

Entrepreneurship in Australia: the missing links

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Background

The purpose of this report is to provide an evidence-based context for understanding the importance of entrepreneurship to Australia's economic prosperity, its link to innovation and how Australia compares with its competitors in fostering an entrepreneurial culture and mindset, particularly through immigration and education. The report is based on an extensive review of a large, complex and disaggregated international professional and 'grey literature'¹ and measurement issues regarding entrepreneurship are emphasized. On the basis of this review, there is no question that Australia is faced with many challenges in better connecting its innovation policy to the realities of a service economy and leveraging the entrepreneurial capacity within its immigrant population, education and research system, and community more broadly.

Global economic context

Few have painted the speed and scale of the restructure of the global economy, or the challenges and opportunities this presents for Western industrialised nations, as vividly as Jim O'Neill, Chairman of Goldman Sachs Asset Management (O'Neill 2011, 2007, 2001).

In 2001 O'Neill introduced the concept of *BRICs* (Brazil, Russia, India and China) as emerging economies with the potential to challenge the traditional pre-eminence of the industrialised western nations – particularly the United States and Japan.

The *Next 11* followed in 2005 – i.e. the most populous countries after the BRICs which might also have similar growth potential. And more recently, O'Neill introduced a sub-section of the Next 11 - the *MIST* (Mexico, Indonesia, South Korea and Turkey). Each of these countries contributes at least 1 per cent of global GDP and as such are termed 'growth markets' rather than 'developed' or 'emerging' economies².

According to O'Neill, the above 15 economies account for 'most of the positive momentum behind the world economy'. A point made all the more poignant by the debt crisis in the US and the Euro zone and the devastating impact of the recent earthquake and tsunami on Japan's economy (Whittell 2011; Alberici 2011; Webb 2011).

The replacement of the G8 by the G20 as the official forum for coordinating global economic policy further reflects the changing influence of the emerging economies. Significantly, China and India constitute not only new markets and competition but they are also new sources of innovations and entrepreneurs (Haour and Miéville 2011; Khanna 2011) and are 'educating their children earlier and longer, with greater emphasis on math and science' (Obama 2011).

There is no doubt that the location of economic power is shifting from West to East. However, the projected dates for this transition vary widely. For example: 2016 (IMF 2010, Parkinson

¹ 'The term 'grey literature' covers material typically produced by OECD, the World Bank, UN agencies and the commercial/private sector' (Royal Society 2011 fn288).

² See also the IMF (2011: 170) and Dadush and Stancil (2009) on the need for replacing outdated economy classifications.

2011), 2020 (Euromonitor 2010), 2025 (World Bank 2011) 2032 (Dadush and Stancil 2009) and 2050 (Wolfensohn 2010)³.

Nonetheless, ‘...these transitions – whether smooth or rocky- have important implications for Australia...they constitute probably the most significant external shock Australia has ever experienced’ (Parkinson 2011).

However, it is important to note that the US still had the world’s largest economy by far in 2010 – accounting for 23.1 per cent of global GDP – followed by China (9.3 per cent), and Japan (8.7 per cent). India was ranked 9th (2.7 per cent of GDP) and Australia 15th accounting for 1.4 per cent.⁴ And whilst emerging and developing economies have recovered much faster than advanced economies from the global financial crisis, they are not necessarily growing in the same way (cf Gupta 2011; Bardhan 2010; Lacy 2011; Dadush and Shaw 2011).

Of the world’s approximate 7 billion population, 85 per cent are located in emerging and developing countries and China and India between them account for approximately 35 per cent (IMF 2011; US Census Bureau). The US is the third most populous country and is expected to maintain this position on 2050 projections. However, India is projected to replace China in the number one rank by 2025. With just over 22.5 million people (ABS 2011a) Australia’s growing, albeit ageing, population ranks 55th and current government focus is on ‘sustainability’ rather than the ‘Big Australia’ proposed under the previous leader (Burke 2011).

These rapidly growing Asian economies, with their burgeoning middle classes and ambitions, offer enormous opportunities for a country such as Australia – in particular for ‘our commodities and our services exports – education, tourism and professional services – and for niche, high-end manufactures.’ (Parkinson 2011, Stevens 2011, see also Euromonitor 2010). *And with the shift of economic growth from the West to the Asian region, Australia for the first time is no longer subject to the ‘tyranny of distance’ from the world’s major markets.*

The Australian context

Regarding economic competitiveness and ease of doing business, Australia performs quite well in global rankings. For example, *Doing Business 2011* ranks 183 economies across 9 topics using a variety of indicators. Benchmarked to June 2010, Australia was ranked 10, behind Singapore (1), New Zealand (3), and the US (5) (World Bank and the International Finance Corporation 2011a,b).

The World Economic Forum’s *Global Competitiveness Report 2011-12* ranks 142 economies across 12 ‘pillars’ using 111 indicators. Australia ranks 20th overall, but has dropped four places from the previous year ‘as other countries move ahead’ (p7). Australia’s advantages include: the efficiency of its financial system (6th) and ‘soundness of banks’ (4th) as well as strengths in Health and primary education (10th) and higher education and training (11th).

³ Projections inevitably are based on a number of assumptions regarding, for example, no changes in international security or environmental disasters and also vary depending on whether measured by Purchasing Power Parity (PPP) or non-PPP eg market exchange rates.

⁴ Derived from Gross domestic product ranking table 2010, World Development Indicators database, World Bank.

However, it ranks 22nd for innovation capacity and 29th for sophistication of its businesses ‘two critical drivers of competitiveness for advanced economies’. The rank of 75th for the ‘burden of government regulation’ raises additional concerns for business leaders.

In a 24-country poll regarding the best cultures in the world for people to start a new business, Australia came in the top five (BBC World Service 2011). Along with Germany, it was also polled as having the most positive attitudes about the possibility of becoming an entrepreneur. And it featured in the top 20 of 82 countries ranked on the basis of their innovation capacity measured by direct innovation inputs and innovation environment (The Economist Intelligence Unit 2009).

However, Australia’s economy is predominantly a ‘services economy’. The services sector contributes just over 70 per cent to GDP and accounts for around three quarters of the labour force in areas such as financial and insurance services, health care, education⁵, telecommunications, tourism, administrative and support services and real estate.

In contrast, the industry sector contributes approximately a quarter of GDP and has just over a fifth of the labour force. The agriculture sector both in terms of GDP and labour is less than 5 per cent (ABS 2011; CIA 2011). Manufacturing has never been well-developed, with growth being constrained by a small domestic market and distance from the major international markets (Stevens 2011).

Whilst mining makes up 59 per cent of Australian exports, it contributes only 9 per cent to the economic output and accounts for 2 per cent of jobs (Irvine 2011). Nonetheless, as mining investment is expected to increase, the ‘two speed economy’ it has generated is also expected to broaden (Stevens 2011).

Finally, there are the emerging knowledge-intensive industries, such as biotechnology, where entrepreneurship and innovation are acknowledged as the primary drivers of growth (cf. Estrin, 2009, 2008; Rowbotham 2009). According to the 3rd Annual Worldview Scorecard published by Scientific American (2011), Australia now ranks fifth globally behind the US, Denmark, Sweden and Canada in biotechnology innovation, with particular strengths in R&D intensity and education (both 4th), but a significant weakness in enterprise support, including the availability of venture capital (13th) (See also Beattie 2011).

As of July the unemployment rate was approximately 5 per cent (ABS 2011b). However, productivity growth has been slow and unit labour costs, along with an exchange rate that is projected to remain high for some time, reduce competitiveness (Parkinson, 2011; Ridout 2011; Kelly 2011; Stutchbury 2011).

According to Parkinson (2011), for Australia to capitalise on the wealth opportunities provided by the growing Asian economies, *new business models will be needed along with further changes in the structure of the economy ‘and perhaps more importantly, in the mindset of Australian businesses and the skill sets of Australian workers’*. As well-established drivers of economic growth, innovation and entrepreneurship will be critical to the framing of any such response (OECD 2011a: 14, OECD 2010c:11; Audretsch et al. 2006b; van Stel 2006). And Australia will need to ensure that it has strategically invested in those knowledge-based industries, creative talents and skills sets that

⁵ The largest services export industry is education services (AEI 2011). However, high exchange rates, student personal security issues and changes to migration rules have seen a substantial decline in international education.

are seen as a ‘crucial source for comparative advantage’ (Audretsch et al. 2006a). A further priority will clearly be how to better leverage service sector innovation to increase competitive advantages and productivity and to understand the role of entrepreneurship in this activity (cf Business Europe 2011).

Innovation

Countries throughout the world are looking to innovation⁶ (particularly derived from advances in science and engineering) not only for wealth creation and job growth but also to help solve the global grand challenges – in energy, food security, water supplies, climate change, environmental sustainability, social unrest and aging populations (Attorney-General’s Department 2010; National Academies 2010; Haour and Miéville 2011; OECD 2009e).

For example, the OECD (2011c) argues that: ‘Governments must look to the green economy to find new sources of growth and jobs. They should put in place policies that tap into the innovation, investment and entrepreneurship driving the shift towards a greener economy’. In the US, President Obama has stated that ‘Clean energy is the new Apollo Project’ (2011, 2010) with significant implications for job creation nation wide.

As part of its 2020 Strategy, the EU has established three Flagships- the ‘Innovation Union’, ‘Youth on the Move’ and ‘An Agenda for new skills and jobs’- to promote ‘smart, sustainable and inclusive growth’ – with education, skilled worker mobility, collaboration and entrepreneurship playing a key role (Commission of the European Communities 2010).

Building in particular on its ‘Review of the National Innovation System’ (Cutler 2008), the Australian Government has developed a comprehensive innovation policy agenda (DIISR 2009). It includes a target of increasing business innovation by 25 per cent in the next 10 years and doubling collaboration between Australian business, universities and publicly funded research agencies. Entrepreneurship is briefly mentioned in terms of increasing opportunities for ‘small entrepreneurial firms’, and the need to increase entrepreneurial skills and to change attitudes to risk. The role of the higher education sector in meeting workforce and community needs and providing innovation skills is addressed in a number of other major reviews (DEEWR 2010, 2008; DIISR 2011).

Services innovation has also become part of policy discussions within the EU where knowledge-intensive services have been a main source of job creation (cf. BusinessEurope 2011 and Royal Society 2009). And according to van Vught (2010): ‘The future prosperity of Europe will to a large extent depend upon our ability to develop and implement new and better innovation support mechanisms for the Services Sector’.

A similar caveat could certainly be applied to Australia.

⁶ Four types of innovation are identified by the OECD (2005): product, process, marketing and organisational

Entrepreneurship

Entrepreneurship is recognised as playing a vital role in promoting innovation and economic growth. Entrepreneurs themselves are valued for their creativity, willingness to take risks and for their role as change agents (Metcalf 2004: 165-166). And high-growth entrepreneurs ('gazelles') are of particular interest to policy makers as 'their firms contribute a disproportionate share of all new jobs created by new firms' (Kelley et al. 2011: 40; OECD 2010b: 12). As OECD economies have become more knowledge intensive, substantial attention has also been directed to researching entrepreneurship 'as a vehicle for transferring and exploiting new knowledge from public or private sources' (NSF 2010: 4-51; see also OECD 2009d: 40-42; OECD 2009a: 80-81). The Kauffman Foundation in the US in particular has played a lead role in research in entrepreneurship.

Whilst different theorists have stressed various aspects of entrepreneurship in the development of national economies, Joseph Schumpeter's conceptualisation of entrepreneurs as 'the primary agents of economic development and change' – 'who think up ways of putting scarce resources to new uses' (Schumpeter, 1911, 1934) – has been one of the most influential, especially in relation to OECD thinking.

Simeon Djankov, creator of the leading World Bank publication *Doing Business*, has grouped studies on the determinants of entrepreneurship (including cross-cultural comparisons) into three categories - the institutional environment, sociological factors, and personal/psychological characteristics (Djankov et al 2005).

Institutional explanations focus 'on the role of economic, political, and legal institutions in fostering entrepreneurship' – in particular credit markets, the taxation regime, labour market flexibility and protection of intellectual property rights. Sociological research considers the impact of social norms, values, and social networks (eg family and friends), in promoting entrepreneurship. The US, for example, is considered to have norms that create positive incentives for entrepreneurs through the high social value placed on commercial success and through 'forgiving social norms which allow for more than one try' (Wessner 2008). The third category of research 'emphasizes the individual characteristics of entrepreneurs, such as a personal need for achievement, self-confidence, self-reliance, and attitudes toward risk' (cf Wadhwa et al 2009a).

However, definitional and measurement problems abound.

According to former President of the International Schumpeter Society, Stan Metcalfe (2004: 157): 'At the outset, we must recognize that acceptable definitions of entrepreneurial activity and its image, the entrepreneur, the agent of entrepreneurial behaviour, are not readily achieved. Entrepreneurship is not one-dimensional and the entrepreneur comes in shades of many different kinds, such that it is presumptuous to conceive of a simple, unifying approach'. (see also Lacy 2011:17; OECD 2011a; Wilson 2008: 119)

Treasury officials Kukok and Regan (2008) draw attention to the absence of indicators and accurate, internationally comparable data that genuinely reflect the innovative nature of entrepreneurship and distinguish it from ordinary business activities. Without such data they believe it 'is difficult to draw firm conclusions about the true level of entrepreneurial activity in Australia or any other country' or improve the quality of public policy initiatives aimed at supporting this activity.

The OECD (2009: 5) has also raised similar concerns:

Policy makers need to understand the determinants of and obstacles to entrepreneurship because they must analyse the effectiveness of different policy approaches. Ultimately, policy making must be guided, as far as possible, by evidence and facts. The lack of internationally comparable empirical evidence has constrained the understanding of entrepreneurship and many questions remain unanswered.

At an international level the Kauffman Foundation, the OECD, the European Commission and the Global Entrepreneurship Monitor (GEM) are key contributors to efforts aimed at improving our understanding of the dynamics and complexities of entrepreneurial activity as well as its impacts on innovation and wealth creation. However, it is clear that measurement issues are still substantial and ongoing.

The Kauffman Foundation

Established in the 1960s the Foundation has a significant asset base of around \$US 2 billion. It is 'the world's largest foundation devoted to entrepreneurship'.

Leaders from around the world look to us for entrepreneurship expertise and guidance to help grow their economies and expand human welfare. Our Entrepreneurship team works to catalyze an entrepreneurial society in which job creation, innovation, and the economy flourish. We work with leading educators, researchers, and other partners to further understanding of the powerful economic impact of entrepreneurship, to train the nation's next generation of entrepreneurial leaders, to develop and disseminate proven programs that enhance entrepreneurial skills and abilities, and to improve the environment in which entrepreneurs start and grow businesses (Kauffman.org).

The Foundation has played a pivotal role in the establishment of the OECD's work on entrepreneurship, discussed below.

OECD

In 2005 The Kauffman Foundation provided both substantial funding and ongoing sponsorship for the OECD to address the many weaknesses in entrepreneurial indicators and the ad hoc nature of data collection. The OECD -Eurostat Entrepreneurship Indicators Programme was launched in 2007 to further develop this work (OECD 2009c). The particular focus is on business data demography and currently 25 countries participate in the programme.

The EIP uses the following definition for entrepreneurship (OECD 2011a:3):

Entrepreneurship is defined by the EIP as the phenomenon associated with entrepreneurial activity, which is enterprising human action in pursuit of the generation of value, through the creation or expansion of economic activity, by identifying and exploiting new products, processes or markets. In this sense, entrepreneurship is a phenomenon that manifests itself throughout the economy and in many different forms with many different outcomes, and these outcomes are not always related to the creation of financial wealth; for example, they may be related to increasing employment, tackling inequalities, or indeed, increasingly, environmental issues.

The EIP conceptual framework distinguishes between *determinants* (regulatory framework; culture; knowledge creation and diffusion; access to finance; entrepreneurial capabilities; market conditions); *performance* (enterprise birth, death, survival and growth rates; ownership rates, average size of firm after 3 and 5 years; productivity, innovation, export of

young firms); and **impact** of entrepreneurship (job creation, economic growth, poverty reduction).

Data are sourced from a variety of organisations including from the World Bank (Doing Business) and GEM. ASIC is the Australian source of 'timely indicators' (OECD 2010d). The indicator set has been extended to cover 'Green', migrant, female and social entrepreneurship. Learning from both successful and unsuccessful entrepreneurs is also advocated within the EIP (OECD 2011: 15).

Among these newer indicators, Green entrepreneurship is a relatively new concept and as such the EIP has experienced difficulties in separately identifying 'entrepreneurship dynamics for a group of green sectors that have high policy-relevance' (OECD 2011a: 26). The lack of substantial empirical analysis in the literature on Green entrepreneurship is also seen as an obstacle to progressing measurement of this concept (p26).

Similarly the contribution of women to entrepreneurial activity is difficult to assess due to lack of relevant gender data. Whilst women are found to be more represented in services than in manufacturing, the EIP notes that there is wide international variation in their presence as entrepreneurs. No major gender differences were found regarding perceived obstacles to starting or growing a business (p92).

And whilst high growth is linked to having needed skills sets available, the OECD comments that the link between tertiary education qualifications and entrepreneurial activity and performance is less clear and difficult to measure with confidence (OECD 2009e: 106).

European Commission

The European Commission has two key ways of investigating entrepreneurship - Eurobarometer and Eurostat. Eurobarometer, which is part of the Public Opinion Analysis section of the EC, was established in 1973 and monitors public opinion in Member States across a range of major topics, including entrepreneurship. Each survey consists of approximately 1000 face-to-face interviews per country.

Eurostat addresses entrepreneurship within several policy contexts – Promoting entrepreneurship, Innovation, SME policies and the Small business act for Europe. As part of its Structural Business Statistics, entrepreneurship is investigated across a number of domains, including business demography and factors of business success. Eurostat is also a partner in the OECD entrepreneurship indicators programme (EIP) which is addressing conceptual and methodological issues in providing internationally-comparable statistics to allow for better policy formulation and monitoring of entrepreneurship.

Global Entrepreneurship Monitor GEM

Established in 1999, the not-for-profit academic research consortium GEM conducts an annual survey of countries throughout the developed and developing world about attitudes to and involvement in entrepreneurship. It addresses the individual's perceived opportunities and capabilities; fear of failure; perceptions about entrepreneurship (as a career choice, status accorded to successful entrepreneurs, media attention); and intentions to start businesses.

GEM produces country specific reports and the 2006 survey results showed Australia as a 'nation of entrepreneurs' (University of Adelaide 2007) - the most entrepreneurial people in the developed world, but lacking confidence in their skills as well as being less innovative than their competitors in other developed nations. The 2008 GEM report included a special topic on

‘Entrepreneurship Education and Training’ (Bosma et al. 2009). The most recent survey also showed that women’s participation in entrepreneurship varied significantly across economies, but was nearly always less than that of men (Kelley et al. 2011: 34). However, in terms of the Asia Pacific region, Australia shows the greatest number of women entrepreneurs among the innovation-driven economies with men and women participating equally in this activity (p36).

Social attitudes and entrepreneurship

Vivek Wadhwa’s extensive research on entrepreneurship in the US stresses the importance of societies having strong social values supportive rather than undermining of this activity (Wadhwa 2009). Social attitudes, political practices, economic policies and the legal system play a key role in creating an environment that is conducive to entrepreneurship – in particular in relation to supporting creativity and risk-taking and starting new businesses.

From its investigation regarding cultural differences and entrepreneurship, the OECD has reached similar conclusions:

The entrepreneurial culture in a country affects the attitude that individuals have towards entrepreneurship, the likelihood of choosing entrepreneurship as a career, the ambitions to succeed and to start again after a failure, or the support provided to family and relatives planning to set up a business. *All these aspects play a role, although there is scarce empirical evidence on their relative importance and differences across countries* (OECD 2011a:104)⁷.

The US culture is noted for its support of risk-taking and for not penalising failure. There is no better example of this than in relation to Silicon Valley (Saxenian 1994; Lacy 2011). From her in-depth studies of the region, AnnaLee Saxenian comments that: ‘The region’s culture encouraged risk and accepted failure. . . .Not only was risk-taking glorified, but failure was socially acceptable. There was a shared understanding that anyone could be a successful entrepreneur: there were no boundaries of age, status, or social stratum that precluded the possibility of a new beginning, and there was little embarrassment or shame associated with business failure. In fact, the list of individuals who failed, even repeatedly, only to succeed later, was well known within the region’ (pp38-39).

A culture of risk-taking and acceptance of failure is also demonstrated within the US Defence Advanced Research Projects Agency, which for a number of decades substantially invested in the research that resulted in the development of the Internet.

Connell and Probert (2010: i) in their research on the growth of the hi-tech economy in the UK comment that: ‘When entrepreneurs start a technology business, a whole range of strategies is open to them, each offering different levels of risk and return. Risks revolve around uncertainty (technology; market; competition), investment (cost to develop a product or service and bring it to market; cost to breakeven), and level of management complexity’.

However, Moran and Valiquette (2011) argue that ‘you can’t legislate an appetite for risk’.

... any government’s appetite for risk will most certainly colour its efforts to support innovation and be reflected in its public policy decisions. One could argue that less government involvement is invariably better because, no matter how well intentioned, intervention by bureaucrats who haven’t lived on the front lines of building a globally competitive business will always suffer for that lack of seasoned perspective. They will

⁷ Emphasis added

almost always favour the safe bet, the low-risk option, the choice that is most likely to secure votes. A risk-averse mindset such as this not only runs counter to true entrepreneurship, it can instil behaviours that act against it.

In contrast to the US, Australia has a reputation as a risk-averse culture. One of the most notable examples of this is the failure to support Zhengron Shi's solar energy research, which was subsequently taken to China where he was provided with start-up funding and government support. Suntech Power, which Dr Shi founded, is the now world's largest producer of solar panels. Dr Robin Warren and Dr Barry Marshall were also unable to secure funding from the NHMRC for their Nobel Prize winning research on *Helicobacter pylori* and stomach ulcers - the research was considered too risky (Commonwealth of Australia 2010: 50-51).

Similarly, part of high profile expat materials engineer Saul Griffith's work is on 'how to develop low-cost ways to adjust solar cells during daylight so that they always point directly at the sun to absorb more energy'. He says that he would be unlikely ever 'to move home to Australia to work because of the lack of resources and an aversion to risk in the technology sector here'.

I've built entire companies that have fallen over with millions of dollars of funding. That type of failure wouldn't have been tolerated in Australia. It's almost celebrated as a success in the US, like: 'Oh, you lost 5 million on that? Well, that was a good warm-up, let's go bigger next time (Cook, 2011:3).

Commercialising university IP

Two key parts of the US's national innovation strategy designed to promote sustainable economic growth and job creation are to increase support for university fundamental research and the effective commercialization of promising technologies.

However, in the view of the Office of Science and Technology Policy (OSTP): 'it is often transferring viable research discoveries to the marketplace that can pose the greatest challenge to innovators and entrepreneurs' (OSTP 2010). As such, it invited all stakeholders (including entrepreneurs and investors) to identify ways in which the economic impact of Federal investment in university R&D and the innovations being fostered in Federal and private proof of concept centers (POCCs) could be increased. The survey has a set of questions focusing on: (1) how best to encourage commercialization of university research; and (2) whether POCCs 'can be a means of stimulating the commercialization of early-stage technologies by bridging the 'valley of death''.

Established in 1974, The Association of University Technology Managers (AUTM) in the US also plays a key role in ensuring that government funded inventions are commercialised effectively. In a 2009 survey on start-ups, patenting and licensing income AUTM showed that scientific research from about 150 universities created 555 start-up companies and resulted in over 4500 patent optioning and licensing deals earning \$1.8 billion for the universities.

In their work on UK innovation policy and the role of university research, Connell and Probert (2010: 98) believe there should be a 'fundamental rethink of how effective universities can ever be at commercialising academic IP, given the way that they are structured, staffed, incentivised and financed'. Major issues in progressing research to a potential spin-out that is 'genuinely VC ready' include (p104):

- it is difficult to build the teams of 5-20 people required as the core of any major spin-out business;

- development is progressed in fits and starts as academics have conflicting time pressures to publish and teach;
- research staff are funded to work on specific projects; it is therefore difficult to switch resources to accelerate work on a temporary basis to service ‘customers’ or on a more permanent basis when the pace of R&D needs to quicken;
- IP is not captured on a regular basis or approached strategically during projects; there is a great deal of IP leakage as researchers come and go, increasingly outside the UK; and
- collaborations with corporate partners are not approached with the ‘hard nose’ and degree of commercial sophistication needed to maximise economic potential within the UK, for example by segmenting IP rights by field and charging sufficiently to build up cash reserves to enable later spin-outs.

Also in relation to the UK, Kastle (2011) refers to the importance of information flows – sharing of ideas – between university researchers and the business world. However, he comments that business engagement is not well reflected in university reward systems and also constrained by the preoccupation of university lawyers to make ‘sure that anything of remote commercial value is protected with a patent or secrecy agreement’.

Audretsch et al. (2006a: 61) draw attention to researchers in the US working outside university commercialisation offices. They comment that: ‘The scientist entrepreneurship emerges as an important and prevalent mode of commercialization of university research activity of faculty and students occurring outside the university without involving university-owned IP’.

In regard to Australia’s innovation policy it is not clear how effectively university commercial arms manage IP or how well the universities themselves support entrepreneurship. However, Merrill and Mazza (2010: 76) comment that ‘...the development of an entrepreneurial culture in an institution and establishment of a suite of university services to support entrepreneurial ventures can be a lengthy and expensive process ... (and that)... the return to the institution is rarely the payoff from an equity investment in a Google or a Yahoo that has a successful initial public offering.’

In terms of applied research, the head of the Australian Industry Group believes that industry should be brought in earlier to the research process (Ridout 2011). Heather Ridout also sees the need for much greater flexibility in the IP transfer and partnership systems. And in her view the business sector is constrained by the lack of consolidated information regarding the types of research actually being undertaken. As Kastle (cited above) found in relation to the UK, Ridout sees that ‘collaboration and networking between industry and the research community enables business to tap into ideas and expertise to resolve ongoing challenges, create new products and services, and become more competitive and profitable’. Whilst Australian universities and SMEs have a reasonable level of collaboration, according to Ridout for larger firms, ‘Australia ranks towards the bottom of the group of OECD countries on innovation collaboration with higher education institutions and government institutions’.

Skilled immigration and entrepreneurship

Skilled immigrant entrepreneurs have played a key role in building American businesses and providing the US with an important competitive advantage (Wadhwa et al 2007). In relation to California, AnnaLee Saxenian’s seminal research (1999) showed that foreign-born scientists and engineers, especially from China and India, had made significant contributions to the State’s prosperity. However, at the national level, such contributions overall have not been well-

documented. In response, the Kauffman Foundation initiated a series of dedicated inquiries regarding immigrant entrepreneurs in the US from 1995-2005 (Wadhwa 2009, Wadhwa et al. 2009a, 2009b).

Extending Saxenian's research, the Kauffman studies showed the same pattern of economic and intellectual contributions of skilled immigrants. For example, a quarter of science and technology companies founded between 1995-2005 had a foreign born chief executive or lead technologist. Immigrants also founded just over half of the Silicon Valley start-ups between 1995 and 2005 and contributed to more than a quarter of US global patents. And they made up a significant proportion of the US science and engineering workforce. Serge Brin, co-founder of Google, and Pierre Omidyar, founder of eBay, are both foreign born.

However, the US is experiencing a decline in skilled immigrants. Many are returning home, particularly to China and India (Christensen et al. 2011). And foreign student STEM admissions to top US universities have started to fall for the first time (National Science Foundation, 2010: pp 2:36 – 2:37; Lacy 2011) at a time when domestic students are increasingly enrolling in non-STEM degrees.

Explanations for this decline in skilled immigrants centre around restrictive visa policies that were introduced post September 11; increased global competition for talent, including from Asia and the middle-East (Wildavsky 2010); and more attractive opportunities developing in home countries.

A recent Kauffman study also suggests that America's financial services industry may be suppressing entrepreneurship because it is a strong competitor for the same talent, especially graduates in science, engineering, maths and physics (Kedrosky and Stangler 2011: 6, 9). In a similar vein, Judy Estrin CEO of JLABS and one of Silicon Valley's 'greatest entrepreneurs and technologists' also believes that there are too many MBAs and lawyers and that the US needs to get back to a focus on basic science and technology (Churchill Club 2009; Estrin 2008).

Knowledge and Technology Intensive Industries are a key part of the global economy and the US has the highest concentration of these industries (National Science Foundation, 2010: 2:26-27; 6:4). Immigrants have been a major component of the STEM workforce needed for these industries, earning more than half of the US Science and Engineering doctorates since 2006. And they are also associated with the founding of high growth firms.

Furthermore, a 2011 Brookings Institute report based on US census data showed that highly skilled temporary and permanent immigrants outnumbered lower-skilled ones and that they had a 'significant presence in various sectors of the economy' (Hall et al. 2011). Immigration policy is often intensely and emotionally debated around illegal immigrants. However, the Brookings' report stresses that 'longer-term U.S. global competitiveness rests on the ability of immigrants and their children to thrive economically and to contribute to the nation's productivity'.

It is of no surprise therefore that President Obama's 2011 State of the Union Address stressed the urgency of retaining, rather than expelling, legal immigrant talents (Obama 2011).

Whilst the role of immigrant entrepreneurs continues to be extensively investigated in the US, the OECD Working Party on SMEs and Entrepreneurship (OECD, 2010b) believes that less is known about the role of immigrant contributions to high growth, innovative enterprises in other member countries. Nonetheless, its inquiries so far are indicative of migrants 'making a significant contribution to entrepreneurship' (p23). Social networks are also shown to help

accelerate entrepreneurship, and consistently with Saxenian's studies, the Working Party finds that migrants 'form tight social networks with fellow nationals' – with many associated benefits, including access to capital, support and knowledge (p9).

In terms of immigration policy, the Working Party believes that 'the type of migration a country promotes can influence the scope of entrepreneurship. If a country promotes more family or humanitarian migration they can expect a different type of entrepreneurship than typically comes from skilled labour migrants' (pp 16-17). But until more is known about migrant entrepreneurship, policies designed to actively promote it are hampered. Despite visa changes in the US, UK⁸ and Australia designed to attract 'entrepreneurial talent', somewhat curiously, the Working Party concludes that: 'So far, there does not seem to be compelling evidence that different countries are competing for entrepreneurial migrants' (p22).

Australia's immigration policies have shifted firmly from those designed to increase population growth (post World War 2) to those specifically designed to meet the skilled labour market needs of the economy. Visa Subclass 457 Temporary business (long stay) visas and student visas have been a particular feature of this shift (Spinks 2010: 8). However, the federal government is currently undertaking a review of the Student Visa program (Department of Immigration and Citizenship 2011) with a specific focus on ensuring that barriers to recruiting high quality international research students are removed. Also as part of its recent migration policy reforms 'a new points test that recognizes overseas qualifications and reduces the advantage enjoyed by onshore international students with Australian qualifications' has been introduced (Lane 2011: 28).

In 2008-09 the UK continued to provide the largest number of migrants to Australia, followed by India and China. However, for the first time in Australia's history, in the year ending June 2011, Chinese migrants outnumbered British – constituting 17.5 per cent of the total migration program (Bloomberg 2011).

The higher education sector in Australia has generated a strong export income from international students (Australian Education International 2011b) and 18 per cent of its students (undergraduate and graduate) are foreign nationals (NSF 2010:2-36 to 2-37). Just under four-fifths of international students are from Asia (particularly China and India) (OECD 2010a: 327).

In 2008 Australia graduated 44.3 per cent of students in social sciences, business, law and services (compared with the OECD average of 37.3 per cent and the EU average of 36.4 per cent) (OECD 2010a⁹). But only 7 per cent of Australian graduates were in engineering, manufacturing and construction compared with 12 per cent and 12.6 per cent for the OECD and EU respectively.

More than half of international students in 2008 were enrolled in Humanities, Arts, Services, Social Sciences, Business and Law (OECD 2010a: 333).

⁸ In the UK an Entrepreneur visa has been established aimed at 'wealth creators' and migrants who come to work for British branches of multinational companies (mainly Indian IT firms) are excluded from the annual limit (Travis 2011); a post-study 2 year visa for international students has also been established (China Daily 2010).

⁹ Data extracted from Table A3.5 (web only)

As with the US and other western nations (eg UK¹⁰), concern has been expressed in Australia over the decline in student interest in science and engineering disciplines (DIISR 2010a: 6; Wood 2004).

Nonetheless, in terms of higher degree research students in science and engineering, international students have made a significant contribution (DIISR 2010a: 6). And just over a fifth of the annual supply of doctorates to the workforce is sourced internationally (DIISR 2011: 3; Access Economics 2010; OECD 2009e)¹¹.

Working across borders

For knowledge-intensive firms to be globally competitive, skilled workers are needed who are comfortable operating at an international scale and who can also work easily within different organisational, cultural and disciplinary boundaries (Salzman 2007: 11-15; Merrill et al. 2010: 43; Commission of the European Communities 2008; Wood 2004).

Higher education systems play an important role in preparing knowledge workers for this environment, as illustrated by the OECD:

Globally oriented firms seek internationally-competent workers who speak foreign languages and have the intercultural skills needed to successfully interact with international partners.

Governments as well as individuals are looking to higher education to broaden students' horizons and help them to better understand the world's languages, cultures and business methods. One way for students to expand their knowledge of other societies and languages, and hence leverage their labour market prospects, is to study in tertiary education institutions in countries other than their own (OECD 2009a: 310).

So where do Australian tertiary students fit in this context?

In 2008 just under 10,000 Australian higher education students (0.9%) were enrolled in full degree courses overseas (Australian Education International 2011a). However, a greater proportion of completing Australian undergraduate students had undertaken an international study experience during their degree – the major destinations being the US, New Zealand, the UK and to a lesser extent, Japan and Germany. The Government also provides \$35 million annually to support international study experiences through a range of schemes.

In the research domain, the many barriers to mobility and networking experiences for Australia's researchers are well documented (DIISR 2011; DIISR 2010a; Allen Consulting Group 2010; Wood 2005; Wood 2004; Wood and Boardman 1999) – including inadequacy of funding, career insecurity, and the potential of existing schemes being 'paralysed by bureaucracy and inefficiency' (Commonwealth of Australia 2010: 58).

Birrell et al. (2006) also provide some interesting data regarding Australia's net gains from

¹⁰ see Department for Innovation, Universities and Skills (2009)

¹¹ The proportion of foreign born doctorates in 2001 in Australia was 45 per cent (Dumonte and Lemaître 2005: 10). Access Economics (2010) has also pointed to the need for 'better information on the qualifications held by migrants when they become permanent residents and how such qualifications are used after arrival'.

International Skilled Movements in 2004-5. In terms of the percentage of native-born tertiary-educated expatriates in OECD countries, relative to the tertiary-educated native stock in the home country, the figure for Australia was three per cent. 'This rate is half the level of Canada (seven per cent) (and) ...only four out of the 29 OECD countries studied, including the United States and Korea, show lower tertiary-educated expatriate rates than Australia' (p25) (see also Moodie 2010b).

We see ourselves as a nation of international travelers but in terms of education and work experiences, the reality appears somewhat different— perhaps more in line with the AIG chief 's view that whilst *'Australia has made big strides in understanding globalisation and its implications... we keep being dragged back to a too-small view of the world'* (Ridout 2011).

Yet a number of Australia's competitors have already well-developed policies and funding commitments needed to build an internationally mobile, experienced and highly educated workforce. The Marie Curie Actions of the EU are exemplars of mobility initiatives directed to ensuring that highly talented researchers have opportunities to work globally, in both public and private sectors, and to develop the innovation skills and entrepreneurial mind-sets needed for the knowledge intensive industries that are increasingly the key to global competitive advantage (Bingen 2011).

The OECD's Innovation strategy stresses the importance of 'empowering people to innovate' – of fostering 'an entrepreneurial culture by instilling the skills and attitudes needed for creative enterprise' (2010c: 3). It also addresses the importance of building creative talent – of developing the critical skills needed for operating in a global system of knowledge networks and to co-invent and move easily across borders. And in relation to education systems generally, a core principle is that students should be equipped 'with the capacity to learn and apply new skills throughout their lives' and that 'skills such as critical thinking, creativity, communication, user orientation and teamwork, in addition to domain-specific and linguistic skills' should be a priority (p9).

Not a labour shortage but a skills shortage

A 2010 study by the Australian Industry Group of 400 companies identified critical skills shortages in key professions and vocations at the same time as applicants presented not having sufficient skills and experience in working with business. Shortages were identified in professional engineers, business administration managers and accountants as well as a variety of trade positions¹². This is despite the substantial number of management and commerce graduates (see above). Many were seen simply not to have the necessary skills in leadership, teamwork and communication (Healy 2010; Hare 2011). In the view of the AIG: 'a qualification did not necessarily equate to a job'.

In the US, similar concerns have been raised about its education system: 'America is in crisis. Employers say paradoxically they cannot find the right people to fill jobs even though the country is facing its highest unemployment rates in a generation. Competition with a rising China and India and their vast populations lend urgency to the need for the country as a whole to do a better job of educating its citizens' (Christensen et al 2011: 1; see also National

¹² Toner (2011:35) has also emphasised the importance of technicians and other supporting occupations to innovation.

Academies 2010). Echoing the AIG sentiment above, Merrill et al. emphasise that: *'In education, the issue is not quantity of academic degrees but quality of talent'* (2010: 43).

The mismatch between the demand for S&T personnel suited to innovation needs and their supply by universities is an ongoing issue. In a *Science* editorial addressing the oversupply of S&T postdocs who could not find work the comment was made that: 'policies are set mainly by elders, who, like the institutions that employ them, have little incentive to downsize their operations. Instead, academic reward structures and government funding priorities tend to perpetuate the 'train more scientists' status quo' (Kennedy et al 2004: 1105. See also: Calmand 2011; Jump 2011; Rohn 2011; Alberts 2010; Lieff Benderly 2010; OECD 2006; Cherwitz and Sullivan 2002). And arguments regarding 'impending shortfalls' are often constrained by poor evidence (Teitelbaum and Cox 2007: 458; Moodie 2010a; Wheeler 2008). However, as Godin (2002: 3) has observed: 'incomplete statistics never prevented people taking a firm position on scientific and technical human resources.'

As in education more generally, the issue with respect to availability of science and engineering skills in Australia is not quantity, but quality.

Embedding innovation skills and entrepreneurial mind sets

The link between a highly skilled workforce and economic growth is well-recognised. Less well understood, but a policy priority in many countries, is the specific skills sets that are key to driving innovation and how best to develop these (OECD 2011b). And given the critical role entrepreneurs play in wealth creation, attention is also increasingly directed to ways of growing entrepreneurial talent and skills sets, particularly through the education system.

The Australian Government recently launched a research workforce strategy (DIISR 2011). Particular challenges addressed are insufficient doctoral graduates working in industry and Australia's lack of effective competition for international talent. The importance of developing 'soft/transferable skills' and innovation capabilities in university research training programs is a key part of the strategy (see also DIISR 2010a: 6-7)¹³. However, the report notes that 'the provision of such training is currently neither mandated nor explicitly encouraged' and that dialogue with employers has been inadequate about what they want (p25).

The workforce strategy includes 200 Researchers in Industry Training Awards (as part of the Clean 21 manufacturing initiative) and internationalizing a number of its scholarship and fellowship schemes. One million dollars has been committed to establish a doctoral training centre for industry in mathematics as a pilot for a new model of PhD education, designed to enhance Australia's innovation capability. However, there are existing schemes intended to promote better engagement between researchers and industry: Enterprise Connect Researchers in Business Program (2-12 months and up to 50% of salary – maximum \$50,000); the Commercialisation Training Scheme; and Commercialisation Australia (DIISR 2010b: 11).

In April 2011, the government also announced \$200,000 funding to sector bodies to conduct projects investigating best practice approaches to research education in industry linkages and researcher mobility.

¹³ In response to the Roberts Review recommendations the UK government committed £20 million per year specifically for 'Career Development and Transferable Skills Training' (1994 Group 2009)

Embedding innovation skills and mind-sets within education systems is clearly not resource - neutral and how governments and employer organizations are to share (if at all) the cost burden is not clear.

Exemplars of entrepreneurship education

The US is seen as a world leader in the provision of entrepreneurship education with the first course offered at Harvard University in 1948 (Wilson 2008:122; Brush 2003: 310). In Europe entrepreneurship education is more recent and with a focus on SMEs. In Australia it is difficult to get a clear picture of the extent and nature of entrepreneurship education. However, Swinburne University of Technology, Queensland University of Technology, University of New South Wales, University of Adelaide, University of South Australia, and University of Tasmania have reputations for their work in this area and the Australian Technology Network of Universities jointly offers 'career-enhancing skills and knowledge' through the e-GradSchool (Australia).

The World Economic Forum (WEF) believes that entrepreneurship can be taught and that 'there is a positive relationship between entrepreneurship education and the generation of growth enterprises' (2009:52). In a comprehensive report entitled: *Educating the Next Wave of Entrepreneurs*, the WEF provides examples of good practice for comprehensive entrepreneurship programs aimed at meeting 'the challenge of nurturing technology-based, high growth entrepreneurship up to the emergence of entrepreneurial gazelles' and for those in higher education sectors where 'entrepreneurship education is still in the fledgling stages'.

Stanford University and the University of Cambridge are seen as leaders in their provision of an 'integrated architecture of entrepreneurship education and technology commercialization'. For example, Stanford's Graduate School of Business has developed a successful 20 week evening program in innovation and entrepreneurship that brings together doctoral and non-business graduate students with Silicon Valley innovators, scientists and engineers 'to gain greater understanding of the pathways to commercializing innovations and to learn general management skills.' Stanford also offers a four week 'Summer Institute for Entrepreneurship' which teaches entrepreneurship to non-business graduate students in life sciences engineering and the humanities.

The Stanford Technology Ventures Program (STVP) is the entrepreneurship centre at Stanford University's School of Engineering. As part of its activities, STVP co-hosts the 'Roundtable on Entrepreneurship Education' which 'brings together business, engineering and design faculty from around the world, interested in building leading-edge entrepreneurship programs'. These conferences are held in various parts of the world.

The WEF report refers to the Australian Graduate School of Entrepreneurship at Swinburne University of Technology as a good practice example for a country where entrepreneurship education is deemed to be still at a 'fledgling stage'.

The Kauffman Foundation's Kauffman Campuses are also playing a key role in 'transforming the way colleges and universities prepare students for success in the American economy.' The campuses were initiated in 2003 with the awarding of \$5 million each to eight universities 'to make entrepreneurship education available across their campuses, enabling any student, regardless of field of study, to access entrepreneurial education.' A specific goal of the Kauffman Campuses is 'to create a cultural transformation on college campuses that results in graduates who are dynamic and risk-takers' irrespective of subject field.

The MIT Entrepreneurship Center ‘provides content, context, and contacts that enable entrepreneurs to design and launch successful new ventures based on innovative technologies. The center does this by giving MIT students, alumni, and colleagues access to an array of education programs, networking opportunities, technologies, and resources, both at MIT and around the world’ (Roberts and Eesley 2009).

Within Europe, the Marie Curie Actions in the 7th Framework Programme (2007-2013) has a range of initiatives aimed at building innovation skills and promoting entrepreneurship. These include, the Industry Academia Partnership and Pathways and the Initial Training Networks – aimed at fostering ‘Innovative Research in SMEs and Training the Next Generation of Research Entrepreneurs’. Also, through the new European Industrial Doctorates, companies are involved in doctoral training with specific objectives to ‘develop innovative aptitudes and entrepreneurial mindsets’ in graduates; ‘provide adequately trained researchers for industry needs’; and ‘enhance the research potential and competitiveness of European companies and SMEs’ (Debiais-Sainton 2011).

Similarly, the Innovative Doctoral Programmes are designed to ‘equip doctoral candidates with innovative skills (scientific and transversal). Through a range of activities the Programmes address the three core dimensions – intersectoral, international and interdisciplinary. And through ‘Knowledge Partnerships’ a pilot action has been established between businesses and higher education and training institutions. A specific priority being the creation of ‘new joint curricula and courses and to develop innovative ways of delivering education and knowledge, with a strong involvement of businesses.’¹⁴

In 2008 a survey of entrepreneurship education in Europe was prepared at the request of the European Commission (NIRAS et al. 2008). Whilst many countries were seen to have policy commitments promoting entrepreneurship, it was unclear how this was represented within the higher education sector. The survey covered six dimensions: strategy; institutional infrastructure; teaching and learning; outreach; development; and resources. The results of the survey were considered ‘worrying’ in terms of the scope of entrepreneurial education. However, 10 best practice institutions were identified. Problems and obstacles for widespread and effective entrepreneurship teaching are extensively addressed in the report.

Also, in 2008 the European Institute of Innovation and Technology (EIT) was set up as an independent body to address Europe’s innovation gap. Its 22 members come from education, research and business. And a key mission is to develop a new generation of innovators and entrepreneurs through its Knowledge and Innovation Communities (KICs). The EIT in collaboration with its KIC partners is developing Masters and PhD programmes that ‘integrate entrepreneurship, innovation and risk management content and include mobility and practical business experience aspects’. The EIT was set up with a budget of over 309 million Euros from the European Communities for the period 2008-2013.

Australia clearly has much to benefit from the experiences in the US and Europe in responding to policy challenges of embedding entrepreneurship education across all levels of formal education and creating an environment conducive to entrepreneurial activities, including the freedom to not only take risks, but to make mistakes.

¹⁴ Interestingly ABG L’intelli’agence notes that an entrepreneur is involved in defining a quality standard for the French doctorate (2008).

Conclusions

The role of innovation and entrepreneurship is expanding both economically and geographically, and our understanding of these changes and their ramifications is still incomplete. Nevertheless, if Australia is to capture the once in a lifetime opportunity provided by the transfer of economic supremacy from West to East, we must urgently tackle the missing links in the entrepreneurial supply chain from research to industry.

This will require:

- Building an entrepreneurial culture that supports risk rather than penalising failure
- Embedding entrepreneurial skills and thinking within our education system, in particular through involvement of entrepreneurs in curriculum design and learning from experiences overseas
- Ensuring the talent that we need for our knowledge intensive industries can move seamlessly between public and private sector organisations and can operate in an international context
- Moving away from supply driven training of mediocre scientists and engineers to meet industry demand for top quality STEM graduates with skills in innovation and entrepreneurship
- Leveraging the entrepreneurial potential of our immigrant population through better designed immigration policies
- Removing barriers to commercialisation within universities and promoting fluidity of movement between universities and the business sector
- Committing greater levels of funding to support mobility of S&T personnel internationally and the 'study abroad' experiences of university students
- Addressing inefficiencies in government bureaucracy that have been identified as major concerns to business leaders
- Ensuring that we are active and visible contributors to international efforts to improve measurement of entrepreneurship and its relation to innovation
- Above all we need to collaborate as a nation rather than compete

A systematic approach to these missing links will provide the basis for a comprehensive, and essential, rethink of entrepreneurship, and entrepreneurship education, in Australia.

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