**Occasional Paper**

***STI[[1]](#footnote-1) Knowledge on Tap:***

***The Structural Basis for Science, Technology and Innovation-dependent***

***Decision-making by Australian Company Boards***

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An education in science, engineering or mathematics can be a special asset for a company director. Despite widespread anecdotal views, there is little evidence that there is a severe shortage of STEM-educated directors for Australian company boards. The more important issues potentially affecting Australian company performance may be at what level major strategic issues with a significant technological content are addressed, and whether more STEM-educated professionals can be encouraged to equip themselves with the necessary experience to become valuable company directors.

**Overview**

* There is a pressing need to better understand pathways to the inclusion of STEM skills and experience on boards and board committees in Australia with a view to maintaining and strengthening capacity for private sector investment in innovation and pursuing opportunities based on new technologies.
* While STI/STEM issues are widely seen as central to company strategy and productivity growth, companies are facing an increasing range of compliance obligations which are adding to the pressure on board agendas and outcomes. This can often result in less focus on longer term strategic issues such as innovation.
* STEM-qualified directors appear to have reasonable representation on company boards ( about 33% and increasing).
* Engineers are widely sought for company director positions; insufficient may be developing the wider skills necessary to make them attractive as board appointees.
* Qualifications *per se* are not a primary determinant of director potential – rather, STEM qualifications are likely to be seen as a component of track record and an enabler of performance.
* There are concerns about the ongoing supply of STEM-qualified candidates for director responsibilities.

**The Changing Role and Responsibility of Company Boards**

Historically, innovation and ownership were closely coupled with the uptake of opportunities for ‘industrialisation’[[2]](#endnote-1). Over time, the expansion of modern corporations has changed patterns of ownership, control and responsibility for the actions of firms, including actions relating to STI*.*  Perceptions about company boards have also changed. For example, concern about the increasing size and complexity of businesses reached a peak during the 1960s with corporate control largely in the hands of managers and boards at times seen as ‘rubber stamps’[[3]](#endnote-2).

In Australia, Companies Acts across the States were becoming increasingly uniform by that time and there was growing interest in the amendment of laws to better provide for conditions relating to both shareholders and directors. These changes paralleled continuing shifts from funds concentrated on broadly understood working capital for industries to demand-driven capital for growth in firms, competitive across sectors and further separating industrial investment from wealth creation objectives as institutions (with decreasing linkage to founders) ‘necessarily commit[ted] to short-term buying and selling for immediate capital gains in the interests of their shareholders’.[[4]](#endnote-3)

A period of slowing economic growth during the 1970s created difficulties for some companies, including those that were valued by the market at less than their asset values. This led to a new pressure on boards where investors and entrepreneurs believed they could make more money from companies than management, sometimes resulting in buy-outs. Meanwhile, shareholder activism became increasingly visible in Australia during the 1990s, with increasing disclosure requirements for boards and greater voting powers for those seeking to express disapproval.

The continuing globalisation of capital markets, while aiding the development of multinational corporations has also resulted in concentrations of power among institutional investors (as owners) that enabled a resurgence of ‘proprietorial interest’ in company activities. External pressure on boards also broadened at the end of the 20th century due to growth in community activism around social issues such as discrimination and environment, and in response to some well-publicised corporate bankruptcies.

Australian Corporations Law has continued to adjust to these changes, with some harmonisation and referral of State-held powers to the Commonwealth in the Corporations Act 2001. This legislation governs corporations today and has been subject to on-going amendment, for example, in relation to financial services reform and auditor independence. Several recent amendments have been part of world-wide changes to governance rules that aim to enhance financial stability following the Global Financial Crisis[[5]](#endnote-4).

There has also been a significant expansion in other forms of state and federal legislation that impose compliance obligations of firms, in areas such as environmental performance and workplace safety. Changes have also occurred in response to recognised systemic concerns, such as mandatory reporting of gender diversity on boards and a heightened focus on financial literacy among directors.

**Innovation Performance of Australian Companies**

Currently, “the innovation performance of our businesses is poor by international standards. This is especially stark for large Australian businesses who rank almost last in the OECD on innovation. Small to medium-sized enterprises (SMEs) face higher barriers to innovation and accordingly innovate and collaborate less often. This may create a reduced likelihood of productivity growth from SME innovation despite the relatively more significant pay-off from SME innovation and its share of total economic output at 58%.”

The evidence presented in the recent Australian Innovation System Report 2012 gives a picture of “Australia as a fast-follower country. Australia is not one of the leading countries in terms of competitiveness or high proportions of new-to-the-world innovations. Although investment in innovation is growing rapidly, Australia still tends to invest considerably more in adopting and modifying the innovations of others rather than investing in more novel forms of innovation… a considerable gap remains between Australia and other advanced OECD countries…

Innovation occurs because managers of organisations make internal strategic decisions to mobilise resources, capabilities and creativity to make it happen. The data shown in this report suggests that

Australian business management capability and innovation culture is poor by international standards and may be a factor in the current productivity slowdown.”[[6]](#endnote-5)

These findings are reflected in a 2013 Australian survey, which lists ‘corporate productivity in a challenging growth environment’, strategy and execution as the top issues for 100 Chairmen and CEOs of ASX Top 200 companies in the next 24 months.[[7]](#endnote-6) The following statements were made in relation to innovation:

* ‘While 77% of Chairs and 72% of CEOs said their organisations were innovative, only 34% of Chairs and 46% of CEOs said that a significant proportion of their revenue was derived from recent innovation. Indeed, while companies saw themselves as innovative, the interviews highlighted several concerns that Australia had not been innovative as a nation.’
* ‘Both Chairs and CEOs raised concerns around innovation, such as a lack of scale, low levels of venture capital funding and changes to government tax rules.’
* ‘But what surprised us was the view that lack of innovation may be cultural. There were several references to tall poppy syndrome and cultural cringe around innovation. Many Chairs and CEOs felt that while Australian companies are good at adapting and may be incremental innovators, they have not generally been breakthrough innovators’.

Another issue of concern is that shareholder requirements are creating an unsustainable focus on short-term results with negative impacts for ‘strategy, fundamentals and conventional approaches to long-term value creation.’[[8]](#endnote-7) A recent Australian review of this issue notes that consequences can include ‘missed opportunities to create enduring value’, ‘under-investment in value-creating opportunities such as research and development’ and ‘the rejection of long-term projects … including high-tech projects’ with broader economic and societal implications being a reduction in innovative capacity and ‘distraction’ from environmental and corporate social responsibility issues.[[9]](#endnote-8)

**STI Capacity in Australian Company Boards and Management**

Investigation at the national and international level reveals a great deal of information about typical board size and composition, but almost no data on STI/STEM capacity – itself a telling finding.

Hence a review was conducted of the annual reports of more than eighty Australian companies (top 100 and beyond). This included an analysis of qualification details for more than 300 directors, which show:

* 32% of top 100 company directors with a STEM qualification in 2002, but no females;
* 36% of top 100 company directors with a STEM qualification in 2012, including 7% females;
* 21% of other company directors with a STEM qualification in 2012 , including 10% females;
* 21 of the 41 Top 100 STEM directors and 13 of the 22 various STEM directors in 2012 had engineering qualifications, a combined average of 54%.

These data suggest that there is strong participation from the STEM community in Australian company boards. There is generally a higher level of participation on the boards of large companies, but there is no apparent significant correlation with industry sector. In addition, the majority of directors with STEM qualifications also had formal training in management or a related discipline. Also, a number of major company boards have technology committees (ANZ, Westpac, formerly Cochlear), or innovation committees (Ridley Corporation).

A series of interviews with leading board recruitment practitioners were also conducted. Key findings that emerged were:

* ‘Our databases show no lack of directors or candidates with STEM qualifications’.
* Directors are not appointed because of their educational qualifications – rather, it is about ‘where you have been, what you have done, how you can help, and what connections you will bring to the company’.
* Over the past decade there has seen a trend towards searches for skills-based directors, following an audit of board skills relative to strategy – for example regulatory, audit and finance, market, supply chain.
* Boards change gradually over time and this enables the composition to be continually adjusted to match a firm’s forward priorities. This is what determines the skills and experience that are required in any new director.
* Avenues for S, T, E and M differ and opportunities may present for each, depending on a firm’s strategic direction.
* There is a demand for engineers for major engineering companies - to bring their perspective, a way of thinking, credibility. There is also a perceived shortage of senior level engineers as candidates for boards. There seem to be few engineering-qualified candidates at the top of Australian industry who are still engineering at the highest levels.
* Another category in demand is IT skills. This form of technology is on the agenda and a specific skill recognised at board level, from architecture onwards, especially given scale of investment and challenges associated with managing impacts. Chief Information Officers are an increasingly attractive pool for directorships.
* The issue of whether innovation and technology matters should necessarily be dealt with at the Board level, because of their strategic nature, or whether they a more operational matter for the executive.

A third methodology was based on detailed interviews with a range of people with wide experience of company management and governance, with a degree of focus on technology-based businesses. The following claims were made:

* Australian boards typically defer to management almost entirely in STI matters, and while there are regular processes and committees for financial management, executive remuneration and business strategy, for example, boards generally do not accept the need or responsibility for oversight of management’s performance on the STI front.
* For large companies that are technology users rather than technology sellers the main comfort the board seeks is that the technology involved in any capital expenditure for which approval is being sought has been independently vetted to ensure it is the most appropriate.
* Large company boards are very much beholden to management to keep them up to date on technology issues – boards by and large approve (or otherwise) or note papers put before them. They can question management but rarely have the expertise to second guess the experts. Directors are called upon to look at technology in a broader context, understand issues such as risk and bring to bear their wider world experience, including in many cases what they have learned from other boards they sit on.
* Primarily because of the modest scale of the Australian market in most industries, technology has not been an important driver for profit. It has always been easier to import proven technology and concentrate business investment and management on local marketing and distribution.
* The education systems of the US and Europe are more effective than the Australian education system at delivering the broad ‘formation’ process which combine an understanding of science and technology with specific management, financial or legal skills.

**The Future STI Capacity in Australian Company Boards and Management**

Importantly, there are grounds for concern that the conditions which produced the current generation of STEM-qualified directors and managers (who are likely to have trained in the 1970s) may no longer be so supportive.

First, the trend in the senior secondary and undergraduate tertiary years in Australia away from the sciences and particularly away from advanced mathematics, and the decline in Year 12 participation in biology, chemistry, physics and geology as a percentage of the Year 12 cohort since the 1970s. Furthermore, the percentages of new entrants to Australian tertiary courses in engineering/ manufacturing/ construction and mathematics/statistics, is significantly lower than OECD averages. These forces may reduce the stock of appropriately qualified people available for appointment to Boards in the future.[[10]](#endnote-9)

And finally, regarding the overall risk of declining ‘stocks and flows’ of candidate directors:

*‘Most nations are closely focused on advancing STEM and some have evolved dynamic, potent and productive strategies. In world terms Australia is positioned not far below the top group but lacks the national urgency found in the United States, East Asia and much of Western Europe, and runs the risk of being left behind*’ - there appears to be some merit in Australia sharing in this urgency.

**Conclusions**

1. On the basis of these findings, it appears that the proportion of STEM-qualified directors of Australian companies is currently broadly appropriate to their needs and opportunities.
2. However, the pressure on Boards created by the increasing range of compliance obligations, and an emphasis on responding to short-term demands may well be having the effect of limiting the time and occasions available to consider strategic STI-based issues and opportunities.
3. In addition, a greater barrier to a more innovative private sector may arise from the strong focus of Australian companies on innovations new only to the company rather than more challenging innovations new to an industry or market.
4. The current decline in STEM education enrolment has serious implications for future levels of innovation, as well as management and governance of Australian companies.
5. A useful approach to strengthening the appropriate skills of STEM graduates in order to take up senior management and Board positions might be through the provision of easily accessible training in the necessary complementary business skills.

**References**

1. The funding of this project by the Office of the Chief Scientist is gratefully acknowledged. In this paper, ‘STI’ refers to science, technology and innovation. ‘STEM’ refers to science, technology, engineering and mathematics. [↑](#footnote-ref-1)
2. von Tunzelmann, GN (1995) Technology and Industrial Progress: The Foundations of Economic Growth. Edward Elgar, Hants UK [↑](#endnote-ref-1)
3. For example, Mace ML (1971) Directors: Myth or Reality. Division of Research, Graduate School of Business and Administration, Harvard University. [↑](#endnote-ref-2)
4. See discussion by von Tunzelmann (1995), p273. [↑](#endnote-ref-3)
5. Refer <http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTGLOBALFINREPORT/> [↑](#endnote-ref-4)
6. Australian Government (2012) Australian Innovation SystemReport, p.x. Department of Innovation, Industry, Science, Research and Tertiary Education [↑](#endnote-ref-5)
7. Deloitte Touche Tohmatsu (2013) Board effectiveness: The director’s cut (4th edition) as described by Media Release 12 April 2013: Productivity trumps growth as the leading issue for corporate Australia [↑](#endnote-ref-6)
8. CFA Institute Centre for Financial Market Integrity (2008) Short-termism Survey. CFA Institute Charlottesville, VA. See also The Aspen Institute (2009) Call for a More Responsible Approach to Investment and Business Management, [http://www.aspeninstitute.org/publications/](http://www.aspeninstitute.org/publications/overcoming-short-termism-call-more-responsible-approach-investment-business-management#sthash.nWyj7HK1.dpuf). [↑](#endnote-ref-7)
9. Australian Institute of Company Directors (2013) Curbing Excessive Short-termism: A guide for boards of public companies. Thought Leadership Paper authored by L Pocock. AICD, Sydney [↑](#endnote-ref-8)
10. Australian Council of Learned Academies (2013) STEM: Country Comparisons. International comparisons of science, technology, engineering and mathematics (STEM) education. ACOLA, Melbourne [↑](#endnote-ref-9)