreneurship is realised in the form of business growth, international competitiveness and productivity improvement.

A critical task of management is to develop and integrate skills into business models that involve a high level of knowledge based skills that will create products and services with a high level of complexity and value added.

A key policy question concerns the way in which organisations can effectively acquire high-level relevant and applicable management skills in order to grow and prosper – and contribute to national output and productivity. University business schools have a key role, in collaboration with industry and business organisations.

[28] Interview with Malcolm Gillies

3 Sourcing skills and capabilities for enterprise innovation

Businesses, and particularly SMEs and fast growing business have a range of options to source skills and capability. These are summarised below.

3.1 Develop skills within the firm

Skills development has been the mandate of the human resource management (HRM) division in a medium to large business – although these capabilities are being downsized themselves[29] in an environment of cost cutting, redundancies, and contracting out. There is some resurgence in larger businesses with the appointment of 'talent managers' or people with similar titles as businesses give more attention to attracting talent in an increasingly competitive global business environment.

In many businesses training is often seen as a cost and there is an inclination to recruit rather than train – particularly as skill requirements change rapidly. It was suggested by one interviewee that training is actually cheaper than recruitment, although this is not well recognised by Australian managers – until they have to rebuild after downsizing. Many professional services firms held onto staff after the global financial crisis (GFC) in 2008.

Larger businesses invest heavily in training and preparing future leaders. Sometimes new staff are identified for 'accelerated promotion' and are given job rotation and external training opportunities, including attending executive programmes at Australian and overseas business schools. But these opportunities are rarely available for talented employees in SMEs. Opportunities for sector based industry and professional associations to support management development scholarships was discussed in interview[30].

3.2 Recruit 'work ready' employees

Competitive pressures, cost considerations, and a focus on short term financial performance encourages businesses to recruit people who are regarded as 'work ready', and equipped with the skills and capabilities to immediately contribute value to business outcomes. The trend towards flatter structures, the removal of management layers, and other forms of capability acquisition, mean that businesses have limited resources to invest internally in skill and capability development.

Interviews indicated that businesses not only expect new employees to come with necessary professional knowledge, they also have an expectation of practical and workplace knowledge. As indicated elsewhere in this report, interviewees suggested that universities should be taking a greater responsibility for preparing work ready employees[31]. Many universities see this as a differentiator and source of competitive advantage, and an implication that students are seeking out those institutions which offer these programmes[32].

Strategies to 'recruit' rather than 'make' represent a *transactional approach* to the the acquisition of 'work ready' skills and capabilities, and does not provide a base for employee commitment and loyalty. Of course, if employees know they are 'work ready' or 'employable' in one particular business, they also know that they will be employable in others. It is not clear whether Australian employers understand the longer term implications of this trend. Concern about *retaining* talented employees is being extensively addressed in the international business journals, magazines and blogs.

3.3 Contract for specific work assignments and projects

The general trend towards flexible work, identified by respondents in the *Future of Jobs* study (World Economic Forum, 2016) is considered to be one of the biggest drivers of transformation of business models in many industries and therefore also one of the topmost concerns at the national level. It was also raised on many occasions by interviewees.

[29] Interview with Innes Willox
[30] Interview with Innes Willox
[31] Interviews with BCA, ACCI, UA, UC
[32] Interview with Hamish Hawthorn, ATP Innovations

Companies are outsourcing back office functions to third party providers in Australia and internationally (particularly India, the Philippines, and other countries with strong English language capacity and close to the Australian time zone). Companies also contract for higher value added skills, such as writing software, graphic design, and design of websites[33]. This gives firms – large and small - the opportunity for greater flexibility in skills mixing.

There is also a growing freelancer workforce of individuals and small companies that contract for specific projects and assignments, particularly in industries where there are few barriers to entry. Search and engagement is facilitated through online markets or 'exchanges' such as freelancer.com.au.

The capacity for people and businesses in the contracting environment to develop and upgrade knowledge, skills and capabilities is a significant challenge. According to some interviewees TAFE is active in delivering business and management skills for contractors and small contracting businesses. This was mentioned in an interview with Hunter TAFE.

3.4 Collaborate for skill and capability acquisition

High growth and internationally focussed businesses know they will *never* be able to have available in-house all the necessary knowledge intensive skills and capability to create and deliver products and services at a particular point in time. They therefore look to the burgeoning professional services industry and, potentially, to universities and other research organisations for this capability.

The rapid growth of professional services firms across a wide range of skill sets is associated with the need for specialised knowledge and high level advice, sometimes on a one-off basis, but more often on a continuing relationship.

This development is, in turn, associated with growing specialisation in some areas of professional practice, such as international taxation law, leveraged finance, mergers and acquisitions, marketing and public relations, advertising, branding and negotiating market access. Working in these areas is also attractive to talented university graduates.

3.5 Conclusion

It is apparent that businesses have a range of choices about sourcing capabilities for enterprise innovation. Survey data and anecdotal evidence suggests that large companies are reducing their employment levels and sourcing capability from contractors and consultants. The trend allows for greater diversity and choice in building capabilities for innovation across industry, but there are risks as large corporations lose a base of corporate knowledge.

Enterprise innovation capability sourcing must be seen as a strategic decision making process, and built around longer term partnerships and collaborations, rather than short term transactional, procurement, or 'purchase order' approach. Process driven procurement procedures are likely to drive out innovation opportunity.

[33] Interview with Kate Carnell, ACCI

4 Overview of interviewee views and opinions on building capabilities for enterprise innovation

Documentation of the views of experts and thought leaders in building capabilities for enterprise innovation is provided in Attachment A of this report. Below is a summary of those views.

4.1 Business and business organisations

Large Australian public companies feel constrained in their ability to commit to innovation and the development of long term strategies for new enterprise opportunities and growth. Many reasons are offered for this, including short time horizons of institutional investors and market analysts, conservative governance arrangements, absence of innovation capability on boards, weaknesses in management capacity and capability, poor human resource management practices, limited investment in training and personnel development, and preferences for returning profits to shareholders rather than investing in business growth.

Australian privately held companies have, however, demonstrated that there is a capacity and capability to succeed through innovation and there are opportunities with potentially fast growing small to medium businesses. Innovations in the financial services sector provide an opportunity for privately held businesses to grow through better access to capital for expansion and the private equity investment sector is evolving, although concerns remain about commitment to grow a company for the longer-term through new investment, increased sales, employment growth, and building an international business.

Businesses and business organisations are concerned about the quality of basic skills and knowledge of the workplace environment among prospective employees. They are also concerned about a lack of business skills, particularly in the area of marketing, sales orientation, and commitment to establishing strong relationships with customers. Business also want graduates to be able to *apply* their academic knowledge in areas of professional specialisation. Commitments to work integrated learning go some way to addressing this issue.

There is some disquiet within the Australian business community that the university demand system has not worked well enough to deliver the skills that individuals and the nation require for innovation and creativity. Many of these skills are currently delivered through the VET system, at a much lower cost. But for some reason in Australia a higher status is accorded to university education compared to VET. This is in contrast to the German system of tertiary education where academic and technical institutions are accorded equal status.

Under the demand driven system business still has the opportunity to influence demand by contributing to the cost of education and training by paying student course fees through scholarships, cadetships, and apprenticeships. But business has allowed the cost of industry training to be shifted to students through the FEE-HELP systems. Even without a change in this trend, there is still a role for businesses, particularly at the regional level, to advise students of employment and work opportunities.

Responsibility for lifting capabilities for enterprise innovation is not something that should left to government to address. Business should be working closely with the tertiary education sector to identify and develop ways that capabilities can be built. Government has a role to support initiatives, particularly when developed within innovation ecosystems, but not to take initiatives without business or tertiary education involvement.

4.2 The Tertiary Education sector

There is a growing national realisation that not everyone is academically inclined and there has to be different pathways for people through the range of institutions in the tertiary education system, particularly as the economy adjusts to economic and industry change. The adjustments are starting now with the mining boom moving to a new phase focussed on ‘smart’ skills and technologies. There was a strong view among interviewees that the tertiary education system needs to be nationally oriented, ‘a bit more diversified and a lot more skills oriented’.

Leaders in the tertiary education system are keen to collaborate with industry in developing stronger links in teaching and learning with the aim of developing workforce skills in entrepreneurship, innovation and creativity through specific courses and programmes, extension of work integrated learning strategies, appointment of business people to academic roles, and appointment of university executive staff to corporate governing boards and advisory committees.

Many universities have invested heavily in entrepreneurial enterprise initiatives including investments in incubators and accelerators that link with advisers, mentors, investors and established businesses in local innovation ecosystems.

International practice points to a wide range of initiatives in training support and capability building, enterprise education and development for students and staff. These include training subsidies and higher level apprenticeships managed in partnership with business and tertiary education institutions (including UK degree apprenticeships), subsidies for recruiting researchers, technicians and PhDs, R&D budgets to allow for R&D personnel to participate in vocational training, and schemes to support development of management capacity and capability.

4.3 The school and community sector

Schools have a responsibility for developing basic skills in numeracy, literacy (including digital literacy). Development of these basic skill sets occurs around active learning, oral expression, problem solving, critical thinking, self awareness, and confidence.

Skills development should not just be directed towards passing tests such as NAPLAN. NAPLAN results provide information about how good students are at tests. They provide little information about how good students are at teamwork, collaboration, self awareness and preparedness for the world of work.

Interviewees pointed out that students and parents require relevant, accurate and timely information about post school options, including whether or not to enter tertiary education, whether to seek employment or to start a business, and how to develop career strategies. Students should also be encouraged to develop knowledge about, and skills in, innovation and entrepreneurship.

4.4 Government

Government innovation, science and research policy recognises the central role of science and research in building national innovation capability. There is less recognition of the role of basic, technical, business and, particularly, management skills in the translation of innovative and creative ideas into adoption and application in business contexts – and broader social, cultural and environmental settings.

Government, through the *National Innovation and Science Agenda* (NISA), can promote a culture of enterprise, and enterprise innovation, that delivers national economic, social and community benefits.

Government also has a role to remove the regulatory and structural impediments that ‘get in the way’ of productive enterprise development and growth. It can also point to cases where enterprises have grown through a combination of talent, commitment, hard work, collaboration (internal and external), and calculated risk.

If follows that Government, tertiary education and business must collaborate to ensure that investments are made in the development of basic workplace skills, knowledge and technical skills, entrepreneurial and business skills, and the management and leadership skills necessary to grow and sustain globally focussed business.

4.5 Conclusion

The views and opinions of interviewees provided important ‘on the ground’ insights into building capacities for enterprise innovation. There was an overwhelming consistency about improving connections between business, tertiary education and government policy in building capabilities.

There is an appreciation within the business sector that it must do more in collaborative arrangements with universities and VET institutions, but there was little appetite for increased government funding, although a re-alignment of priorities was mentioned.

In the following section a brief overview of international practice, drawing principally on secondary sources, is outlined. This provides some context for consideration of policy options in Section 6.

5 International approaches to building capabilities for enterprise innovation

The project brief required consideration of international approaches to developing skills and capabilities for enterprise innovation in business, tertiary education, and government policy. There was limited opportunity to approach this through interview. Four interviews were held with experts and thought leaders in the UK and one in Germany.

5.1 Overview

A *Global Review of Innovation Intelligence and Policy Studies* (L. Green, Jones, & Miles, 2007) identified nine policy categories that are associated with the enhancement of business and innovation skills. Respondents from the 29 countries were asked to indicate what categories of measures had been pursued within their territories. Summary information is provided below.

Policy & Scheme Category	Description of activities	Programmes No.	Share (%)
Getting industry involved in curriculum development at (technical) schools	Involvement ranges from formal cooperation agreements at the highest government-industry levels (e.g., France) to ad hoc arrangements (UK and Austria). Geography is an important factor – some schemes operate at national level, some at regional (Italy), and others at the level of individual organisations	16	13
Providing subsidies for employee training (including tax benefits)	22 countries report provision of subsidies. Support can be direct or indirect and much is organised centrally (some use of ERD Funding is recorded). It is common to see aid granted to SMEs only. Some schemes operate on the basis of a mandatory levy on business that is repaid in the form of a training grant (Hungary)	22	18
Providing subsidies to develop vocational training projects at firm and sector level	Vocational training is frequently organised and coordinated by a public or semi-public intermediary. Some national ministries offer grants for 'employment and knowledge enhancement' programmes under a broad umbrella of training. Programmes are in place in Netherlands, Portugal, Sweden and UK	16	13
Recruitment of highly skilled employees for innovation projects in firms	Some recruitment is project specific. Schemes operate at either national or regional level. 'Mobility schemes' are designed to allow companies to employ highly skilled R&D personnel	9	7
Recruitment of researchers, technicians, PhDs and Post docs in firms	Schemes in this category aim specifically to increase research activities in firms (and are not targeted at general skills development). Programmes support the employment of researchers in start-ups and transfer of research results (via transfer of researchers). Some countries indicate that one aim of recruitment schemes is unemployment reduction	16	13
Schemes to allow R&D personnel to gain higher degrees while working in firms	Such measures are targeted at reducing 'blocking' of research careers. Institutional arrangements that hamper the development of research careers (when academics work in industry or their 'applied' research leads to patents rather than publications) are identified as a major obstacle to the mobility of researchers and knowledge transfer. (See 'Knowledge Transfer' and 'Faraday' Partnership schemes in the UK)	11	9
R&D programmes that include a percentage of the budget for vocational training	In a small number of countries, a percentage of research programme budgets is reserved for vocational training (Belgium, Italy, Latvia andTurkey)	4	3
Schemes to allow firms to develop human resource skills strategies	HR development is rarely perceived as a strategic target for companies. Schemes in this category aim to support a change in corporate culture that will ensure that the development of HR is taken seriously. Programmes involve training entrepreneurs in techniques for long-term HR strategy-building, and support for contracting-in HR consultants	12	10
Schemes to support innovation management, i.e. to improve the skills of managers of firms in the area of innovation	Schemes support the cost of management training (sometimes inside an individual company, sometimes involving a specific training provider). Many programmes are one category in a broader innovation training programme	17	14

A number of these initiatives, where there was support among interviewees, are canvassed in the sub-sections below.

5.2 Centres for doctoral training

The UK Centres for Doctoral Training (CDTs)[34] are one of the main ways by which the Government provides support for Doctoral Training. Centres bring together diverse areas of expertise to train engineers and scientists with the skills, knowledge and confidence to tackle evolving issues, and future challenges. They also aim to provide a supportive environment for students, create new working cultures, build relationships between teams in universities and forge lasting links with industry.

Students are funded for four years and include technical and transferrable skills training, as well as a research element. Many Centres leverage additional studentships from other sources (e.g. EPSRC DTP funding, EU funding, industrial funding, and private funding). Centres are established under an umbrella term and within that there is an Industrial Doctorate Centre, which has a formal requirement about the level of industrial involvement. Nearly all of the centres engage with industry.

5.3 Apprenticeships

Internationally, governments are looking at measures to bolster the support for *apprenticeships* and open up pathways for *higher level apprenticeships*.

The UK has taken an initiative with the introduction of *degree apprenticeships*.

UK Degree Apprenticeships

UK Degree Apprenticeships combine a full degree with the practical skills gained in work and the financial security of a regular pay packet. They aim to bring the world of business and the world of education closer together, and build the high-level technical skills needed for the jobs of the future.

- Apprentices split their time between university study and the workplace and are employed throughout – gaining a full bachelor's or master's degree from a top university while earning a wage and getting on-the-job experience in their chosen profession.
- Higher Apprentices are able to study to degree level as part of their apprenticeship but Degree Apprenticeships will go further. They will involve a degree as an integral part of the apprenticeship, co-designed by employers to make sure it is relevant for the skills industry is looking for.
- The cost of course fees are shared between government and employers, meaning that the apprentice can earn a full bachelors or even a Masters degree without paying any fees. As well as being suitable for school leavers as an alternative route to gaining a degree, the new qualifications are expected to strengthen the vocational pathway and be suitable for existing apprentices looking to progress in their career.

More than 2.1 million apprenticeships have been created since 2010. The Government contribution is funded by an Apprenticeships Levy (Department for Business Innovation and Skills, 2015)

Reports indicate growth in numbers of higher or degree apprenticeships in advanced technology, construction, and digital media. Entry standards are higher than traditional apprenticeships, with off the job training blending both vocational and university courses. This responds to companies seeking higher skilled apprentices who are more employable in the longer term. The initiative is coupled with collective industry input into higher quality design of apprenticeships under the Trailblazers programme[35]. Current Government policy is to recruit an additional three million new apprentices.

In *Germany*, once students have completed full-time compulsory schooling (usually age 18), they may enter the dual system for two, three or four years (depending on the prior qualification or the occupation). The dual system is a highly standardised and regulated system in which apprentices combine paid work with training. About 66 per cent of students move into the dual system.

[34] See https://www.epsrc.ac.uk/skills/students/centres/
[35] http://cver.lse.ac.uk/andhttp://www.bibb.de/en/index.php

Germany's Dual System[36]

There are 1.5m people doing an apprenticeship in Germany's dual system. On average, more than 500,000 new trainees start an apprenticeship every year. The programmes are co-operations between companies and schools, but rather than ad-hoc commitments, each partnership is based on a unified national programme

Students apply to a private company for a training contract, and if accepted, the Government supplements the trainee's on-the-job learning with more broad-based education in his or her field of choice at a publicly funded vocational school. Usually, trainees spend three to four days at work and one to two in the classroom. It is expected that students will come out with both practical and technical skills to compete in a global market, along with a good overall perspective on the nature of their profession.

The system is seen to work because the corporate sector sees technical and vocational training as one of its key responsibilities. To create an effective system, it is argued that nations must lose the stigma attached to vocational and technical school as a fall-back for those who have failed in higher education. Rather, the training system should be embraced because it works, as the German youth unemployment rate shows. Through its Chambers of Industry and Commerce (DIHK), Germany has launched pilot programmes all over the world and are inviting companies to Germany to see the system in operation.

In 2015 the *Obama Administration* committed $175 million to encourage and expand apprenticeship across the U.S., and in his FY 2016 budget the President asked Congress for another $2 billion to establish an *Apprenticeship Training Fund*. Apprenticeship training is seen to offer a lifeline to both workers and employers. As the President notes in his proclamation, "apprenticeships help people upgrade their skills and keep pace with the demands of the 21st century[37]."

> We all know that work has changed – the type of work we do, the skills required to do it, and the people doing the work. Apprenticeships have changed as well. Traditionally, apprenticeships were focused in the construction trades (and occupied mostly by men), whereas modern apprenticeships encompass a broad range of career areas – including IT, healthcare and finance.
> Even older fields, such as manufacturing, are undergoing modern makeovers. No longer is factory work a low-skilled assembly line job. Instead, highly skilled technicians work to install, adjust and maintain complicated machinery and computer systems that run the modern plant. And all of these fields are equally open to both men and women.

5.4 Repositioning the responsibilities of business schools

In the UK business schools are being encouraged to provide greater support for businesses in the delivery of innovation outcomes. Schools have been criticised for their commitment to a model of academic excellence and downplaying their obligation for professional engagement. They are being encouraged to do better, which is reflected in a number of reports, including:

- *Business Schools Seizing the Future* (The Association of Business Schools, 2012)
- *Growing Your Business: The Role of Business Schools and Professional Bodies* (Chartered Management Institute, 2015)
- *Cultural Innovation and Entrepreneurship in London* (Culture Label.com, 2014)

Business schools are being encouraged to measure themselves in terms of the competence of their graduates and how well their faculties understand important drivers of business performance. They are under pressure from Government and business to change.

The *UK Small Business Charter* (SBC) brings together world-class business schools and SME and start-up companies across the UK. The SBC awards charters to business schools recognised for excellence in supporting SMEs and creates a framework for them to provide small businesses with nationally recognised programmes of expert advice and training to help their business grow[38]. The SBC originated following Lord Young's report *Growing Your Business*, which was aimed at bringing business schools, business and entrepreneurs closer together to deliver support for small businesses and drive local economic growth (Chartered Management Institute, 2015).

International rakings of business schools now place weight on feedback from students and alumni, as well as research performance. In 2015 the top five global schools are Harvard, LBS, Wharton, Stanford and INSEAD[39].

[36] https://theconversation.com/german-apprenticeships-are-built-on-a-cohesive-national-plan-not-ad-hoc-partnerships-23210
[37] http://www.forbes.com/sites/nicholaswyman/2015/11/04/how-apprenticeship-will-save-the-american-economy/
[38] http://charteredabs.org/small-business-charter/
[39] There are no Australian business schools in the *Financial Times* top 20 (Financial Times Business Education, 2015).

5.5 Enterprise education

The Lord Young Report, *Enterprise for All: The Relevance of Enterprise in Education* initiative focusses on lifting entrepreneurial spirit in education (The Lord Young of Graffham, 2014). It is the latest in a series of moves from the Government to make sure that young people leave education ready to work, with the skills and experience employers are after. The report covers the full breadth of education and is aimed at education leaders, teachers and all those involved in policy and delivery of teaching and learning.

Lord Young's recommendations mean that students will be able to rank university courses by their employment rates and earning potential[40]. Other proposals in the report include:

- The introduction of a new Enterprise Passport – a digital record of all extra-curricular and enterprise-related activities that students take part in throughout their education.
- A new national volunteer network of Enterprise Advisers co-ordinated by LEPs, working closely with school heads.

The UK has had a long tradition of encouraging, supporting and funding universities to deliver entrepreneurship skills. The *Higher Education Innovation Fund* has been an important and significant 'third funding' stream for English higher education institutions, with the aim of stimulating universities to reach out to business and the community[41].

5.6 Government subsidies for business and regional development

Most OECD countries have innovation and business development agencies that support research translation and to a lesser extent, skills and capability development. These are reported in SAF 09, *Securing Australia's Future - Translating research for economic and social benefit - Country comparisons*[42]. It is important that skills receive a higher profile in building innovation system performance.

In the EU policies to develop innovation skills have focussed on building regional competitiveness (Cunningham, 2007). For example:

> Ways to improve regional innovation performance include improving technology-related skills among the population (absorption capacity) or making it less hard to start companies. This can be done by increasing cooperation between the local business community and a regional college (regional development policy). However, it can also be done by providing infrastructure for IT (IT policy) - as a way to give people incentives to develop skills in IT.
> In terms of defence policy, innovation skills can be promoted by supporting a so-called "dual use" approach when defence equipment is developed.
> In terms of transport policy, innovation skills can be promoted by developing logistics and making it possible to distribute (new) wares in new ways.
> The same holds true for environmental policy. In order to be able to develop clean technologies, improved skills are needed in order to understand if more efficiency can be combined with less pollution, use of organic materials, knowledge about the eco-system, etc.

These policies are being pursued through Regional Smart Specialisation Strategies as a basis for EU regional funding (Foray, 2015; OECD, 2013). A Smart Specialisation Strategy for the Hunter Region was launched recently by the Prime Minster (Regional Develpment Australia Hunter, 2016)

At the same time, in the UK many innovation and entrepreneurship programmes are being unwound with concern that it is large businesses that are the primary beneficiaries. NESTA, an innovation charity with a mission to help people and organisations 'bring great ideas to life', continues. It has a strong focus on design and building social entrepreneurship[43].

Enterprise Ireland offers customised management development programmes, delivered in collaboration with leading international providers, to inspire business leadership, provide the tools and techniques to operate more effectively, and to achieve business results in international markets.

The US Small Business Administration web based information pages stand out as a place for obtaining useful content about business, including skills development, and continuity over successive Administrations.

[40] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/338749/EnterpriseforAll-lowres-200614.pdf
[41] HEIF has been in operation for 16 years.
[42] See http://www.acola.org.au/index.php/projects/securing-australia-s-future/saf09
[43] See http://www.nesta.org.uk/

6 Matters for policy consideration

Drawing on the material covered in previous Sections and from the interviews (see Part II) this Section brings together a number of matters for policy consideration. They are set out in relation to business, tertiary education, schools and community, and government areas of responsibility.

6.1 System wide policy matters

Greater integration of the tertiary education system around developing skills and capabilities for innovation

There was a strong view in interviews that the higher education and the vocational education sectors should be working much more closely to develop the skills for innovation. Mention was made in interviews about the higher status accorded within the community to university education compared to vocational education and training (VET). This is in contrast to the German system of tertiary education where academic and technical institutions are accorded equal status.

The German and Scandinavian tertiary education systems were referred to on many occasions during interviews, as were the tertiary 'systems' that operate in many of the US States, including California.

Fostering workplace skills in Australia has traditionally been a responsibility of national skills organisations (councils) connected with employment and workplace relations agencies and VET institutions, sometimes referred to as registered training organisations (RTOs). Skills councils endorse *national training packages* that are focussed on the delivery of workplace *competencies* through training. Universities, by contrast, tend to be focussed on the transfer of *knowledge* through education.

State owned VET institutions (technical and further education (TAFE) colleges) are subject to direct Ministerial responsibility and accountability. Universities by contrast are autonomous and self accrediting public organisations responsible to their governing Councils or Senates. Academic Boards approve courses and teaching programmes taking into account knowledge content and academic merit. Universities work with industry on differing platforms within and between States/Territories. Professional associations often accredit university courses.

Interviewees indicated an increasing interest in ensuring that competency based training incorporated greater knowledge components, particularly as skills become more knowledge based and technologically oriented. There is a parallel view that university education should give greater recognition to competency – sometimes captured in the terms workplace skills and employability. Bringing these two approaches to learning in a policy framework is a major challenge[44].

The challenge is exacerbated in the institutional setting where higher education policy and vocational education policy are handled separately between Ministers and Departments, and between the Commonwealth and States/Territories. There are different funding arrangements, including contestable funding and competition between the public and private sectors in VET, although VET students are eligible for the higher education loan programme (HELP). There are five 'dual sector' university-TAFE institutions in Victoria, and many universities have established their own RTOs.

With renewed interest in knowledge based capabilities in the VET sector, and higher education interest in skills from the perspective of the employability of graduates, there are opportunities for greater integration in education and training programme design and delivery. This would provide greater opportunities to build capabilities for enterprise innovation. Better connections between higher education and VET will provide enhanced prospects for linking with industry, particularly as the VET sector has always had a strong industry interface.

Whilst there are many good examples of cross-institutional education cooperation and student articulation between VET and universities (in-built within some institutions), they tend to be institution specific with little commonality within and between States/Territories. *A national approach is required.*

[44] Interview with Peter Noonan, Mitchell Institute.

With the progressive deregulation of the tertiary education 'industry', a new framework should emerge that enables and promotes *diversity* in the tertiary education system, with institutions being encouraged to develop specialisations, distinctiveness, and competitive advantage in areas such as global research excellence, technology development and its application, 'liberal arts' education, and community education. There should be consistency in regulatory arrangements, funding mechanisms, and accountability across the Commonwealth States and Territories.

1. **In the light of the strong views about the need for higher education and the vocational education sectors to be working much more closely to develop the skills for innovation across education sectors, buisness, tertiary education providers and government (Commonwealth and State/Territory) should consider collaborarting with the aim of developing a *tertiary education and training system framework* that promotes education and training diversity and makes available the broad range of skills and capabilities required for business and enterprise innovation. This should be an ongoing and inclusive commission over a five-year period with members having a capacity to build a high level of engagement with all sectors.**

Organisational options for university-industry collaborations

The Cooperative Research Centres (CRC) model has evolved over 25 years, and is highly regarded for research training in industry. The new CRC-P model has the potential to be a less expensive way of building collaborations.

Some of the more effective vehicles for university-business collaboration are through standalone centres for teaching and research established under joint venture and other forms of corporate agreements or under university policies relating to University Research Centres. These are often established without government support or subsidy.

There are also other models of business-university-government collaboration in the form of faculty research centres, university controlled entities, and joint venture partnerships. There is little information, at least publicly, about what form of governance, organisational, management, staffing, and financing arrangements work best in fostering sustainable collaboration is skills development, academic teaching, and research.

2. **There is broad awareness th**at u**niversity-business collaboration occurs through a range of governance, organisational and management frameworks including but not limited to the CRC framework. Tertiary education institutions and business leaders should consider working together to design a range of collaborative models and structures that can deliver both capability development and research outcomes efficiently and effectively. The Industry Growth Centres may provide a forum to address this in the first instance.**

6.2 Matters for business

Build corporate governance and innovation capability

Corporate governance, longer term investment horizons, and commitment to innovation was discussed in several interviews.

There is a view that companies should appoint to their boards an *innovation director* with a specific obligation to build innovation capability across business units, and to submit to the board *an annual innovation report* alongside other board documents covering finances, safety, and risk.

The innovation report would show the percentage of sales accounted by new products or services, outlining priorities, showing the portfolio, external linkages and relations to other companies and tertiary education institutions. It should also report on innovation skills gaps and how skills are being sourced.

3. **There was a strong view coming through interviews that Australian businesses had not addressed innovation well. To lift the focus on innovation and capability development, including the skills for enterprise innovation, peak industry associations might consider encoraging businesses to appoint an *innovation director* in a senior executive role to be responsible and accountable for lifting innovation performance. That role would include developing relationships with universities and research organisations.**

In the current innovation environment that gives priority to formation of new businesses, it is important that boards are constituted by people who can add value to a business as well as ensure that regulatory and compliance requirements are met. It is also important that the pool of potential directors be extended to meet the potentially growing demand for director positions. New board members often require education in their corporate roles and responsibilities. The Australian Institute of Company Directors performs an important service in this area.

In addition to compliance issues, the focus of governance education should be on the role of a board in driving innovation, and *managing risks* not avoiding them. It should also address governance transition as businesses undergo transformation and diversification enabled by digital technologies and international engagement. Boards of new and fast growing companies require members who can create value in addressing innovation, technology and collaboration challenges.

4. **In the current innovation environment that gives priority to formation of new businesses, it is important that boards are constituted by people who can add value in building a business as well as assuring that regulatory and compliance obligations are met. It is also important that the 'pool' of potential directors be extended. Business associations and the Institute of Company Directors could address this matter by developing corporate governance education and training for current and potential board members of start up and high growth businesses.**

Encourage business to invest in the human resources management (HRM) function

During interviews the tendency towards downsizing of the human resource management (HRM) function to an industrial relations (IR) or workplace relations role was mentioned. For many businesses, staffing is seen as a cost, and staff reductions are seen as being capable of yielding significant savings in tough business conditions. HRM is often seen as an enforcer rather than an enabler of talent development.

In an ideal world, the HRM function should be involved in skill and capability development, and looking at options for skill sourcing to meet required skills mixes efficiently and effectively. Managers and boards need to know the costs and benefits of internal training compared with contracting (labour hire), collaboration, and external recruitment – relying on third parties to invest in training and skill development.

Businesses should understand that talent cannot be instantly replaced through recruitment. Inevitably, growing businesses must develop talent in-house. Even in start-ups and fast growing businesses, the HRM function has a high priority for attracting the best talent[45] It follows that talent management and skills development should be regarded as a critical area for investment. Whilst this is generally acknowledged in global businesses, it is not always the case in small to medium businesses.

5. **There are indications that small to medium businesses are under investing in human resource management (HRM) capability, with the flow effect that the skills for enterprise innovation and talent management are not being well addressed. Business associations and enterprise development agencies could address this by devising an information and awareness programme about the importance a strategic HRM function that can spot talent trends and skills gaps, and provide insights that can align business, innovation and talent management strategies**

Create awareness of future skill requirements and business capability sourcing strategies

Business requirements for skills are being met in a complex framework involving career development, contracting, consulting and recruitment of 'work ready' employees. It is now quite well

[45] Interview with Hamish Hawthorn. *The Start-up Muster.* http://www.startupsmart.com.au/

understood that most people will be unlikely to have a 'life long' career with a single organisation. Business associations and professional organisations are in a position to tap into their membership and knowledge bases to profile future skill requirements in the light of market developments and technological change.

Organisations are constantly going through stages of transition, transformation, and even disruption in the light of shifts in consumer preferences and advances in technology, whilst people have a range of choices about their prospective working arrangements. Many will establish their own businesses, either by entrepreneurial choice or by force of circumstance (redundancy, for example). There is an understanding that people will have to take a greater responsibility for managing themselves in this environment. This is a feature of the contracting and 'freelancer' economy.

Business requirements for knowledge, technical, and innovation capabilities call for more information about capability sourcing options, the comparative merits of alternative strategies, the regulatory obligations and requirements, and the risks involved. This information requirement applies to all businesses, and particularly small businesses, and to people wanting (or having) to work in more flexible employment, contractual and consulting arrangements. Contractors and freelancers must be able to develop new innovation and business skills that are essential to compete in a competitive capability sourcing environment.

6. **Business requirements for skills are being met in a complex framework involving internal career development, contracting, consulting and recruitment of 'work ready' employees. Each approach has benefits, costs and risks. To assist businesses in making the most appropriate sourcing decisions, business associations and professional organisations could provide guidance on efficient and effective capability sourcing strategies which could also be a platform for informing people about decisions to invest in developing, maintaining and upgrading their innovation and business skills.**

Encourage commitment to work integrated learning

Peak business associations and Universities Australia have entered into an agreement to promote work integrated learning. Whilst this has been embraced by universities, many businesses are concerned about the costs. That is, work based learning requires a strong resource commitment of people, time and money, sometimes including an obligation to pay award rates. There is also concern that students may have under-developed workplace skills. But for some employers, making available non-paying workplace learning places provides an opportunity to screen and identify talent for future employment.

For small to medium size businesses, the commitment of time and cost for supervision, mentoring and guidance is a major constraint on capacity to offer workplace learning opportunities. In the ICT industry there is some State/Territory Government and industry organisation support for short term work placements for in 'demand' areas like computer science, software engineering and project management.

It was apparent from interviews that many small to medium businesses are not aware of the opportunities in work based learning and how to manage and achieve value from short term temporary work placements. Business associations and national professional organisations have the opportunity to make a major contribution in this area by providing information, advice and funding. Associations have been able to source funding from State and Territory Governments to run programmes in this area.

7. **Whilst Work Integrated Learning (WIL) has been embraced by universities, many businesses are concerned about the costs. For small to medium size businesses, the commitment of time and cost for supervision, mentoring and guidance is a major constraint on capacity to offer workplace learning opportunities. National industry and professional organisations could collaborate to support the extension of work integrated learning in small to medium businesses through information and assistance and advocacy for government financial support to defray some of the costs of taking on trainees and providing advice on how to manage firm based work based learning schemes.**

6.3 Matters for the tertiary education sector

Build commitment to management education

As indicated in Section 2.7, the task of management is to bring together, through leadership, direction, and organisation, a mix of skills and capabilities that will create a product or service (output) that has economic and social value.

This report has highlighted in various places the need to lift management capacity and capability in Australian businesses, particularly in small to medium businesses with high growth potential. While it is important for students in STEM disciplines to be exposed to the principles of innovation and entrepreneurship as part of their courses, it has to be recognised that management is a profession and a practice that is learned through both experiential learning formal education and training.

Recent policy statements have focussed on developing an entrepreneurial culture, formation of start-ups, and the economic potential of fast growing businesses. Interviews and discussions for this project have drawn attention to a reality that start-ups and high growth SMEs inevitably require effective management and organisational frameworks that are fit for purpose as they develop and mature. Whilst there has been a great deal of attention to developing entrepreneurial skills, less attention has been given to developing business and management skills in small to medium enterprises.

University business schools have an important role to work with business associations, professional organisations, and sector specific industry bodies to develop and design courses and programmes that meet needs for enterprise innovation. Formation of a National Business School was recommended in the Karpin report and largely supported by business, but opposed by Vice-Chancellors (Deveson, 1997).

There was little support for the formation of a national business school in project interviews. Some improvements in business school focus were noted following the report of the Australian Council of Business Deans review of management education (Australian Business Deans Council, 2014). But there was a general view across interviewees that a stage has been reached where a national effort is required to lift Australia's management capacity and capability, particularly for small and growing businesses, and small businesses with high growth potential.

Businesses, whether large or small, should take opportunities to build management capability in collaboration with tertiary education institutions, nationally and internationally, to capture the opportunities for enterprise innovation. There is potential for business schools to collaborate in the design of courses and programmes that offer sustained and ongoing value for participants. Business associations, professional organisations, and Industry Growth Centres, can work with business schools in designing programmes, along the model developed by the Minerals Tertiary Education Council (outlined on page 50 below).

8. The interviews highlighted the need to lift management capacity and capability in Australian businesses, particularly in small to medium businesses with high growth potential. Universities, business associations, professional organisations, and Industry Growth Centre leaders could consider collaborating in designing graduate business education programmes that meet industry needs on a sector basis. The model of the Minerals Tertiary Education Council should be examined with a view to application in Industry Growth Centres and other priority industry sectors.

Consideration could be given to providing scholarships to talented mangers to attend Executive Programmes offered by the provider business school(s).

Encourage universities to appoint DVCs Innovation

It was suggested during interviews that all universities should appoint a Deputy Vice-Chancellor of innovation (DVCI). The role would be responsible for overseeing the whole range of innovation activities in the university and its external relations with business and government. The role would differ from the DVC Research (DVCR), which is essentially to lift a university's research performance and recognition.

A DVCI would be to build long term relationships with identified strategic partners in industry and government. The role would provide one coherent, powerful voice to oversee all the actions of the university in this area. The role should have equal status with the leaders in research and education. Appointees should also have high level industry experience and achievement and be comfortable in corporate boardrooms and business associations.

The appointee would be expected to be actively involved in external business and industry forums, councils and committees, and be seen by business as the 'entry point' to the university. Businesses and industry associations should seek to have appointees involved with their own innovation committees and strategies.

Appointments would be made for the longer term, and performance assessed on the strength of partnerships, including adoption, application and change generated, rather than transactional indicators such as income generated.

9. Responsibilities for innovation leadership varies across the higher education sector. It is important for both universities and industry that there is a capacity to to build long term relationships with identified strategic partners in industry and government. Industry associations, business organisations, and government should consider encouraging all universities to appoint *DVCs Innovation* with a role to achieve innovation outcomes and provide a focal point for engagement with industry.

Extend and support doctoral training centres

The UK and German *Doctoral Training Centres,* that integrate both discipline-specific and generic industry elements, are highly regarded. The ATN universities have already taken an initiative in this area. Information is provided below.

Industry Doctoral Training Centre (IDTC)

The IDTC, run across five universities, combines a traditional PhD thesis with specific training in professional and broad technical skills required by industry. Graduates are skilled to seamlessly work in either industry or academia throughout their careers, with the skill set for both. This should be the norm.

Significant barriers exist before programmes such as the IDTC can be delivered at scale across the sector. Delivering the industry readiness and broader skills that make the IDTC such a valuable programme requires additional time and resources. To really tackle research training in a meaningful way, dedicated funding will be required to underpin the extra training that is not part of a traditional PhD. Global competitor nations that have gone down this path and reaped benefit. It is a de-risked investment.

Businesses also need to be encouraged to build a culture of collaboration. This could be achieved through changes to the tax system, motivating businesses to spend the extra dollars to directly support students on industry research-focused PhDs and to hire PhD graduates who can make a real and immediate impact.

Industry should be encouraged, through sectoral industry and professional associations, to support doctoral training centres on a partnership basis. This would assist in building scale and scope.

10. *Doctoral Training Centres,* that integrate both discipline-specific and generic industry elements, are highly regarded internationally. Australian research funding councils, including the ARC, NHMRC, and the Rural RDCs, should consider providing assistance for the formation and operation of doctoral training centres. Each centre should involve the participation of at lease five universities and support of sectoral industry and professional associations. The ATN Doctoral Training Centre should be supported under this initiative.

Encourage Tertiary Education providers to continue to address workplace and innovation skills in curricula

The BCA, AIGroup, and ACCI are of the view that universities should be encouraged to include workplace skills in the curricula. University reaction varies with some already progressing down this path seeing it as a way of building their competiveness and market position, whilst others are more cautious about student reaction and crowding the curriculum.

Tertiary education institutions, businesses, professional organisations, and NGOs already collaborate in a range of be-spoke courses and programmes. These may involve a substantial financial risk by a

university to establish course viability, or involve a minimum commitment by a business r professional association to provide a 'break even' number of students.

On the basis of interviews there are a number of strategic initiatives that tertiary education institutions might put in place to improve the development and application of non technical skills and capabilities in courses and programmes. These can include initiatives around work integrated learning as well as capstone projects and service learning.

Developments in this area are likely to come from greater collaboration between tertiary education institutions, business and professional organisations, and NGOs.

11. The national business organisations are all of the view that universities should be encouraged to include workplace skills in the curricula. Business organisations should collaborate with universities and academic boards to identify the best ways to include effective workplace and innovation skills development in course and programme curricula

Develop lifelong learning strategies across the tertiary education sector

Learning is increasingly a continuous and lifelong commitment. With constant change in the demand for skills and capabilities, as industries transform, and businesses grow and fade, people need opportunities to redevelop skills and acquire new capabilities as a way of enhancing their continuing and future employment prospects.

Whilst many people take their own initiative in upgrading skills it is desirable that employers are supportive in that investment. Continuous learning and engagement with tertiary education (universities and VET) also facilitates networking and mobility in the innovation system.

The dwindling future population share of the youth cohort implies that focussing only on reforming current education systems to better equip today's students to meet future skill and capability requirements is not going to be enough for Australia to remain competitive. People who have passed a nominal 'retirement age' must be regarded as an important segment of the participation workforce and the 'freelancer' economy.

Mature aged business people bring knowledge, skills *and experience* to the business skills mix, and capacity to build economic complexity, and their contribution should be valued.

12. With constant change in the demand for skills and capabilities, as industries change and transform, people need opportunities to redevelop skills and acquire new capabilities as a way of enhancing their employment prospects. It is important that tertiary education institutions, business and government collaborate in developing strategies that enable progressive lifelong learning and reskilling of the current workforce to ensure that individuals have the time, motivation and means to seek retraining and professional development opportunities.

6.4 Matters for Government

Support the introduction of national apprenticeship degrees

Interviewees were of the view that there are serious national, economic, and also social issues to address in the apprenticeship system. There is also a need to achieve continuity of training across the States/Territories. Interviewees saw this as a big concern because of the long-term implications that will flow through into coming decades.

Internationally, Governments are looking at measures to bolster the support for *apprenticeships* and open up pathways for *higher level apprenticeships*. This was addressed in Section 5.3 above. In the UK the scheme is part funded by a levy on companies to help pay the costs of training fees.

13. Internationally, Governments are looking at measures to bolster the support for *apprenticeships* and open up pathways for *higher level apprenticeships*. The Commonwealth Government, should consider supporting a broadening of the apprenticeship system to establish national apprenticeship degrees, as implemented in the UK, and as a way of achieving a better integration of academic and occupational learning

Encourage Tertiary Education institutions to extend education and training in innovation, entrepreneurship and business

Many universities have already gone down this path, with a number of established courses and programmes. However, there was interest in ensuring that programmes were less about studying and describing the characteristics of entrepreneurship, and more about developing skills and capabilities in starting and growing entrepreneurial business. Interviewees were particularly interested in programmes being delivered across a university, and not only for students in a business faculty.

There is a need for education and training standards, QA, and a system of accreditation to guide students in making choices. Business, tertiary education providers, and government education and training agencies should collaborate to develop these standards. Tertiary education providers should be encouraged to move and continue in this direction with a small financial incentive.

14. There is a great deal of interest and commitment among universities to education and training in innovation and entrepreneurship. There is a need for education and training standards, a balance between theory and practice based learning, QA, and an information system to guide students in making choices. Consideration might be given to establishing a collaboration arrangement, involving tertiary education providers, government, and industry, that aims to deliver consistent whole of sector approaches to the incorporation of innovation and entrepreneurship into the undergraduate curriculum.

Provide business tax incentives for employment of PhD graduates

A PhD programme is seen as one of the only forms of training the universities provide that actually gives people the mindset to break new ground.

An interviewee observed that a PhD student has to come up with something no one else in the world ever has thought of, but do it in a way that proves to every conservative professor, who is trying to hold the boundaries of their discipline, that this actually is a new addition to knowledge. This mindset is a capability that is (or should be) highly sought after in business leaders[46].

In contrast to Germany, Australian business do not employ many PhDs in senior positions, or if they do, they tend not to recognise it. However, to build problem solving and critical thinking capability businesses should be encouraged to employ PhDs, *from any discipline*, through a specific tax incentive. It might be expected that PhDs with good workplace skills would rise through the general management system, which would provide the added advantage of knowing where to go in a university to find innovation.

With a tax incentive, employing a PhD would be no costlier that hiring an undergraduate. PhDs would be employed whether or not they are doing research. The objective would be to lift innovation capacity by capturing the 'innovation mindset'. The incentive would cover the social sciences and the humanities. Internationally, global professional services firms recruit a broad range of PhDs, particularly in the consulting divisions.

There is already a mechanism for a tax Incentive. The incentive would be targeted at SMEs with high growth potential. One interviewee argued that 'this would be the cheapest way to transform the country in a generation'.

[46] Interview with Professor Arun Sharma, DVC Research, QUT.

15. By international comparison, few Australian businesses are involved in practice oriented PhD research projects or are employing a PhD graduates as researchers. This could be encouraged through tax incentives for businesses to participate in and hire research focused employees. Administrative arrangements would need to be developed to ensure continuity of employment and protection of employee rights.

Provide national support for a network of Tertiary Education based accelerators and incubators

There is some limited funding in the National Innovation and Science Agenda to support the development of business incubators, but by and large the universities and regions are working it out for themselves. It follows that there is a diversity in approach, scope and coverage.

Whilst diversity in approach is to be welcomed, an acknowledgement of the importance of regional innovation systems in innovation policy suggests that there might be benefit in an arrangement for sharing experience, better practices, and approaches to governance and management.

The Regional Development Australia network of 55 RDA committees might be an appropriate forum to develop this network. Several RDA Committees are active in promoting the development of regional innovation systems and have committed to Regional Smart Service Strategies (RS3) on the EU model for providing support for innovative regions.

16. There is a growing acknowledgement of the importance of regional innovation systems in innovation policy, and interview discussions suggested that there might be benefit in an arrangement for sharing experience, better practices, and approaches to governance and management. Government, through Innovation and Science Australia could consider providing support and assistance to encourage tertiary education business incubators and accelerators to develop connections and identify and share better practice.

Extend the scope of innovation vouchers to cover skills development

Several State Governments have introduced innovation vouchers to subsidise business access to university and research organisation R&D. Interviewees commented that vouchers should also be available for the development of skills related to the implementation of new approaches to business development and growth.

17. In recent years several State Governments have introduced innovation vouchers to subsidise business access to university and research organisation R&D capability. In the light of the importance of skills for enterprise innovation, State/Territory Governments should be encouraged to extend their innovation voucher systems to cover skills development and training.

Initiatives for Innovation and Science Australia (ISA)

Innovation and Science Australia (ISA) has been established by Government, as part of the National Innovation and Science Agenda, with a mandate to provide strategic whole-of-government advice on all science, research and innovation matters. ISA is expected to establish strong and extensive business and community stakeholder links to audit the performance of the innovation system and develop a long term 15-year plan for the Government's investment in science, research and innovation.

ISA is expected to publicly advocate reforms on key issues such as innovation investment, innovation collaboration and skills, delivering and operating research infrastructure, and better planning and use of Australia's investment in research and development. In the area of collaboration and skills development it is important that ISA engage with the VET system as well as the higher education system.

18. Within the framework of its roles and responsibilities, and particularly in relation to *innovation collaboration and skills*, Innovation and Science Australia should consider developing strategies to:

- **Support initiatives for sector specific management education and training, and related skills development, for entrepreneurs and managers in potentially high growth businesses drawing on the resources of the tertiary education system.**
- **Provide a greater understanding of why and how employers can take on more 'learners' as graduates, interns and apprentices, and the benefits that can be expected.**
- **Publish material that highlights careers and achievements of VET-trained and university educated entrepreneurs and business leaders, particularly those who have become significant employers.**

Implement a national career information and advice service

There is a need for a greater commitment on the part of business, education institutions, community organisations and government to provide access to credible, consistent and reliable information about investing in the development of their skills and capabilities, not only at an early age, but throughout their working lives. Information should be available about new and emerging skills and occupational categories, the skills and qualifications required, and the prospective demand for capability.

19. Business organisations have pointed to the need for accurate, relevant and timely information about career opportunities and emerging skill areas. The Commonwealth and State/Territory Governments and peak business associations should consider collaborating in the development of a national web based careers information and advice service that is accessible, and readily comprehended by parents, students and business.

Students and parents will inevitably make their own choices, having regard to perceived opportunity, passion and commitment. In areas of emerging and future technology, predictions are very difficult and fraught. It may well be the case, of course, that students will create their own futures in areas where they want to create their own opportunity. Nonetheless, basic factual information about the current situation is a good starting point.

Establish an income contingent loans scheme for skills development in SMEs

Several prominent Australian academics have proposed a scheme that would help high growth potential SMEs finance innovation (Chapman, 2014; Chapman & Simes, 2006; Chapman & Withers, 2015). The arrangement involves modest or even zero net imposition on the public purse, and it is potentially administratively straightforward. The proposal builds on the successful design and application of income contingent loans in financing arrangements for domestic university students, and emulated now in many other countries.

An income contingent loan scheme for Australian innovators

The idea is to link industry research grants to university teams that have developed their plans in collaboratively, and which are designed with profits to the business as a major motivating factor. It is driven in part by the view that collaboration between university researchers and the private sector has potential to advance the interests of both sectors, and in ways that can be instituted with negligible longer-term budgetary costs.

Projects would be suggested, promoted and explained, and costs estimated, through interactions between university and business partners (in much the same way that ARC Linkage grants currently operate). If successful, projects would involve the provision of financial resources taking the form of grants to finance the university activities and contingent loans for the business partner. Repayment of the loans is a critical aspect of the arrangement.

Businesses benefitting from the research funding would be required to repay some (or even all) of the loan, but only when they are in a viable future situation. This can be ensured by having the obligation depend on future profits, as explained in a similar policy scheme. For example, this could be handled with an additional 2 percentage points being added to company tax, with the amount/proportion of the loan to be recovered set as a policy parameter by government. The transactional efficiency from government collection of debts through the tax system is a major advantage of the scheme.

A further advantage of such arrangements is that they provide insurance to the agents assisted: insurance against repayment difficulties and, critically, insurance against default. If the business is not in a position to repay, no repayment is actually required. Capacity to repay, as with all contingent loans, is the defining characteristic of such schemes.

Applications for support would need to be vetted by the same sort of process now used in the awarding of ARC/NHMRC grants plus the extra element of business assessment too. This joint approach would ensure projects have both university and industry merit and some industry financing is also likely to be required as 'skin in the game'.

The scheme could be introduced on an experimental basis with a sample of businesses across sectors, with a view to learning about implementation and execution.

20. During interviews, several Australian academics advanced the concept of an income contingent loans scheme for developing skills and capabilities in small to medium sized businesses by accessing capability in universities. Government could consider introducing such a scheme, on a pilot basis as a method for supporting business-university collaborations.

Attachment A: Observations and comments from experts and thought leaders in business, tertiary education, government

This Attachment brings together observations and comments from experts and thought leaders in business, tertiary education, government brings together, and the innovation policy community about barriers to, and opportunities for, developing the skills for innovation.

Some insights are provided in the form of quotation and paraphrasing from interview transcripts. With the time and resources available (particularly on the part of interviewees) it has not been possible to develop *Hansard* quality transcripts, with the result that the quotations have an element of vernacular narration. However, this contributes to their authenticity.

Business and business associations

This Section covers the areas of governance, leadership, relationships with universities and governments, management and business education, apprenticeships and special issues associated with new and potentially fast growing businesses.

Governance

Australia has very rigorous regulatory requirements relating to boards, which can have both a positive and a negative impact. They can be constraining in some ways, but they can be very good on accountability. It depends on how the board sees its own role, and in particular how the chair sees his or her role. And how that interacts with management. The role of the board is to provide strategic direction, strategic guidance, and to be a sounding board. And basically to put the red flag up when some silly ideas emerge.

Because Australia has a culture of going public, and there are a lot of companies with boards, together with Government based boards or advisory boards, there is a question about whether the talent pool within Australia is big enough to cope with the demand for competent and capable directors. There was a concern during interviews about whether Australia has enough people with the right sort of skills and expertise, connections, and depth so that companies get a wide source of advice and information, and whether that information is current, up to date, and forward-looking, and can address business capabilities for innovation.

Professor Mark Dodgson from Imperial College and UQ observed that Australian corporate boards of directors are heavily weighted towards law and accounting, with very few scientists and engineers, very few people with experience internationally, and very few people who have actually started and run a business as a general manager. Another interviewee suggested there is a predilection on the part of shareholders to 'stack your board with a bunch of accountants and lawyers, which is not likely to lead to innovation and taking risks'.

Australia hasn't had the innovative history to generate a pipeline of innovators, who are getting more senior, wanting to do more board positions and provide their expertise. There are simply not enough of them around.

Dodgson pointed out that in successful multinational companies, boards will send their high flyers overseas and say 'your job is to build a business'. So they'll build a business as a general manager and then progress through the organisation. There is little evidence of that in Australia. 'It's quite frustrating that you occasionally see the Business Council getting into this, and when you see the high quality of people involved, it is strange that there's not more push in this area'.

Glenn Keys, CEO of award winning medical services company Aspen Medical, also pointed to the issue of diversity, and research that indicated that 'boards with women make more money.' He added that 'boards need men and women, straight and gay, Asian and white Anglo-American'. He suggested more proactive approaches to developing board experience, including training in AICD courses and programmes. Boards can lead with a rich mix of skills and capabilities for innovation.

The Canberra Business Chamber has just started, with AICD, a future leaders programme so people will come onto the board, go to AICD, have a mentor, stay on the board for a year while they learn, and ask them to move on, and get another one.

The AICD has made a change in their focus. It's not only about compliance but it's now more about innovation as well. But the other hard thing around boards at the moment is that compliance/governance/responsibility has increased so dramatically that a lot of people are afraid to do it. That's a problem because we'll be left with the few that say "I get it. I get how to get around this, I get how to ask the right questions and if all starts to smell, I'll resign and move on."

Commitment to innovation

Innes Willox suggested in interview that 'we haven't done innovation well'. And those businesses that have done it well, or better, are usually the foreign owned companies, who take their experience from overseas and imbed it in the Australian context. They're also the ones who go out to find partners more readily. These businesses go out looking to take the next steps and the advances. Part of the reason is that they're part of internal competition which creates a competitive culture within their business framework. Accordingly, they're much quicker to address innovation, much more ready to do it, and much abler to do it, because they have the skills and capabilities.

An interviewee pointed to a current trend in innovation strategy in Australia's large businesses:

> For a listed company there are analysts calling the tune; but a business has to be listed to access the funds required for growth. Listed companies tend to buy innovation or take innovation over from other people, including high growth technology based firms. Big companies have tended to take small companies and put them inside the big pots of innovation. Telstra, Australia Post and the banks are moving down that track with their incubators.

With these sort of attitudes, it is hard to focus on developing the skills for enterprise innovation in Australia's largest companies.

Within Australia there are many notable and terrifically successful cases of innovative capacity and there is a 'laundry list' of accomplishments. But part of the problem is that Australian business has an unusual makeup – and it is largely a *small business culture*. They're more focused on turning the wheels on a day to day basis, and tend not to have the time, the focus, or the money, to spend on developing innovation. Innovation is a secondary issue. This has implications for the way in which these small businesses acquire the skills for innovation. There are many options apart from direct recruitment including contracting and collaboration in 'innovation ecosystems'.

Andrew Stevens from the Advanced Manufacturing IGC mentioned that there is *an absence of a culture of enterprise innovation* in Australia. He observes that It is not widely appreciated *that business enterprises* are the vehicles by which research, development, commercialisation, the realisation of the returns on that effort, and the way that endeavour is managed. It is 'not our culture, as a nation' to appreciate the role of business enterprise. For example, at one of the NISA communication sessions there was antipathy in the research and university community towards business and a feeling of: 'I don't want business to be making money out of my idea". This was seen as a serious national issue.

The National Innovation and Science Agenda (NISA) is seen to be 'moving the needle' towards a greater involvement of the enterprise part of the economy rather than focussing attention on the science and research and capability part of the economy. NISAS has a role not only in supporting entrepreneurs who want to take a risk with an entrepreneurial venture, but also in creating an awareness and understanding in the wider community that business enterprise is good for the economy, employment and growth. Unfortunately, the larger business organisations have not been good at communicating this message.

Management and executive culture

It has been suggested that Australian business follows a culture of economic fundamentalism – rather than one that prizes leadership and shareholder value. It drives a focus on cost control and bottom line performance. It is driven in large part by demands of institutional shareholders for short term returns and tends to downplay the role of businesses in creating value for customers, employees, the nation, and the broader community. Staff tend to be treated as 'costs' rather than the embodiment of valuable knowledge that will secure and sustain the future of a business.

A focus on short term results and quarterly bottom line performance is detrimental to the creation of long term value and building capabilities for innovation.

AI Group is trying to lift the eyes of business leaders to think beyond the immediate and the short-term, and to think longer-term about what is happening, not just in their particular business, but in their sector and then in the concentric ring beyond that - the broader economy, and how business can fit into that. 'And it's not something that business leaders are necessarily asked to do when they take on the job. They're more sort of inwardly focused, so it's really about trying to lift their horizons beyond the immediate and the short-term, into the medium and longer-term'.

AiGroup organised a headline leadership conference in September 2015 where it brought to Australia globally recognised management speakers, 'Gary Hamel[47], for example, did a lot of work with members around getting them to understand the world we're operating in now. The discussion was around the era of disruption and how old business models—standing still business models—just weren't going to cut it'.

In an increasingly global environment business leaders recognise the need to think global. AiGroup is granting scholarships, for business leaders to go and study at Harvard 'and other places like that' to take them away from the day to day, and to broaden their horizons, and to see what's out there.

AiGroup is also doing a lot of training work at the CEO and at one or two levels under it, around what the broader innovation agenda is, and what's required in terms of capacity and capability of a leader in the modern economy.

In a workplace relations context, there has been a move from a centralised system to an enterprise based system, which has put a lot more focus on managers having to deal with their employees on a day to day level, and to actually get out and lead, to inspire, and to drive. This takes time.

There is a view that Australia is getting a far better understanding of leadership and realisation that leadership is important. Glenn Keys from Aspen Medical thinks that leadership has always been there as a very understated model. He says that some businesses `develop leaders very, very well'. BHP is regarded as doing a terrific job nurturing people — particularly in diversity. They have a separate women's group, they deliberately target them, give them a career path, they let them know where they're going to go. Mirvac is also well regarded. These large firms will map out a career for 15 years in advance.

Keys also commented that 'the military is acknowledged to be very good at training some of the best leaders in the world'. They deliberately say 'you have two years in this job or three years in this job, now we need to put you in that job. Now you haven't done a personnel job yet, we need to get you into personnel'. The public service is very good at training, and many people leave the military and the public services and make good careers in business and business associations.

Apprenticeships

Innes Willox commented that apprenticeship and training is 'something we're still grappling with and have not got right, and we're not close to getting right. The mantra is to be industry led, which means to be responsive to industry, and not a supplicant of industry, but to be responsive to industry's needs'.

The view is not that the apprenticeship system is broken, but it's very close to it. Apprenticeship numbers are now down to the low 300,000—about 2.5 per cent of the national workforce. A decade ago it was close to four percent. Business isn't taking on apprentices in the numbers that they were. They have concerns about economic considerations and its not uncommon to hear a business say 'I haven't taken on an apprentice for three or four years, but I will when things turn around'.

Moreover, the four-year apprenticeship is not seen as fit for purpose for the modern economy. 'The focus has been 'on getting kids to finish school, which is fine, but now you're dealing with 18 year olds—there are not many 18 year olds who want to dig ditches or trenches for a year as a plumbing apprentices, or do the equivalent in every other trade'. In the ACT there is a big commitment to school based apprenticeships, but there is still pressure for students to obtain an ATAR so they can go to university.

In the UK and Europe, the concept of degree apprenticeships has emerged to partially address this problem. This is discussed further below.

[47] Author of a number of global best selling management books (Gary Hamel, 1994; Hamel, 2000, 2007)

New, emerging, and high growth businesses

An interviewee commented that there is an increasing awareness of entrepreneurship. Ten years ago, nobody was ever referred to as an entrepreneur because it was still vaguely a negative statement. Whereas now, people more readily identify as an entrepreneur because it's entered the language and you can get insights into what Mark Zuckerberg is doing, Larry and Sergey from Google, Elon Musk who are talked about.

In terms of how people can gain access to skills and capabilities for enterprise innovation there is now a huge amount of information that people have access to through blogs and resources on various websites. This material is critical but it didn't exist five years ago. Previously, for example, if an investor sent a term sheet to a start-up it had to be 'de-ciphered'. It was almost impossible because there weren't a lot of people to speak to. Now, there's any number of sources that will provide help and access to information.

What is limited now is the availability of people who can help give context to that information. There is a small number of 'highly engaged and very generous mentors out there in the ecosystem who will do anything for anybody with almost unlimited commitment'. But there is 'mentor overload', and that's becoming more and more prominent. There's also peer support, but there's a limitation in contextualising that information and that advice that everyone can get.

Part of the challenge, particularly from the start-up context, is a tension between somebody knowing that they have some skills gaps but then having the time required to enter a formal education and training structure. A specific complaint raised in interviews concerned the lack of after hours delivery options[48] There is also a strong preference among SMEs to learn from people who have actually been in business, rather than academics who have studied business and entrepreneurship and written up findings in academic publications. This came out strongly in interviews.

ATP Innovations, and other incubators, has been reluctant to become a training organisation, but increasingly it is finding that where there's a clear need, 'we can aggregate a bunch of our capability into a framework that's easy to deliver'. This is seen as 'useful in delivering value to the cohort, but also to generate a pipeline of companies for our incubator. It is providing that educational experience which generates deal flow, which is where we are more interested in playing'.

But it isn't necessary to become a training organisation. An incubator could be an intermediary between a start-up community and education partners. Hamish Hawthorn from ATP Innovations put the matter in the following terms[49]:

> So you don't actually deliver, but you negotiate with the business schools and with universities. The way that we're currently engaging with the business schools is certainly as a referral source. Also, if somebody comes to me and says 'I need some help with this particular technical skill or this management skill, who should I speak to inside the universities to see what's available?', we certainly do that referral.
>
> Where we've had more engagement between the companies and the business schools is where somebody from the business schools rings up one of my team and says 'the entrepreneurship course is running next semester, we'd love to have five companies who are willing to come and be the project specific activity for that course and so we connect people up that way, and that does work well'. In general, it's a win-win. So the companies here get some smart people to help them out, they also get a bit of an insight into what's going on with that cohort of MBA students and the students certainly get a lot out of it because they're getting a real business exposure.

Another interviewee commented that in Ultimo, Sydney, there are 670 small, IT based companies, and out of that probably nine out of ten will fail; but one will come up with a good idea, and one in a hundred will come up with a great idea. 'Well that's six or seven great ideas if you look at it that way. So it's about that culture of risk-taking'. These observations point to a tendency for the skills for innovation to be developed in the start-up community and in innovation ecosystems.

Business relationships with universities

The topic of university-business collaboration in skills development was raised extensively in interviews. Businesses generally find it easier to work with VET institutions rather than universities – possibly because VET is intended to be 'industry facing'.

[48] Interview with Neville Sawyer
[49] Interview with Hamish Hawthorn, ATP Innovations

Business is keen to work more effectively with universities. But it sometimes needs some 'mavericks' who 'aren't being driven by monthly reporting requirements' and who are allowed to go and invest in a relationship. Aspen Medical has invested in the University of Newcastle to establish a chair for the research into health and safety in the mining industry — it's the only chair like it in the world. The business committed $1m over four years.

Seventy-eight of the 80 companies consulted by the Advanced Manufacturing IGC said, 'We have given up on trying to work with universities and CSIRO, so we do our work in-house." There is a belief among companies that research and development is important, but to go the publicly-funded research institution route is seen to be not viable. Some companies identify PhD students or candidates, fund their PhDs, and hire them to do research in-house. The companies that do engage are largely foreign owned global corporations.

AIGroup relationship with universities is good, and it's getting better. The CEO sits on university advisory boards (Melbourne and RMIT). State AIGroup Directors are also positive. The CEO spoke at a Go8 function in February, and is working with the Business Deans, as part of a broader collaborative agenda. Universities are being seen to be doing a lot more to reach out to business. The drivers are much stronger because the workplace is changing, and the economy more broadly is changing, and it's becoming much more competitive to get a job. The universities have to be closer to business to 'give their students that competitive advantage'.

Companies with experience in working with universities tend to say that they don't want to dictate the path of education and research, but they want it to take account of the issues they face. In other words, they do not see universities as 'contractors' but as organisations interested in their business. Successful collaborations are not dictated by one side or the other, but are based on contact and discussion[50] (Ternouth & Garner, 2011; Wright, 2008).

In the past there was a tendency for a university to say 'well we've trained, here they are'. But that doesn't cut it anymore for business. Some universities are seen to be getting much smarter about specialisation to meet the needs of specific sectors (in mining and energy for example), and they're getting much more aware, and looking to develop curricula around student demand and what would be called soft skills. But the bottom line is that courses require enough students to be profitable.

There was a general view coming from the interviews that business does not have a problem about the *knowledge and technical skills* for innovation that come out of the tertiary education system. However, businesses place a priority on *workplace employability skills.* In a rapidly changing technology environment there is a view that technical skills can be acquired or updated on the job – particularly where technical activity is largely driven by software.

Businesses also acquire high level knowledge and technical skills externally from consulting firms, contractors and, potentially, universities and research organisations. But universities are much harder to deal with.

Some businesses have very specific technical needs that are not quite being met, so they are having to do a lot of training. Universities are seen to be trying to adapt to that, but businesses want a basic skill of aptitude and desire to learn, and an understanding of how a workplace operates.

Some of the universities have a significant business in the area of business training. But it is often only in a 'one-off' training context. There is a category of people who are going through the system now, in their 20s to early 30s, who may need training over a career, or for 'all-of-life'. Interviewees pointed to a gap in post-business school training, a continuous journey of career training activity that is fostered by the employers and employees who feel as though that is necessary.

Industry training is not seen as a stand alone role of universities but they are key providers and thought leaders. Business and government has to be supportive of this role, but 'there's this little issue' about how that fits in with whole of government education and training policy. One interviewee commented 'logically, if you're taking an innovation perspective to the tertiary education sector, skills would be something to have fairly prominent in the profile of things you'd be looking for, and not just STEM skills'.

[50] LinkedIn post from Philip Ternouth, Owner at Innovation Policy Research and Associate at The Work Foundation, http://www.linkedin.com/pulse/truth-far-messier-philip-ternouth?trk=hb_ntf_MEGAPHONE_ARTICLE_POST

Another interviewee commented that 'we're getting better at STEM skills and there is a serious profile there. But the social scientists and arts people would say, 'hang on, but we've got a contribution to make as well. We've got a chief scientist role, which arguably doesn't extend that far'. There is an interest in whether this issue gets picked up in the context of the newly formed Innovation and Science Australia (ISA), and the chair of the board of the ISA. But, as the comment continues, unless it gets picked up and run with by people who want to actually push the agenda *inside* the system, it won't happen.

International practice

The issue of developing closer relationships between business and tertiary education institutions is global in its orientation. Fortunately, there has been a move in the discussion of relationships from a transactional focus on licensing intellectual property as a way of generating income for a university, to a more sophisticated analysis of the complex texture of university-business interactions and models and methods for building mutually beneficial collaborations. Nonetheless, most publicly available reports suggest that more can be done to improve the effectiveness of university-business relationships (Davey, Baaken, Muros, & Meerman, 2011; Ranga & Etzkowitz, 2013; Ranga, Hoareau, Durazzi, & Etzkowitz, 2013; Ternouth & Garner, 2011).

Internationally businesses and governments are supporting a range of initiatives to develop knowledge, technical and workplace skills, including:

- Subsidies for employee training, including tax incentives.
- Subsidies to develop vocational training programmes at the firm or sector level.
- Recruitment of researchers, technicians, PhDs and Post Docs in firms.
- Schemes to allow personnel to gain higher degrees whilst working in firms
- Schemes to support innovation management in businesses.
- Degree apprenticeships as a way of developing knowledge, technical and workplace skills.

Many of these incentives are available in Australia, but there are gaps that could be addressed.

The tertiary education sector

The Tertiary Education Sector covers higher education (universities), vocational education and training (technical and further education institutes), and private registered training organisations (RTOs).

There is a growing acknowledgement within the higher education sector about preparing people for work. Some universities consider that achievements in graduate placement in industry and work integrated learning are a source of competitive advantage.

Universities Australia (UA) noted that a number of universities are changing their perspective from a more traditional technology transfer view of the world to 'how can we actually help our young students who look like they might be wanting to establish start-ups and develop their entrepreneurial skills'.

The higher education and VET segments

In 2008 the Bradley review observed that businesses want employees with technical skills, sometimes in addition to, or as well as academic skills (Bradley, Noonan, Nugent, & Scales, 2008). An interviewee said that universities are recognising this and are now trying to develop relationships with business, including putting students into businesses contexts for a short term to develop vocational skills. Some universities work with public and private VET institutions to strengthen these connections.

There was a major concern coming through the interviews about the imbalance in policy focus between the higher education and vocational training segments, and resourcing between them. Higher education has gone through a phase, and evolution, from the Whitlam Government policy 'anyone can go to university', and the Gillard Government demand driven system, combined with inducements to lift access by students with low socio-economic status (SES). The effect has been that

university enrolments have boomed and the demand for vocationally oriented education (particularly trades) has dropped off.

Interviewees expressed a concern that the tertiary education system was inappropriately encouraging young people to enter university, and that a bachelor's degree was the only path to material success. Students and parents often prefer the prestige of universities – which is in contrast to the German tertiary education system where higher education and VET have similar status.

The demand driven system, and the university business model, has been encouraging universities to maximise their enrolment intakes, with a result that graduates are finding it difficult to get jobs in the professions that they had set their sights on. The funding model has poured a lot of money into higher education, but it has not seriously looked at the implications, particularly in terms of the direction of demand. Under the demand driven model there are no quotas for 'discipline clusters' and students can do whatever they want if a university is willing to take them. There is a view that this abdicates completely from the idea of developing skills for the individual and the nation[51].

An interviewee commented

> . . . there has been a lot of focus on access to higher education, but when you see that we are producing many more teachers than we currently need, or way more lawyers of course, or journalism students, that's telling us that we're misaligning want and need, and we've got to find ways to recalibrate that[52].

The VET sector continues to play a key role in training people in a range of technical professions and occupations. The Australian VET system is just one of a few in the world where a trainee is assessed by his or her acquisition of *competencies* relevant to a field of skilled specialisation. Australian TAFEs tend to have very strong industry interfaces, and in addition to delivering national industry training packages, they offer a range of 'be-spoke' training courses and advice in specific areas of technology.

Interviewees gave little support for the idea of amalgamating universities and VET institutions as a way of addressing skills issues. Victoria already has five 'dual sector' institutions. But even within integrated institutions, HE and VET need to be run separately[53].

Universities Australia (UA), in its policy statement *Keep It Clever*, pointed to the need for a much more streamlined but borderless approach to tertiary education, recognising the need for diversity in institutions to meet the needs of a rapidly changing modern labour market. UA argues that 'we need a system where there can be greater hybridisation in the delivery of the different types of skills that the traditional sectors offer'. This would entail a more integrated system, with a variety of learning options, and skills delivered in a cohesive, systematic way, with easier movement between segments.

In interview, ACCI observed that the tertiary education system is not meeting the needs of business and is no longer 'fit for purpose'[54]. ACCI suggested a need for a 'fundamental rethink'. There was also a view that more funding is not required, but it should be allocated more effectively and efficiently. The BCA indicated that policy for improvement should address tertiary education, rather than university versus VET.

BCA is concerned with the perception that higher education is a superior education product to VET, 'which is not something that BCA would agree with'. BCA acknowledges that the two sectors have different purposes, particularly higher education with its research focus, and the need to be an environment that can create research and that can contribute to researchers. This does not mean that the higher education sector should be purely academic. BCA added:

> We think that higher education needs to have a much stronger vocational focus, and a much stronger focus on industry. VET has that much stronger focus on industry than higher education, but what it's lacking, as a sector, is a broader concept of what a learner should be, and that it doesn't matter whether a student is going into trade, or into a mid-level occupation in finance. It should have a broader focus than technical skills.

BCA sees VET as 'pretty much the most important platform for the future of skilling Australia's workforce, effectively, far more than higher education at the moment'. But BCA considers that the VET sector 'has been underdone in funding, and underdone in focus'. There is a view among interviewees that Governments, particularly State Governments, undervalue VET, although VET tends to have strong industry partnerships.

[51] Interview with Stephan Parker, University of Canberra
[52] Interview with Neville Sawyer, former Chair, Ampcontrol
[53] Interview with Peter Noonan
[54] Interview with Kate Carnell, ACCI

BCA does not advocate a see a shift in training responsibilities from VET to higher education. Higher education is seen as a 'much higher cost delivery mechanism, 'and for no good reason'. In terms of technical skills, there's no reason for someone to go to university to get technical skills. And it is a waste of both Government, business and individual contribution if that were to occur.

In regional areas, and notably Newcastle and Wollongong, business people expect both TAFEs and universities to be close to their communities. TAFEs are seen to be more adaptive to community needs and probably much more responsive. They also expect them to collaborate.

> The University of Newcastle has what they call Open University that's been run for 25 years. People who have no qualifications can go and do a one-year course, and be guaranteed a starting place in the University the following year. But if students have come through TAFE and started out with a trade and then done a certificate and then done a diploma, students must start from square one at the University.

In 2014, Hunter TAFE was able to get the University of Newcastle to accept four courses run concurrently. Students do 'so many years of TAFE and then they do two years at university. They come out with a graduate degree; one is in industrial design, one is in environmental engineering, the other two are in nursing and social sciences'[55].

Nationally, universities and TAFE institutes are developing Integrated HE-VET programmes, but pathways can be complex, particularly in linking the knowledge focus of university subjects with the competency focus of VET training packages. It is understood that training packages are beginning to re-introduce knowledge components. As noted in the pervious section, there have been successful pilots, including at the University of Newcastle.

The Australian Government is introducing a new model for engaging Australian industry in the development of training products that guide the delivery of vocational education and training.

What does the new VET model look like?

The new approach will place industry engagement at the centre of training product development and will cement industry's role in overseeing training product content. The new model will also:

- Engage more employer feedback in training product development
- Embed the national character of qualifications, not only for the benefit of seamless operations across borders, but also enhanced career opportunities for graduates of VET
- Ensure the quality of VET qualifications is retained

Specifically, the new model will support Industry Reference Committees (IRCs) as the conduit for industry intelligence into training policy and practice and to guide the development of industry-based training products (including training packages and support materials).

These IRCs will be convened as required in response to industry identified needs and government priority. The IRCs will be supported by Skills Service Organisations (SSOs) which will be funded by the Australian Government to provide administrative, technical and operational support to assist IRCs in their engagement with industries.

SSOs will be governed by professional boards with demonstrated independence and strategic and professional skills.

https://docs.education.gov.au/system/files/doc/other/ed15-0079_contestable_model_quality_and_regulation_comms_pack_factsheet_acc.pdf

The new model could, potentially, stimulate stronger relationships between the higher education system and the VET system. With continued State de-funding of the public VET system, universities could seek greater integration between academic and occupational learning in the new VET model. University graduates would come to VET to learn the technical side of their profession and develop closer relationships with industry, particularly in addressing work integrated learning matters.

A significant amount of VET training is already offered in the business area, which complements other vocational education and training areas. This training could be more readily available to university educated students outside the business schools as a way of building their business skills.

Management and business education

Interviewees reflected a view that Businesses Schools are failing in their task. This was addressed in the Australian Business Deans Council report funded by the Department of Industry and B-HERT (Australian Business Deans Council, 2014; Hall, Agarwal, & Green, 2012). The report highlighted the role of innovative leadership and management in Australia's future economic prosperity, environmental sustainability and social progress. The report identified challenges for business schools in both shaping and adapting to a more complex, globalised environment with new interdisciplinary and inter-professional educational models.

[55] Observation in interview by Neville Sawyer, former CEO, Ampcontrol.

Interviewees indicated that Australian universities haven't been particularly strong in the area of business education and teaching innovation and entrepreneurship. The implication is that people with MBAs can go out into the business world without understanding what innovation is. 'They'll be trained in financial accounting, managerial accounting, marketing plans, HR strategies and so forth, but may have little idea how value is created through innovation'.

The problem can be addressed by designing MBA programmes around innovation and entrepreneurship (as has occurred at UTS) and recruiting faculty staff with industry experience. There was a strong preference expressed in interviews for business courses to be taught by people with this experience. But universities now will simply not recruit anybody to lecturer or senior lecturer level without a PhD. And while there are some outstanding industry leaders and industry practitioners who've got PhDs, most don't[56].

Business interviewees saw the role of Business Schools as being really critical. There was a view that Schools should be going out to business and offering a training position to up and coming managers as a *quid pro quo* for senior executives committing to doing a series of lectures over the course of a year. This can also apply to the writing of case studies and subsequent business involvement in learning from them. This arrangement is applied in the Australian Defence College which offers military and professional education for talented defence staff.

In addition to the defence industry, other industries have developed management education and development programmes. The Australian Minerals Tertiary Education Council (MTEC) was citied as an example of an industry led initiative.

The Australian Minerals Tertiary Education Council (MTEC)

MTEC was established as a division of the Minerals Council of Australia (MCA) to pursue the development of world-class education for a world-class minerals Industry. The minerals industry had recognised that the delivery of education in Australia's universities had to change if the industry was to maintain and grow its international competitiveness.

In October 1999, the industry developed a course of action to ensure the supply and quality of technical professionals. Since this time MTEC has been a major driver in establishing three national higher education programmes in Mining Engineering, Minerals Geoscience and Metallurgy across 15 Australian universities, which now produce the bulk of new, highly skilled technical professionals from those disciplines

Since 1999, over $30 million of industry funds have been allocated to assist MTEC in the development of industry-focused courses and in the employment of academic staff and educational specialists.

MTEC also runs support programmes and projects to assist with attraction, retention and up-skilling of professionals for the Australian minerals industry and is the policy/research division of the MCA dedicated to the tertiary education sector.

MTEC is developing and implementing national strategies to ensure the adequate supply of skills to the industry to increase minerals industry labour productivity by: Advocating public policy and institutional capacity building for improved delivery in the tertiary education sector – both the university sector and vocational education and training sector (VET) – in minerals industry related areas.

MTEC has re-connected industry with education, so that the three programmes have been designed in collaboration with industry to ensure graduates are industry-ready with the right balance of theoretical, technical and soft skills. Through MTEC, industry has demonstrated a long-term skills development strategy beyond the cyclical imperatives of the present.

MTEC continues to devise strategies to ensure there is a consistent and long-term supply of appropriately skilled professionals entering Australia's largest export industry. The Minerals Industry National Associate Degree (MINAD) programme is one such initiative that seeks out "true partnership between industry, government and academia to reshape minerals education in Australia," and will provide the minerals industry with efficient, appropriately skilled paraprofessional workers as part of their workforce profile.

By moving beyond reactionary initiatives to counter cyclical industry requirements, the MINAD project is a natural extension to the MCA's vision of an uninterrupted sustainable education and training pathway for workforce participation, diversity and skills.

Source: http://www.mtec.org.au/who-is-mtec

It is open for other industries to develop similar initiatives. The Commonwealth Industry Growth Centres may be able to lead initiatives in their respective sectors.

Singapore has established the Singapore Management University in the middle of the City. They recognise that management is crucial to innovation and building their economy, and that excellent management schools are where leadership capabilities are developed. Interviewees thought that Australian and State/Territory Governments could instil a culture of excellence in management as a foundation innovation capability.

[56] There are suggestions earlier in the report about industry recruiting more PhDs (see page 9) which would enhance the potential for interchange.

Interviewees saw that the role for government is not so much in funding or setting up management schools but it's about changing the conversation about the importance of management capability. Interviewees suggested that universities will do that because they recognise the need to – and will be motivated by co-funding from industry.

Universities have historically been competing on a broad canvas without any great specialisation. Competition may well force a university to go down that path of specialisation and collaboration - to make its name and reputation. Most universities run a MBA course – but they are of uneven quality. Australia does not have that history of an institution making a stand on business, or an industry sector, and all that involves, from teaching through to research and thought leadership. A few have instituted some initiatives, particularly the Australia Technology Network (ATN) Universities and Swinburne University, but it remains a challenge.

University role in enhancing employability skills

The overwhelming message from employer organisations in the interviews is that they are seeking *workplace employability skills.* There is a view that technical skills can be acquired or updated on the job – particularly where technical activity is largely driven by software. Businesses also acquire high level technical skills from consulting firms and contractors[57].

BCA mentioned in interview that they have complained a lot about work readiness, but while they have talked about it, they have not really articulated where the gaps are, or said 'this is what we're looking for.' From BCA's perspective 'that's something that we, as an industry association, can do. We can get that done for our members and publish it. Which we are doing this year'.

The interviews indicated that businesses think that universities and VET institutions have a role to develop workplace skills as part of their curricula. While workplace skills form a part of many training packages, there is mounting pressure from business for workplace, entrepreneurial, and business skills to be included in university undergraduate courses. Some universities are heading in this direction, whilst others are not convinced that students will demand it.

There has been a history of Australian companies and public sector agencies offering cadetships and traineeships for school leavers and students part way through their degree programmes[58]. Many companies, now offer internships and work experience, and some of these are supported by government.[59] In ICT most students in 'demand' areas like computer science, software engineering and project management have fulltime work by the time they graduate.

In some professions, such as accounting, finance and the law, demand for internships by students is now so high that they will work for free in order to build 'employability' experience. It is not clear whether these placements are delivering employability skills as distinct from low level technical skills. However, it is a reflection of young people taking greater responsibility for their own 'employability' profile – and forms an important part of contemporary résumés.

University teaching and learning programmes in entrepreneurship

Professor Parker, of the University of Canberra, indicated that universities have a central responsibility that relates to what education actually is: the origin of the word comes out of self-leadership. In the modern world 'self-leadership requires a range of skills and not just knowledge learned from a textbook or in a lecture theatre. On this definition teaching people how to work in teams, how to be creative or to harness their creativity is very much part of education. That's an essential responsibility. Whether we discharge it very well is a different question'.

Parker sees that as universities focus more on research, rankings, and status symbols, that are essential to their survival, they have tended to 'withdraw from the students'. And students are withdrawing from the university for their own reasons, including commitments to the maximum work time allowed under FEE-HELP in order to pay for their education. Parker does not see this to be a healthy development.

[57] The Australian Government no longer employs engineers. Engineers are predominantly employed in global, national or local consulting firms. Simular trends have occurred in other occupational categories.
[58] Reflects interview discussion with Peter Noonan
[59] Discussion with AIIA

There is a view that universities need a lot more contact with students, virtual or in person, in order to do the kinds of things that develop workplace and employability skills. Universities need a higher level of knowledge of students, case management, personal tutors, and so on. 'They are not just going to pick this up by staring at a screen'.

> A partial answer is integrated learning. That is our antidote to the disengagement pressures. But as a sector I think it's a real problem. And if you then say, look, Australia's got a small population, it's got an economy that isn't sufficiently complex, it's got universities where students are disengaging and they've become kind of factories for international students as well.
> I do wonder whether the more innovative graduates are innovative despite the university rather than because of it. So as I approach the end of my time in universities, I am sceptical actually about what we do.

Andrew Norton from the Grattan Institute has produced an analysis of the extent of cross-subsidisation of research by teaching funds. A question arises about what would actually happen if universities were required to spend all of the money that comes in for teaching purposes on students in some way. Professor Parker argues that it would be likely to result in real change – taking students seriously and personally. Each individual student would be a personal charge.

Interviewees were asked about whether the responsibility for picking up 'softer' skills lies in the education sector or is it in the broader community, or whether it is a combination of both. Feedback was that universities are giving attention to the the wider 'student experience' and introducing them to extended life experiences.

Nonetheless, Australian universities are investing in a range of initiatives that support *student and staff entrepreneurship* including:

- Undergraduate and post graduate courses and programmes in entrepreneurship.
- Availability of entrepreneurial units in other degree programmes.
- Work Integrated Learning programmes.
- Industry placements.

Individual universities are approaching the issues differently, sometimes centralised and sometimes distributed across faculties and centres, with a follow on issue concerning coordination across academic 'silos'. Collaboration is facilitated with strong executive and academic leadership and a commitment to address student demand and subsequent workplace opportunities. Graduate employment outcomes has become a significant indicator in the demand driven system.

Most universities have made commitments to *campus master plans* to guide investment in teaching and research facilities over the medium to longer term. Many of these plans provide for *collaborative 'learning spaces' and 'hubs'*, with several in 'down-town' or CBD locations. Learning spaces are associated with subject and course design around collaborative learning in groups and teams, and provision for group assessments. Interviewees suggested that this meets with some resistance from students over 'free-riders'[60]. But an important aspect of developing leadership and teamwork is ensuring that all participants pull their weight: it can amount to an introduction to life and the reality of the workplace.

Australian universities are also investing in a range of initiatives that support *student and staff involvement in entrepreneurship, innovation and creativity.* Several universities, including, UTS, Swinburne, and Canberra, have been offering courses and programmes in entrepreneurship for many years. However, post graduate programmes have not been well regarded, due to their emphasis on research and publication rather than experiential learning.

The recently launched UTS Business School *Master of Business Administration in Entrepreneurship* is a unique one year intensive MBA designed for entrepreneurs and innovators that focuses almost entirely on practice based learning.

[60] Interview with Professor Stephen Parker

UTS MBAe Programme

The programme is designed to enable participants to:

- Take business ideas up to venture capital grade.
- Understand what makes entrepreneurs successful.
- Become immersed in an entrepreneurial environment working on live projects.
- Develop, test and launch ideas, in collaboration with aspiring entrepreneurs and innovators.

The Programme is directed towards the following outcomes:

- Knowledge with impact: Research is developed with industry for industry.
- Learn from the experts: Teaching by leading academics and practitioners who cut their teeth in industry, and who bring in a global network to our doorstep.
- Reality-based rigour: Live case studies, with real clients, provide the ultimate opportunity to apply learning while being mentored by a who's who of corporate leaders.

The Programme is uniquely constructed as three short courses to enable choice between how, when and what to focus on whilst developing, with increasing confidence, your own enterprise ideas. The elements are:

- Graduate certificate in commercialisation.
- Graduate certificate in entrepreneurship.
- Graduate certificate in new venture funding.

http://www.uts.edu.au/future-students/business/business-study-areas/mba-and-executive-mba-programs/mba-entrepreneurship

Most Australian universities have strategies for formalised *Work Integrated Learning (WIL).* There is, of course, a number of disciplines where WIL has been core business for many years. There is a history of clinical, teacher, and engineering student placements. In many courses universities have to make a payment to secure student placements.

Universities Australia and peak industry organisations have developed a *National Strategy on Work Integrated Leaning in University Education* (Universities Australia, ACCI, AiGroup, Business Council of Australia, & Australian Collaborative Edication Network, 2014) . There is a strong view that WIL should address the development of *both* technical and professional skills *and* workplace/employability skills. In many universities academic policy is that all students should have an opportunity for an internship, or 'internship like' experience, which can include working in a new business incubator or student consulting project.

Universities advise that, with the growth in student numbers, placements are becoming difficult to find, and are becoming more expensive. There are still issues to resolve around whether work can be paid or unpaid, how much should be part of a student's assessment, and whether businesses should be part of the assessment process. There may be academic board procedures around assessment of paid work. If students are not paid, industrial relations issues may arise.

As part of the new Colombo Plan Australia is encouraging the countries receiving students to give them an opportunity for a work integrated learning placement to develop their cultural understanding. Australian international students from those countries will also have an expectation that they will have a work-integrated learning experience in Australia to develop their cultural competencies.

WIL is an important aspect of gaining an understanding of the work place and what business is. It's not necessarily about innovation or entrepreneurial skills but more about getting students into an environment when they haven't been in very vast numbers in the past. People who manage placements advise that sometimes students change their career choice after a WIL placement. They decide that actually they're going to do a different thing once they get out there and have a look. So they reconsider - will they become a career researcher, or will they go out and work in business or as a researcher?

Universities Australia sees, from a whole of sector perspective, a need to work with business peak bodies to try and scale up work-integrated learning significantly.

In the demand driven system, and with university income tied to student enrolments, universities have every incentive to develop *be-spoke certificates, diplomas and degree courses and programmes* that deliver benefits to employers and employees in industry where it makes commercial sense to do so. Business and industry can advise students of future employment opportunities, which will encourage students to enrol and make courses and programmes viable

Be-spoke courses are expensive to set up, and industry contributions might be sought. This may be preferable to universities providing courses on a supply oriented basis, although universities do assess demand through their own market research. Industry involvement is sought through industry oriented course advisory committees. In most professional courses, peak professional bodies

accredit courses. The VET system training packages can be tailored to specific workplace needs. However, audit processes can limit opportunities to include innovation in delivery[61].

Universities have for many years sought to *engage people with business experience in teaching* through casual and honorary appointments and alumni networks. Part time tutors are extensively recruited from business and professional organisations. Many interviewees suggested that people with business experience be more fully engaged in teaching roles. Universities are introducing new academic designations to reflect industry rather than academic merit – such as Professorial Fellow.

Alumni can be incentivised to 'give back' through participation in teaching and learning. Australian universities tend to be quite unsophisticated in engaging with alumni compared to North American, UK and European counterparts.

Many interviewees suggested that *academic workloads and performance agreements* should recognise, and incentivise academic staff to engage more with industry. This means that academic promotion criteria should also give more weight to industry engagement, particularly where the work involves consultancy and expert advice rather than commissioned research (which is captured and recognised as Category 3 research funding). Business can assist in developing these relationships by ensuring that potential research projects are framed as collaborations and set out in research terminology.

There have been wide-ranging suggestions to *increase the exposure of post graduate students to business operations*. The former Commercialisation Training Programme, was highly regarded by students, although science and technology academics raised concerns about 'time being spent away from the lab'[62]. Interviewees commented that it should be easier for PhD students to take time out from their APA and other scholarships to undertake work for industry.

Enterprise development initiatives

Universities are being encouraged to increase their commitment to teaching in entrepreneurship. A recent report for the Office of Chief Scientist set out a way in which universities could teach entrepreneurial skills and provide an environment that encourages students to explore high-impact entrepreneurship as an alternative to traditional career paths (Kinner, 2015) . The report finds the following desirable attributes for developing entrepreneurial skills:

- Strong engagement between the university and the local start-up ecosystem.
- Courses delivered by experienced entrepreneurs.
- Students given multiple opportunities for engagement—ranging from short courses to immersive programmes such as internships and overseas placements.
- Programmes support multi-disciplinary collaboration that includes STEM.

An interviewee commented that five or ten years ago universities were not really concerned about entrepreneurship 'because they wanted bums on seats and student numbers to go up [student intake] and they wanted good ATAR scores'. What's changed in the last five years and increasingly in the last couple of years is that students are looking around and, whatever degree they're doing, they're saying "where's my entrepreneurial exposure, where's the course here that will teach me to be an entrepreneur?"'[63].

The view emerging from interviews is that the change is 'bottom up and it is demand led, not top down and supply pushed from higher up in the universities'. Universities are seen to be saying 'well if we don't provide this, our students are not going to be happy, which means they're not going to come back next year'. This is an important consideration in the competitive demand driven system that is emerging.

The initiatives started in the engineering schools and the business schools, but it is now seen as almost ubiquitous. There are always small groups throughout a university who are self-selecting as more entrepreneurial and often more strongly engaged. Students are interested to learn about entrepreneurship and the commercialisation process. Many universities have started to embrace this idea within the university culture and seeing it as something that's adding to the student experience.

[61] Interview with Patricia Neden
[62] Interview with Mark Dodgson
[63] Interview with Hamish Hawthorn

Universities support *innovation contests and tournaments*, including InnovationACT, the UTS 3P Business Plan Competition, and the RMIT Business Plan Competition. An inventory of programmes is provided in the report for ACOLA SAF 09, *Translation of Research for Economic and Social Benefit: Measures that facilitate transfer of knowledge from publicly funded research organisations to industry* (Howard, 2015). These programmes potentially develop business skills, including business planning, teamwork, and collaboration.

There are at least 14 *university sponsored incubators and accelerators* distributed across the higher education sector. These are also listed in the report for SAF 09 referred to above. These initiatives are directed towards producing technically capable and entrepreneurially enthusiastic young people with a desire to start a business and make a serious commitment. Competitive pressures between universities in attracting talented students wanting a broader learning experience will, desirably, push this along. However, available funding is tight and often squeezed from faculty budgets.

There are also Student enterprise initiatives, such as the Monash Entrepreneurs club[64].

A number of universities have made major commitments to the development of *science and technology hubs and precincts* to build linkages between research, innovation, and industry adoption and application. Many provide opportunities for internships and other forms of work integrated learning[65]. University campus development plans are increasingly being developed around the development of communities and 'suburbs'. The University of Canberra is doing this with an integrated vision, which is not always the case across the higher education sector where initiatives have much more focus on property development considerations.

Business and community engagement

Many universities have introduced *capstone* projects or courses, which have the purpose of helping students synthesise their learning, demonstrate holistically their development of graduate capabilities, successfully negotiate the transition to their next career stage, and enabling the institution to assess final graduate capabilities.

A Guide prepared for The University of Melbourne notes that Capstone experiences are varied. They may consist of experiences that illustrate a student's skill, development and/or experiences that broaden a student's understanding of the work environment and the communities with which they will engage and contribute to.

Discussion of capstone projects did not come up in interviews for the project. However, capstones offer an opportunity for integrative learning and student collaboration across faculties.

Service learning is a teaching and learning strategy that integrates community service with instruction and reflection to enrich the learning experience, teach civic responsibility, and strengthen communities. It must be grounded in a wide range of solid, reciprocal, partnerships (Jacoby & Associates, 2003)

Service learning has the potential to build the social skills associated with workplace skills that employers seek. *Service learning was not mentioned in interviews – although it is known that employers look for evidence of community service*.

The workplace relations environment

Interviewees pointed to the constraints that the existing workplace agreements and the workplace practices that we have in universities, have on being able to do some of these new and innovative things around innovation skills training. There is concern that universities are moving towards greater rates of casualisation and in many cases that is probably a very bad thing because there are people who 'don't want to be casualised'.

[64] See http://monashentrepreneursclub.com/
[65] More detailed description of these initiatives is provided in Howard, J. H. (2015). Translation of Research for Economic and Social Benefit: Measures that facilitate transfer of knowledge from publicly funded research organisations to industry Retrieved from http://www.acola.org.au/PDF/SAF09/1%20Australia.pdf

But on the other hand, it could be that, to some extent a reflection of the fact that we are getting some cross-fertilisation between universities and industry through people wanting to be working in their own businesses or working in industry somewhere, and being able to bring those skills into the teaching arena. There are several issues that need to be addressed relating to contract formation and execution.

UA has been talking to the universities about whether they might consider including engagement with industry as part of their performance agreements. It may not be appropriate for much of university activity but if it is done in a performance agreement context it can be rewarded. Maybe it's not recognised for career advancement but it can be recognised as a legitimate part of their employment

The ARC is looking at that as well, in terms of including spells that researchers have spent in industry not being considered as a break in their performance but rather something which is considered positively in their grant applications.

The schools and community sector

It is estimated that 65 per cent of children entering primary schools today will ultimately work in new job types and functions that currently don't yet exist. Technological, demographic, socio-economic trends will create many new cross-functional roles that will need combinations of technical, social and analytical skills.

Interviewees suggested that skills such as communication, teamwork, confidence and resilience or character cannot be taught in academic lessons, but, if developed from a young age, will complement academic learning throughout education.

Reform in schooling and modifying career expectations

One interviewee commented that 'we think you get your biggest bang for your buck if you focus on your younger, primary school aged students—because that provides the foundation and you start to get interests developed at that stage. What do the Jesuits say? "Give me the child to the age of seven and I'll give you the man". There's a lot of truth in that'[66].

In interview, BCA indicated that there is a need for some reform in schooling, part of which is to recognise that academic learning is not the only requirement out of schooling. BCA notes that there are a lot of disengaged young people, who become disengaged because they're in a schooling system that doesn't support their style of learning. BCA identifies a fundamental challenge for the schooling system, and in terms of their foundational knowledge covering literacy, numeracy, and digital knowledge. BCA would like to see that built in from the very beginning of schooling.

These sentiments were echoed by ACCI.

Our culture is built on an expectation that people leaving school or graduating from universities will work in a large business, which will provide long term income security. The reality is that half of our university graduates end up in a small business with very little employment security. Many of those businesses are new businesses created by students prior to graduation. Accordingly, students should be aware of what it takes to set up and operate a business – and the opportunities to do so.

An interviewee pointed out that this was starting to get a little traction with the popularisation of the successes of technology companies and social networking businesses. Students need to know that they have societal 'permission' to be entrepreneurial, but also be aware of the amount of teamwork, collaboration, and behind the scenes commitment, that underpins these successes.

This comes back to the messages in the *National Innovation and Science Agenda* about entrepreneurship, willingness to take risks, and learning from failure.

Interviewees pointed out that students should be aware that large businesses no longer offer the security of long term 'permanent' employment or careers. Students should also be made aware at an early age that they will probably need to take greater responsibility for their own career options.

[66] Interview with Innes Willox

Increasingly, people will need to address the demand side of their skills and capability portfolios, which may mean investments on non-technical aspects of learning. Most significantly, they will need to learn to manage themselves.

Delivering a broader curriculum and community engagement

Changes are being made to school curriculum to include STEM and analytical skills and encourage teachers to deliver workplace capability skills. Progress will depend on the commitment of teachers, parents and School Boards.

Interviewees were highly critical of school curricula that focussed on rote learning and performance in NAPLAN, which was seen to drive out the cognitive and social skills required in a post school working environment.

Entrepreneurship: delivering the soft skills that drive hard productivity gains
Michael Mercieca, CEO Young Enterprise UK

It has been known for a while now that employers in the UK struggle to find young recruits with the right 'soft' employment skills to start in the world of work. Our research in 2013 found that 70% of UK employers find it difficult to hire good quality applicants for entry level jobs. This trend is echoed across Europe, with 75% of German and 56% of Spanish employers reporting the same issues.

A highly-skilled workforce is a productive workforce, and to produce this, we need to start in education. Enterprise (and financial) education unlocks the potential of students by improving their creativity, productivity and business acumen. It teaches them how to be entrepreneurial and productive employees or indeed entrepreneurs themselves.

Unlocking this untapped potential in our young people will help to ensure our countries have a sustainable annual output of better skilled, ambitious, motivated workers coming out of schools, colleges and universities.

http://www.ee-hub.eu/blog/352-national-policy-framework/32-entrepreneurship-the-soft-skill-that-drives-hard-productivity-gains.html

Clubs, societies and service organisations have a role in building leadership, collaboration and other soft skills. Organisations like Duke of Edinburgh Awards, Outward Bound, and Rotary exchange arrangements all have an important place. Employers and customers look for participation in community activity and service to identify skills such as commitment, team approaches and leadership.

State Education Departments and Schools be encouraged to play down the significance of NAPLAN testing and focus on the development of the cognitive and social skills necessary for effective participation in a workplace environment.

Information and advice for parents and students

It was suggested in interview that parents and students tend to know what an engineer or a lawyer does, and can relate to it. But these are areas where students are going to find it hard to get jobs. But there may be opportunities, for example, in new and emerging work areas which need to be explained. There was a strong message in the interviews that parents and students needed better information about future work opportunities. These messages should include information about non-technical aspects of skill needs.

Sharon Winacour from B-HERT considered there was a role for business to engage more with schools in creating awareness of career options and what employers are looking for in employability skills. Academics tend to have less credibility in communicating with students, but business should be working with university faculty deans to address workplace opportunities for school students and students entering the university system. Parents tend to listen more to people seen to have a practical orientation.

Currently, responsibilities for providing career advice and counselling is widely distributed between Commonwealth and State Governments, School Counsellors, and tertiary education careers advisers. Interviewees pointed to the lack of easily accessible information for parents and students about careers options and choices[67].

The Commonwealth Department of Education provides careers information on its website https://www.education.gov.au/career-development. State Governments also provide careers information. These sites are difficult to navigate - possibly written from the perspective of the

[67] For example, interview with Kate Carnell, CEO, ACCI

information provider, rather than the potential user. They point to the absence of a key workplace skill – communication.

Government

Government is an important enabler in the innovation system. It cannot drive innovation, but can assist in ensuring that framework conditions (education and training, infrastructure, trade and market access, business regulation and taxation, enforcement of the law of contract, assurance of property rights and obligations, and the management of public expenditure) are in place and working effectively.

Education and innovation policy

State and Territory Governments have a long standing commitment to developing and funding workplace skills and competencies through their education and training systems and support for technical colleges, which have evolved into colleges of Technical and Further Education (TAFE) and Institutes of Technology. Since 1972, the Commonwealth Government has assumed responsibility for funding higher education (universities). Several State based school systems offer vocational education and training qualifications in high schools.

As mentioned earlier in the report, State Governments have been 'defunding' their VET systems but universities have been able to grow through a demand driven system with students paying a high proportion of the cost of their education through fees, underwritten by income contingent loans. The availability of these loans to students in the VET sector has seen an expansion in the private VET segment. There has been some failure of regulation with several private colleges offering places to students with very little hope of ever receiving a qualification.

Analysis undertaken by the Mitchell Institute indicates that over the period 2003-04 to 2013-14 there has been a much lower rate of growth in VET spending as the other education sectors have grown substantially. Expenditure on VET in 2013-14 was $6.3 billion ($6.0 billion in 2003-04), compared with $23.5 billion for higher education in 2013-14 ($16.5 billion in 2003-04) (Noonan, Burke, Wade, & Pilcher, 2015). The Mitchell Institute report concludes with the observation:

> There are currently major debates about funding in each of the sectors of Australian education and training, but there is little consideration of the pattern of expenditure between the sectors and how collectively they can best meet our future population requirements and workforce needs. Education funding in Australia needs to be coherent and integrated, rather than the current ad hoc and piecemeal approach.

With the relative defunding of the public VET system, pressure is being placed on the higher education system to provide the workplace employability skills that businesses are seeking. Many universities have established their own registered training organisations in order to deliver VET training packages or have entered into joint ventures with VET providers. In Victoria there is close collaboration between higher education and vocational education and training in the five dual sector universities.

An increasing vocational orientation of degree courses offered in universities, and the reduction in State vocational education and training funding is likely to see changes in the orientation of many Australian universities, and potentially a higher level of diversification as universities address market signals and play to their capabilities and competitive advantage. Further deregulation of university fees is likely to see further differentiation in the system, and institutional realignment between the 39 public universities and 55 Government TAFE institutes.

Institutional change and restructure has the potential to provide a more efficient and effective way of addressing and delivering the skills for enterprise innovation in all of the dimensions identified in earlier parts of the report[68]. It is important, however, that restructuring occurs with strategic input from the business sector and with regard to national innovation, education, science and research policy.

[68] That is: basic skills, knowledge skills, technical skills, creativity and design skills, entrepreneurial skills, business and resource management skills, and general management and leadership skills.

The National Innovation and Science Agenda: Welcome to the Ideas Boom

NISA is based on the premise that "Government supports innovation by investing in enablers such as education, science and research, and infrastructure; incentivising business investment; and removing regulatory obstacles such as restrictions around employee share ownership or access to crowd sourced equity funding" (Australian Government, 2015). The statement sets initiatives in the areas of:

- Culture and capital
- Collaboration
- Talent and skills
- Government as an exemplar.

The Agenda compliments a range of other Commonwealth policies and initiatives that support innovation, some of which have a training agenda. These include the Entrepreneurs Programme and the Industry Growth Centres Programme.

However, it does not specifically address the skills for innovation area. It is well understood, however that a key enabler of labour productivity is the capacity of businesses to develop and apply new knowledge and ideas through the skills of employees, particularly higher education or vocational education graduates (Fowler, 2016). Fowler notes:

> NISA is commendable. Successes in research and entrepreneurship are celebrated. But it may prove inadequate in 'skilling for innovation' existing (and start up) companies. A wider collaborative remit and a quantum jump in co-investment between tertiary institutions and employers is needed to have the nation 'surf' a bigger 'wave of economic prosperity', making the now announced inquiry in workforce for a new economy by the Standing Committee on Education and Employment welcome. The National Industry Skills Fund was reduced by $274m in the 2015/16 Mid Year Budget Review, perhaps part offset for NISA.

NISA supports a stimulation of collaboration between academics—typically post graduate Masters/PhDs employed in research institutions and R&D production professionals in industry. But it does not address the need for improved collaboration between enterprise and the tertiary sector in general, focussed on higher Certificate/Diploma/Degree holders. These graduates make up 54 per cent of the labour force (11.8m) and work on 'better ways of doing things on the job'.

NISA does not address the broader employability skills identified as a priority in interviews for this Project. The next iteration of NISA should focus much more on developing the skills for innovation in a broader skills development context.

Policy research and development

Mark Dodgson refers to the perennial problem of the lack of research in innovation in Australia and the 'mystifying way that we've never been able to grow an innovation research centre and sustain it'. Innovation research such as it is, has rarely focussed on the skills for innovation.

Moreover, innovation research is largely disconnected with research in relation to skills – reflecting in large part the policy discontinuities between agencies within the Commonwealth, the States, and between the Commonwealth and States/Territories.

There are already resources allocated to research through the National Council for Vocational Education Research (NCVER) and the Australian Council for Education Research (ACER). These Councils support an impressive work programme. It is important that the mandate of the Councils covers building skills and capabilities for enterprise innovation.

Business information and advisory services

Commonwealth and State/Territory Governments have a range of business development programmes, including the Entrepreneurs Programme and State based business enterprise centres.

There is also a range of Commonwealth and State business websites that offer advice about how to set up and run a business. These have tended to reflect a culture of management by checklist – a list of things to be done, but often without context and how to develop capability.

The *Business.gov.au Advisory Services*[69], launched in February is aimed at assisting businesses find advisory services. This is a welcome initiative and cuts through the plethora of business advisory services on offer. It includes links to providers offering skills and training services.

Several States and Territories provide access to skill and capability development in the form of *Innovation Vouchers.* These focus mainly on access to research and development capability, although some do provide for access to skills training and development.

- NSW Tech Vouchers programme provides grants to small or medium-sized enterprises to access technical research infrastructure and expertise such as testing, validation, and feasibility studies in NSW public sector research organisations (PSROs) such as universities.
- The Victorian Innovation and Technology Voucher Programmes (IVP and TVP) aim to assist companies to undertake R&D, design research, learn innovation-relevant skills, and adopt and develop specific new technologies by providing a voucher that can be exchanged for access to facilities, goods, services, advice or expertise provided by other companies or publicly funded research organisations.
- The South Australia Innovation Voucher Programme (IVP) aims to encourage collaboration between small to medium enterprises (SMEs) and research and development organisations. The programme is an element of Manufacturing Works, South Australia's manufacturing strategy.
- The West Australia Innovation Voucher Programme can provide financial assistance to eligible SMEs to access professional skills, services, or knowledge to enable them to advance their innovation or commercialisation activity in Western Australia.
- The Northern Territory Voucher Scheme offers co-funding to NT-based pre-start-ups, start-ups, sole traders, micro businesses and SMEs, to carry out science, engineering, technology and design R&D projects which could lead to successful new products, processes and services. BISI helps NT-based companies prove concepts and develop prototypes

[69] https://beta.business.gov.au/advisory-services

Attachment B: The project brief

In June 2012 the Australian Government announced Securing Australia's Future (SAF), a programme to undertake a series of strategic research projects for the Australian Chief Scientist and the Commonwealth Science Council. Coordinated by ACOLA, Australia's four Learned Academies are working together to deliver research-based evidence to support policy development in areas of importance to Australia's future.

Objective and background

The aim of SAF10.4 is to compile a review of evidence relating to the roles of government, industry and education and research institutions in supporting the development and dynamic mixing of technical and non-technical capabilities that enable business innovation. The policy review is the last of four research projects initiated for the preparation of a final report for the SAF10 Project – Capabilities for Australian Enterprise Innovation.

To complement the findings of the other projects (literature review, statistical analysis of Australian data from the ABS, and case study analyses of "best practice" innovative firms) the policy review explores roles of government, industry and education and research institutions in fostering optimal investment in and dynamic mixing of technical and non-technical skills for innovation.

As part of this project, the project team is commissioning a consultant to interview experts and thought leaders on potential policy options. The primary focus is on examining current innovation policy initiatives implemented in Australia (and other jurisdictions) and to explore additional options for how policy instruments may foster optimal investment in and dynamic mixing of technical and non-technical capabilities of Australian enterprises.

Project scope

The scope of SAF 10.4 broadly mirrors the broader SAF10 research aims. It seeks to address what we know about the following questions:

(i) What is the role of government, industry and education and research institutions in fostering investment in technical and non-technical skills for innovation?
(ii) What mechanisms are used to generate or foster investment in optimal skills for innovation in other jurisdictions?
(iii) What are the policies currently implemented in Australia (and possibly in other jurisdictions) to foster investment in technical and non-technical skills for innovation and what are other potential options?
(iv) What are the challenges for policy to foster investment in skills mixing and what policy mechanisms do experts see to address these challenges?
(v) Are there, in other jurisdictions, new and innovative ways to support the development of technical and non-technical capabilities and how effective are they?

In addition to a desktop review of international evidence, the policy review relies on insights gathered from key informants on policy topics. The list of interviewees is to be coordinated with the project team. The interviewees are listed in Attachment D.

Project outputs

The primary output of the commissioned part of this research is a ca. 20-page report of synthesized research findings to be, in full or in excerpts, included in the final SAF10 project report. The structure of the 20-page report will be coordinated with the project team to align thematically with the overall SAF10 report. In addition, outputs of this research include the audio recordings from all interviews and the accompanying transcripts.

Attachment C: Guiding questions for interviews

The following material was provided in the Project Brief.

This is our starting point. It might seem a fairly obvious starting point.

- But how obvious is this need for our understanding of innovation to embrace not only technical and scientific capabilities, but also capabilities in business, systems, culture, and societal uptake?
- How would you characterise Australia's level of understanding and implementation of this perhaps more holistic understanding of innovation?
- What are the strengths/weaknesses of the Australian innovation system? Where do skills and skills mixing fit into the current innovation system?
- What is the role of specific initiatives, such as the Growth Centres, in the innovation system?
- How would you compare Australia to other countries/regions' approach to this more holistic understanding of innovation?

In our research so far for SAF10 Securing Australia's Future - Capabilities for Australian enterprise innovation*, we have been struck by the large gap in the international academic literature, with very little focus on skills/technical-non-technical skills/technical-non-technical skills mixing as a key input into innovation and productivity.*

This gap is only partially filled with the grey literature – advocacy material and consultants' reports – which sometimes lacks rigorous evidence and can be discounted by decision makers.

- What is your view of the role of skills/technical-non-technical skills/technical-non-technical skills as an input to Australian innovation and productivity?
- Do you see a role for government in addressing this more holistic approach to innovation and productivity?
- What are the roles of other actors in the system: e.g. industry peak bodies? Industry associations? Individual firms, not-for-profits, public agencies? Universities? The training sector? Schools? Any other actors? (should overall address the triangle government-business-education)

We are generally interested in examples of initiatives that have addressed the skills for innovation issue.

- Could you point us to outstanding examples of any actors in our innovation system that are embracing the mixing of technical and scientific capabilities on the one hand, and capabilities in business, systems, culture, and societal uptake on the other?
- In your examples, how is skill-mixing achieved? What are the actors doing in, for example, their recruitment practices, training or use of on the job learning, to develop and to sustain the use of this mix of capabilities?

The role of government policy, industry and education and research institutions.

Over the last decade, government policy has shifted considerably between governments. Given the current focus on Growth Centres to enable transfer of knowledge, skills and capabilities, do you think that current policy settings designed to fostering investment in diverse skills and skills mixing are well adequate? If not, in what ways are they inadequate? What are the most significant issues or challenges? And who should be responsible for addressing them?

Possible prompts here:

- Match between supply and demand for different technical and non-technical skill sets / qualifications?
- "Job ready" skill mixes within specific qualifications (e.g., Engineering) which include both technical and non-technical skills?
- Formal vs non-formal acquisition (on-the-job training) of different types of skills and capabilities?
- Who should make the investment in skill development (employer, individual, or public investment)?

Attachment D: Interviewees

Interviews were conducted with the following people. Organisational affiliations are listed together with a link to their LinkedIn profile where available.

Business enterprises

1. Glenn Keys, Aspen Medical, Chair Canberra Business Chamber, (19 Jan) https://au.linkedin.com/in/glenn-keys-36b8491
2. Russell Rankin, Director of Food Innovation Partners Pty Ltd http://www.food-innovation.com.au/
3. Neville Sawyer, Ampcontrol, former Chair ACCI (22 Dec) https://au.linkedin.com/in/neville-sawyer-am-b7349931
4. Andrew Stevens, former MD of IBM Aus, Chair, Advanced Manufacturing Growth Centre (8 Feb), https://www.linkedin.com/in/andrewstevensibm

Business incubators, innovation advisers, regional innovation ecosystems

5. Brenton Caffin, Director Innovation and Skills, NESTA, UK, (28 Jan) https://uk.linkedin.com/in/bcaffin
6. Hamish Hawthorn, CEO, ATP Innovations (18 Jan) https://au.linkedin.com/in/hamishhawthorn
7. Todd Williams, CEO, Hunter RDA (27 Jan) https://au.linkedin.com/in/todd-williams-faicd-71826244

Business and industry associations

8. Angus Armour, Megan Kirchner, Mike Hubbard, Business Council of Australia (7 Jan, 12 Jan) https://au.linkedin.com/in/angus-armour-06968630
9. Kate Carnell, CEO, ACCI (20 Jan) https://au.linkedin.com/in/kate-carnell-24ab4a15
10. Tim McKay, ICT Skills and Education Manager, Australian Information Industry Association, (20 Jan) https://au.linkedin.com/in/timothy-mckay-53521933
11. Innes Willox, CEO, AI Group, (11 Jan)

Technology investors

12. John Dyson, CEO, Starfish Ventures (Feb 4) https://au.linkedin.com/in/john-dyson-7b287232 (4 Feb)

Tertiary education leaders

13. Mark Dodgson, Professor at University of Queensland, and Imperial College London (1 Feb) https://au.linkedin.com/in/mark-dodgson-9484329
14. Malcolm Gillies former VC at London Met University and London City University (9 Dec) https://uk.linkedin.com/in/malcolm-gillies-1954bb47
15. Roy Green, Dean, UTS Business School, UTS (21 Dec)
16. Swee Mak, Director, Accelerator and Incubator Initiative, RMIT University (4 Feb), https://au.linkedin.com/in/swee-mak-475098b2
17. Stephen Parker, Vice Chancellor, University of Canberra, (19 Jan)
18. Arun Sharma, DVC Research and Innovation, QUT, (1 Feb) https://au.linkedin.com/in/arunksharma1
19. David Sweeney, at HEfCE (8 Dec) https://uk.linkedin.com/in/david-sweeney-5bb2535
20. Jim Watterston, Queensland DET (written response) https://au.linkedin.com/in/jim-watterston-91b80bb9

Tertiary education peak bodies

21. Belinda Robinson and Anne-Marie Lansdown at UA (Nov) https://au.linkedin.com/in/belindarobinson1,
22. Sharon Winocour, CEO, B-HERT, (4 Feb) https://au.linkedin.com/in/sharon-winocur-24264814
23. Patricia Neden, CEO, Industry and Business Skills Council (4 Feb) https://au.linkedin.com/in/patricia-neden-01483220

Tertiary education research

24. Craig Fowler, NCVER (22 Dec) https://au.linkedin.com/in/craig-fowler-2bb38621
25. Peter Noonan, CEO, Mitchell Institute, (13 Jan)
26. Todd Davey, Professor at Munich Business School, https://nl.linkedin.com/in/toddadamdavey

Public Research organisations

27. Jack Steele, General Manager, Science and Government, CSIRO (27 Jan) https://au.linkedin.com/in/jack-steele-155b47a

Government

28. Ian Cox, Executive Director, Innovation, Trade and Investment, ACT Government (25 Jan)
29. Geoff Garrett, Queensland Chief Scientist (29 Jan)
30. Luke Hendrickson, Manager Innovation Research at Department of Industry and Science (20 Jan) https://au.linkedin.com/in/luke-hendrickson-95bb527

Policy analysts and advisers

31. Mark Evans, Director, Institute for Governance and Policy Analysis, University of Canberra (20 Jan) https://au.linkedin.com/in/mark-evans-4b851960
32. Mark Matthews, Science, Technology and Innovation Policy consultant, at Sheffield, UK (Nov 28) https://uk.linkedin.com/in/marklmatthews
33. Richard Snabel, Chief Strategy Officer, Designed4Growth and former Chair OECD Committee on Industry, Innovation and Entrepreneurship, Chief Economist, Department of Innovation, Industry, Science and Research (19 Jan) https://au.linkedin.com/in/richard-snabel-38656658
34. Glen Withers, Bruce Chapman, Crawford School, ANU (Nov 16)

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