



NEW PATHWAYS TO PROSPERITY
A NATIONAL INNOVATION FRAMEWORK FOR AUSTRALIA

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Society for Knowledge Economics

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FOREWORD

Australia's future prosperity will depend on having an economy that is continually able to lift its productive potential and meet the rapidly changing requirements of global markets.

Australia's capacity to innovate will be an increasingly important catalyst for sustaining economic growth, capitalising on future economic opportunities and meeting the challenges presented by an increasingly connected and competitive global economy.

In broad terms, innovation can be defined as the application of knowledge to create additional value and wealth. Innovation is much more than invention, specifically it requires that knowledge is used in a way that provides benefits through additional value-add. Through the application of knowledge and technology to create new products and services and improve production processes, innovation allows us to increase our competitiveness, create high-quality jobs and achieve greater value for what we make and export. It also enables us to respond more effectively to unavoidable economic and social challenges such as the ageing of the workforce.

In March 2006, the Business Council of Australia (BCA) released its *New Concepts in Innovation* report. The report highlighted that the current framework for advancing innovation in Australia, with its focus on science and technology policy, requires broadening in order to deliver the innovation outcomes to which we aspire.

Innovation is the application of knowledge to create additional value and wealth

The report concluded that a broader, more committed effort was needed by government, business and the community. In response, the BCA, in collaboration with the Society for Knowledge Economics, sought the views of a wide range of people and organisations with a stake in Australia's innovation success, in order to develop and outline a framework for improving and sustaining our innovation performance.

In key areas, Australia has demonstrated the ability to compete with the best in the world in turning innovative ideas into high-value products and services. However, in a complex and competitive global economy, we have to ensure we have the capabilities and infrastructure to consistently convert great ideas into real economic value.

The BCA, and those with whom we have collaborated to develop this paper, considers that Australian innovation needs a clearer framework of strategic support at the government, business and community levels to make sure local capabilities are translated into leading-edge, high-value products and services.

Currently, there are areas of relative weakness in Australia's innovation system that are becoming increasing barriers to Australia reaching its full potential. To this end, we support the establishment of a National Innovation Framework built upon a clarification of roles and responsibilities, strong collaboration and strategic action between government, the research sector, business and our schools and universities.

This framework requires:

- + A national commitment to innovation through clear and aligned policy objectives that enable Australia to maximise its innovation potential.
- + New linkages, increased funding and other strategically allocated resources to bridge the current gaps in Australia's innovation system.
- + Improvement of our research and educational systems to encourage and develop greater innovation success.
- + Building of a culture in our public agencies, schools, universities and workplaces that champions innovative thinking.

The BCA and those it has collaborated with have identified the following five priorities as key ‘pointers’ to the creation of a comprehensive National Innovation Framework for Australia.

1 Recognise innovation as a critical national priority, and align efforts by governments and business to boost innovation.

In particular, set innovation as a new national reform priority for the Council of Australian Governments (COAG), and establish a new governance framework for Australia’s innovation system. A new central body, ‘Innovation Australia’, reporting to COAG, would be tasked with the responsibility of ‘bridging across silos’ and providing whole-of-government policy coordination and consistent performance assessment across federal and state jurisdictions.

2 Strengthen linkages and collaboration between all elements of Australia’s innovation system.

For example, compile an ‘Expertise Australia’ database of national research expertise to assist in identifying and building innovation networks and collaboration with industry.

3 Implement specific policy and investment measures to strengthen Australia’s research networks and institutions.

In particular, provide greater support for public research organisations, and research careers in key innovation-related areas such as science, engineering and technology.

4 Enhance policy focus and strategic investment in education and training to improve the innovation capabilities and culture of our people.

For example, institute programs in business schools and universities to build innovation management and leadership skills, with a review and development of the recommendations of the 1995 Karpin report.

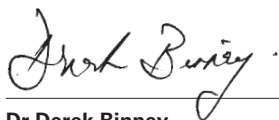
5 Undertake continuing micro-economic reforms to improve and sustain a business environment suitable for innovation.

In particular, undertake reforms to Australia’s regulatory and taxation systems and improve information and communications (ICT) technology and broadband infrastructure.

Just as a concerted and long-term commitment to micro-economic reform over the last two decades has harnessed the sources of growth in the Australian economy upon which our current prosperity is based, a concerted and long-term, strategic commitment to innovation policy by government, business and the broader community will be a prerequisite for economic success in the future.

In developing this framework the BCA believes it is important to gain the views of a wide cross-section of the community with an interest in Australia's innovation future. The BCA thanks the members of its National Innovation Framework Advisory Committee who have generously given their knowledge and time to make a valuable contribution to developing the framework, as well as the Society for Knowledge Economics, which was an important partner in the development and management of this project.

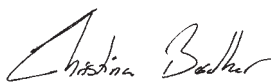
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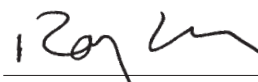
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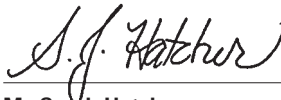
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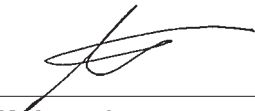
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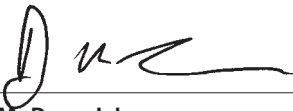
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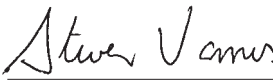
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INTRODUCTION

The future growth and prosperity of Australia will depend on its ability to find new ways to increase productivity. Australia's ageing population and the emergence of strong global competition mean that our productivity performance is increasingly important as a source of growth and determinant of international competitiveness.

While productivity has become the primary determinant of our economic prosperity as a nation, the ability to innovate has become an increasingly important factor in productivity growth. Improvements in Australia's productivity growth as a result of two decades of micro-economic reform are beginning to fade. In a global and domestic economy in which knowledge and know-how is becoming increasingly important, the way we use and apply knowledge is now as important to the value-add in the economy as efficiencies in production.

This trend is being further amplified by the changing nature of global competition, particularly from low-cost emerging economies, and the steadily increasing rate of technological change. Competing through efficiencies delivered by structural reform and competition is no longer enough for developed economies such as Australia. Instead, 21st-century economies are increasingly competing on the basis of unique value delivered through the application of knowledge in the production process and the development of new and better products and services.

The changing nature of our economic challenges is pushing to the fore the importance of innovation for future economic prosperity in Australia. That is why governments, together with the private sector, must make innovation a national economic priority. As in the 1980s when we began to recognise the importance of micro-economic reform to future prosperity, we now need to recognise the critical role that a comprehensive and strategic innovation policy will play in our economic future. This paper sets out what innovation is, why it is important and why a more focused and strategic approach is needed by Australia to capture greater benefits in the form of increased productivity and higher value for the goods and services we produce.

Governments and the private sector must make innovation a national economic priority

The paper outlines why a National Innovation Framework is needed to identify and harness the benefits of Australia's innovation potential and allow it to take a lead role in global innovation. It provides a series of integrated recommendations as critical 'pointers' the BCA believes are vital to the creation of a comprehensive National Innovation Framework for Australia. The key theme throughout the paper and its recommendations is 'collaboration'. Each agent in the innovation process brings its own capabilities and strengths to this process. Business brings the commercial know-how, capital and access to markets, educational institutions the intellectual capital and linkages, while the key input from government is policy leadership, strategic focus and overarching vision that enable these other agents and their capabilities to be 'joined together' into a coherent whole.

The BCA looks forward to further developing the initiatives outlined in the framework with government, the research sector, business, our education and university system and the broader community over the next 12 months.

EXHIBIT 1

A NATIONAL INNOVATION FRAMEWORK FOR AUSTRALIA

1 Recognise innovation as a critical national priority and align efforts by governments and business to boost innovation.

- + Achieve consensus on a broad-based definition of innovation that recognises the importance of organisational and institutional innovation as well as R&D-based innovation.
- + Federal and state governments to set innovation as a new national reform priority for COAG.
- + Establish a new governance framework for Australia's innovation system that seeks to overcome weaknesses in the current system, in particular the need to improve focus and better align policies within and between governments. This would include:
 - Establishing a new body, 'Innovation Australia', with an advisory committee of business leaders and stakeholders in innovation policy. The objectives of 'Innovation Australia' would include providing whole-of-government policy coordination within and between governments, and between governments, business and the education and research sectors.
- + Establish medium- to long-term strategic objectives and measures for Australia's innovation system. This would include:
 - Benchmarking Australia's innovation performance internationally and conducting a 'Knowledge Foresight 2025' exercise that enables collaborative planning for the future between government, business and education.
- + Investigate the feasibility of federal and state government investment fund arrangements to finance innovative activities where there are currently barriers to private sector investment.
 - The feasibility study could investigate reasons for private sector under-funding of certain innovative activities, and possible arrangements to improve funding for innovative activities such as early-stage venture development and activities that involve the creation or use of intangible assets.
 - Consideration should be given to whether Enterprise Ireland, the Finnish Funding Agency for Technology and Innovation (Tekes) or other similar foreign initiatives might be useful as models for setting up an investment agency or vehicle.
- + Ensure Australia's place as a knowledge economy through policy frameworks that allow the appropriate availability and application of ICT.
 - Increase the availability of people with the necessary skills to deploy and support ICT across industry.

1

2 Strengthen linkages and collaboration between all elements of Australia's innovation system.

- + Support 'Innovation Partnerships' between business and the research and education sectors, particularly through ensuring that publicly funded research is informed by the needs and opportunities identified by industry. This would include:
 - Examining the benefits for extending the opportunity for researchers in universities and research organisations to have a partner or partners outside their organisation when making an application for various research funding mechanisms (possibly using Australian Research Council Linkage Grants as a model).
- + Compile an 'Expertise Australia' database of all research expertise to assist in building innovation networks and collaboration.
- + Improve the knowledge transfer and commercialisation activity of universities by:
 - Supporting university commercialisation structures, including 'Shared Services Centres' for groups of universities.
 - Reviewing the intellectual property (IP) regimes of universities to improve the arrangements for sharing and transferring intellectual property between universities, businesses and the research sector.
- + Establish a national network of 'Innovation Resource Centres' for businesses. This would include:
 - Extending the range of activities supported by governments through small and medium-sized business support programs to the development of skills on how to use relationships and collaboration with other businesses to support innovation.
 - Support collaborative 'lighthouse' organisations that connect thought leaders across industry, government and the education sector to find solutions for sustained prosperity in the knowledge economy, such as the Society for Knowledge Economics and the Australian Institute for Commercialisation.

3 Implement specific policy and investment measures to strengthen Australia's research networks and institutions.

- + Provide greater support for public research organisations, as well as research careers in key innovation-related areas such as science, engineering and technology – especially through measures that allow greater movement of people between public research organisations and private businesses.
- + Include the assessment of the impact of research, in addition to the assessment of quality, in the new Research Quality Framework, with net additional research funding for demonstrated success.
- + Provide improved research infrastructure and equipment for public research organisations including through appropriate shared access arrangements.

3

4 Enhance policy focus and strategic investment in education and training to improve the innovation capabilities and culture of our people.

- + Improve participation rates in post-compulsory education and training, particularly national participation and education attainment in the innovation foundation subjects of maths, science and technology.
- + Ensure education and training systems are providing Australians with the capabilities to become innovative by:
 - Ensuring education and training systems provide students with industry-relevant technical skills, as well as capabilities associated with communication, teamwork, problem solving, entrepreneurship and leadership.
 - Developing the content for a new subject on business innovation for state and territory school authorities to include in year 11 and 12 curriculum.
 - Instituting programs in our universities and business schools to further build innovation management and leadership capabilities, with a review and development of the recommendations of the 1995 Karpin report.

4

- + Support teachers to teach and assess knowledge that contributes to innovation, particularly through professional development, such as:
 - Supporting teachers of maths, science and technology who are not yet fully qualified in those areas in studying part-time to extend their qualifications.
 - Including the teaching of employability skills as a component of all education and teaching courses for school and technical and further education student teachers.
- + Increase business focus on leading-edge innovation practice in the workplace by:
 - Improving the overall quality of leadership and management skills, particularly with regard to the innovation strategy and processes within businesses.
 - Develop workforce management 'Enterprise Partnerships' to drive innovation and productivity at the workplace by drawing more effectively on the talent and creativity of employees.
 - Increasing the level of support available for existing workers to update or upgrade skills that support innovation, including communication, technology and business skills.
- + Introduce a national post-school 'Entrepreneurs and Innovators Internship Program', allowing young people the opportunity to gain from the experience of working for a short period with leading practitioners, including those based overseas.

5 Undertake continuing micro-economic reforms to improve and sustain a business environment suitable for innovation.

- + Undertake reforms that improve the business environment in Australia for innovation, including:
 - Ensuring business red tape systems, in particular corporate governance systems, do not inhibit entrepreneurial behaviour.
 - Enhancing the quality of Australia's infrastructure systems, in particular internationally high-quality information and communications infrastructure, including broadband.
 - Developing a taxation system that encourages greater levels of innovation, and expanding financial incentives for expenditure on innovation through venture capital support, loan subsidies and income-contingent loans.

5



THE INNOVATION IMPERATIVE

Put simply, innovation means 'creating or doing new things or doing things in new or better ways' drawing on knowledge, creativity and collaboration to add value to products, services and processes. While research and development activities make a vital contribution to innovation, it is essential that we recognise, define and promote innovation across a much broader range of sectors and activities than R&D.

There is increasing recognition around the world that innovation is a key driver of the competitiveness of firms and organisations in the global economy, and the quality of both private and publicly provided services. Both the Australian Government and the federal Opposition have highlighted the importance of innovation to Australia's economic success. The *Backing Australia's Ability* packages seek to encourage innovation to 'enhance ... international competitiveness, economic prosperity and social wellbeing' (*Backing Australia's Ability*, 2001 and 2004).

As the BCA outlined in its *New Concepts in Innovation* paper released in March 2006, a new concept of innovation needs to be embedded into the national culture – in government, economic policy, business strategy, workplaces and the community.

Backed by 19 comprehensive case studies of major Australian companies that examined what makes new ideas tick in organisations, *New Concepts in Innovation* found that businesses are undertaking innovation through a variety of different activities that are highly dependent on the characteristics of their markets and industries. Importantly, the report found that innovative activity extends across all parts of a business, rather than being confined to research units.

As a result, the report argued for a realistic definition – and recognition by governments, business and the wider community – of the nature and value of Australian innovation. Such an understanding of innovation has fundamental implications for the nation's economic reform agenda.

It is now evident that the most successful societies of the new millennium will grasp the opportunities and challenges of innovation, make it their own vision of the future and translate the vision into reality through strategic focus and action. Australia must ensure that it is one of these societies.



INNOVATION AND ITS IMPORTANCE IN PASSING ON PROSPERITY

Traditionally, wealth was thought to have its source in land, labour and capital as factors of production, but with the joining of information to technology the world changed forever. This new industrial revolution has forged greater understanding among business leaders, researchers and policy-makers of the dynamic role of innovation in creating value for organisations and, in doing so, transforming the productive performance of whole economies.

Australia is currently experiencing an unprecedented boom in its commodity exports, and a reversal in the decades-long deterioration of its terms of trade, as markets are reshaped by China's entry into the world economy. Whether this boom proves to be temporary or longer lasting, the BCA has argued as part of its broad reform advocacy that Australia cannot take its current high levels of prosperity for granted. We need to make the most of our current position to make the reforms and adjustments needed to minimise potential risks to continuing growth and maximise new opportunities.

The experiences of other countries with similar advantages are instructive. Possible scenarios for Australia in coming years include the so-called 'Dutch disease', where a rise in the exchange rate associated with North Sea gas discoveries made much of Dutch industry uncompetitive. Similarly, we could follow the path of Britain in the 1980s, where, despite major economic reforms, a North Sea oil windfall was squandered on domestic consumption.

Alternatively, we could look to Norway, which has leveraged its oil wealth for strategic investment in research, education and infrastructure. Norway is following the example of countries that have sought competitive advantage through knowledge-intensive products and services.

Innovation transforms the productive performance of organisations – and economies

Many of these are small economies on the periphery of larger markets. They include: Finland, now a world leader in mobile telephony and related technologies; Ireland, whose success is based on integrating global investors with local supply chains to build a presence in software, pharmaceuticals and medical devices; Taiwan, with its formidable and continuously improving manufacturing capability in electronics and semiconductors; and Singapore, which is reinventing itself as a trade, investment and financial services hub for the Asia-Pacific region.

Other successful knowledge-based economies may be larger, but one of their key strategic advantages lies in geographically concentrated clusters of skills and technologies, which drive an increasing share of growth. Examples from the US have included Silicon Valley; the Carolinas 'Research Triangle'; Minnesota's 'Twin Cities'; Austin, Texas; and, following the exit of computer hardware, the remarkable emergence of a Massachusetts biotech region. From Europe, examples include biosciences clusters in Cambridge and Munich; digital media in south-east England and Flanders; and French 'competitiveness poles' such as Grenoble and Sophia Antipolis.

While these economies are diverse and complex, with distinctive systems of governance and public policy, there is arguably a common thread in their success – investment in human capital as part of a broader research, technology and innovation framework that provides a favourable business environment for innovation and enables knowledge diffusion. It is this strategic policy focus, through a mix of government, business and educational institutions, which creates innovation capacity at national and regional levels. This capacity underpins the development of more specific innovation capabilities at the organisational level, where it influences growth, employment and competitiveness.

Investment in human capital as part of a broader innovation framework that provides a favourable business environment is essential to innovation success

EXPANDING THE BOUNDARIES OF INNOVATION

Innovation can only be understood in its totality as a combination of different but interrelated elements contributing to the development of new, commercially relevant products and processes, or the delivery of better, more cost-effective services. It ranges from what Clayton Christensen calls 'sustaining' or incremental innovation, by improving the performance of organisations, to 'disruptive' innovation, which creates whole new markets. While the innovation pathway may proceed along a conventional 'linear' route from scientific discovery to exploitable invention, and then to market, this tends to be the exception rather than the rule.

As the BCA's *New Concepts in Innovation* report highlighted, innovation is both a more complex and much broader phenomenon than traditional views focused on R&D and paradigm-changing technologies, although these remain very important. Essentially, innovation has at least three main elements: technological, organisational and institutional.

Technological Innovation

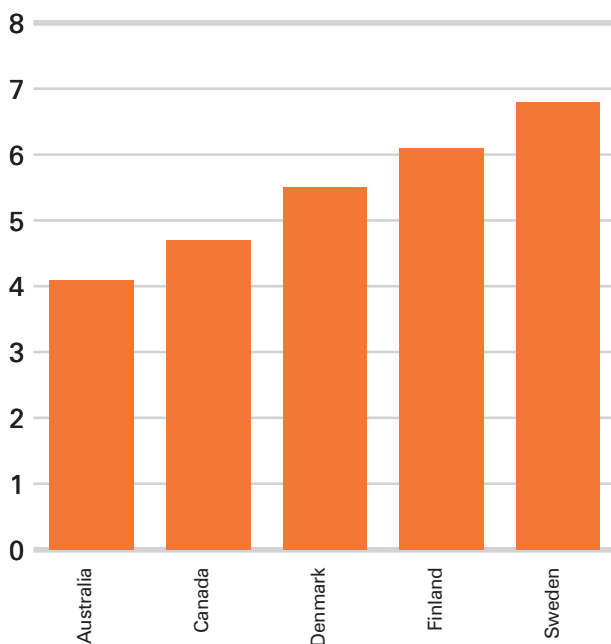
Technological innovation is often identified with the formal, codified knowledge arising from basic research in science and technology and its application to product and process development. In this sense, it can be measured by the output of scientific papers and patents, and a strong correlation with public investment in research and education is suggested by the international data. However, such innovation may also reflect continuous improvement in technology, which results from an internal focus on quality and externally from a broader process of networking and collaboration, including with customers and suppliers. Such activity is more difficult to quantify.

Australia has always compared well in scientific output, but a lower proportion of investment in education and research as a proportion of GDP when compared to other developed nations threatens this achievement. There are also serious gaps and weaknesses in our R&D performance and in the transfer of knowledge to markets by industry and public research organisations. While technological innovation in Australia has been stepped up in the past decade, so has the performance of the rest of the world, and in many countries at a faster pace. According to OECD data for 2004–05, Australia spent 1.76% of GDP on R&D, lagging the OECD average of 2.26% and far short of leaders such as Finland (3.5%), Japan (3.13%) and the US (2.68%). While R&D may not be a comprehensive performance measure, it is an important indicator of levels of technological innovation.

ABS data points to a 25% increase in higher education expenditure on R&D to 0.48% of GDP in the two years to 2004, which is still behind leaders such as Sweden (0.88%, 2003) and Canada (0.73%), but a clear improvement. On the other hand, the modest increase in business expenditure on R&D to 0.95% of GDP in 2005 compares much less favourably with the position in Sweden (2.95%), Finland (2.46%), Japan (2.36%) and Korea (2.01%). Aggregating expenditure on R&D, higher education and software into an index of 'investment in knowledge', OECD data shows Australia (at 4.1% of GDP) trailing comparable countries, including Canada at 4.7% with a similarly substantial resources sector, Denmark at 5.5%, Finland at 6.1% and Sweden at 6.8%.

The structure of Australian industry, with a large services sector, smaller scale manufacturing operators and a significant resource base, may provide a potential explanation for Australia's low business R&D expenditure. However, R&D is an important input into the innovation process in the mining and agricultural sectors, and increasingly so in services industries. Not only does it generate new technologies, even in 'low-tech' industries, it also drives competitive advantage by increasing the absorptive capacity (i.e. the ability to absorb knowledge and technology) of firms and organisations. We should be concerned if Australia's business R&D intensity is substantially less than its international competitors.

FIGURE 1: INVESTMENT IN KNOWLEDGE (R&D, HIGHER EDUCATION, SOFTWARE), PERCENTAGE OF GDP, 2002



Organisational Innovation

Clearly, as can be seen for the case of technological innovation, not all knowledge is codified and measurable, and nor does innovation always embody R&D in new products and processes. The second element of innovation is organisational innovation, where knowledge and learning may be tacit as well as codified, and has the capacity to transform organisations through adaptation and absorption of new technologies, introduction of new operational processes and implementation of new workplace structures and practices.

Significantly, a recent survey by the ABS and the Department of Industry, Tourism and Resources (DITR), *Patterns of Innovation in Australian Businesses* (2006), found that non-R&D spending accounted for over two-thirds of total business expenditure on innovation. While most innovating firms reported changes that were 'new to the business' rather than 'new to the world', research suggests that organisational innovation can result in substantially improved performance through structural flexibility and agility, high-performance workplaces and good practices associated with new product and service development, quality and supply chain management. This applies equally to organisations within the public sector. The organisational challenge, identified in the innovation management literature, is how to do two things at once: how to be 'ambidextrous' – to explore and exploit, to be fluid and organic and structured and systematic.

There is support for this approach in IBM's 2006 global CEO survey, *Expanding the Innovation Horizon*. While CEOs continue to place more emphasis on technological innovation, according to the survey they now focus 30% of their efforts on organisational innovation, particularly changes in their business models. Further, 'companies that have grown their operating margins faster than their competitors were putting twice as much emphasis on business model innovation as underperformers'. In this context, CEOs identified 'organisation structure changes' and 'major strategic partnerships' as key features of business model innovation.

Innovation can transform many practices at the organisational level

Institutional Innovation

Firms engaged in innovation clearly do not operate in isolation from the external economic and policy environments. Innovating firms benefit from structured collaboration, technology spillovers, networking and knowledge diffusion, where the boundaries of the extended enterprise become less easy to draw. Recent research has highlighted the emergence of 'open systems' approaches to innovation, including increasing engagement with the innovative feedback loop generated by customer engagement. In Australia, a recent DITR (2006) analysis, *Collaboration and Other Factors Influencing Innovation Novelty in Australian Businesses*, found that firms that collaborated for innovation had a much greater chance of achieving a 'new to the world' degree of novelty, especially in technology-intensive sectors.

Internationally, a Frost & Sullivan (2006) research program, *Meetings Around the World: The Impact of Collaboration on Business Performance*, supported by Verizon Business and Microsoft found that 'collaboration works in conjunction with strategic orientation and opportunities inherent in the market environment ... to improve business performance', and that collaboration was more than twice as significant for performance than several other factors.

This is why the external environment of innovating firms is necessarily shaped by the third element of innovation: institutional innovation. Successful and emerging knowledge-based economies are typified by 'national innovation systems', which have been defined by Richard Nelson as a 'set of institutions whose interactions determine the innovative performance of ... national firms'. These institutions support not only the internal capabilities of firms and organisations but also the interrelationships that allow them to realise their full productive potential. International comparative studies by Michael Porter and others suggest that national innovation capacity generated by systems of innovation – including research, education and networking infrastructure – is as important as internal technological capabilities in driving competitiveness.

**Institutional innovation
helps companies to
realise their full
productive potential**

AUSTRALIA'S INNOVATION SYSTEM – WE CAN DO BETTER

Australia's efforts to create a coherent and effective national innovation system have made insufficient progress. The Australian Government report, *Mapping Australian Science and Innovation* (2002), restated 'the importance of strengthening our ability to generate ideas and undertake research, accelerating the commercial application of these ideas, and developing and retaining skills'. *Backing Australia's Ability* (2004) emphasised 'the complex nature of innovation and the importance of the people, linkages and interactions between the different system elements'.

Australia's national innovation system has pockets of excellence, such as the CSIRO and its National Flagships Program, the various Cooperative Research Centres, and sector-specific R&D institutions such as the Australian Centre for Minerals Extension and Research (ACMER). But the effectiveness of this system is compromised by the lack of innovation policy alignment and 'joined-up thinking' in government, public agencies, business and universities, as much as by funding deficiencies (OECD report on *Governance of Innovation*, 2005). These key agents or 'actors' in the innovation system (see Figure 2) must have a shared understanding of their role and interrelationships as well as a willingness to collaborate for the system to deliver results and to build innovation capabilities at the level of individual firms and organisations.

For example, if there was a substantial increase in research funding for priority areas of science, engineering and technology, how would resulting inventions and disclosures find their way to market as products with commercial potential? By what mechanisms and linkages would partnership opportunities between business and universities be maximised? How would infrastructure and expertise be deployed for intellectual property protection, licensing arrangements, equity stakes and spin-offs? The UK's Lambert Review of Business–University Collaboration (2003) noted the additional challenge of not only increasing the supply of commercial ideas from universities into business but also raising 'the overall supply of demand by business for research from all sources'.

Australia's national innovation system is compromised by the lack of innovation policy alignment and 'joined-up thinking' across government

At the strategic level, there is little understanding of the long-term advantages conferred by a comprehensive innovation system that promotes both the generation and systematic application of knowledge within and across sectors. There is no strategic vision for Australia's role in the global innovation system. While Australia faces a huge challenge in becoming a significant global 'technology maker' in its own right, research (such as *No Simple Solutions: How Sectoral Innovation Systems can be Transformed*, 2005) suggests that Australia is a successful technology integrator – adding value to existing products and services and creating new ones by providing business solutions. There needs to be a more strategic approach to emphasise and capitalise on this role through a comprehensive policy focus.

At the operational level, innovation agencies in Australia do not have the support or funding linkages to allow them to emulate the role of their counterparts in other countries, such as the Fraunhofer institutes in Germany, Finland's Tekes and the highly effective Enterprise Ireland. These agencies work with business and public research organisations to identify and evaluate opportunities and then to exploit them in a systematic way, from 'proof of concept' stage to commercial application, including opportunities for business and technology integration. In some cases, these agencies also support technology transfer and commercialisation to ensure research funding is used for public benefit, either individually or on a 'shared services' basis as in Switzerland, Israel, Midlands in the UK and the University of California system (Cunningham and Harney 2006), and to encourage universities to become 'innovation hubs' for business networks and clusters. Public agencies of this kind are part of the new emerging technology and innovation infrastructure of 'innovation intermediaries' (Dodgson, Gann and Salter 2005).

While this paper does not necessarily advocate the establishment in Australia of institutions identical in structure and function to these overseas organisations, it is important to recognise that Australian innovation agencies currently do not have the capabilities or mandates to perform similar roles in the Australian innovation system.

BUILDING BROADER INNOVATION CAPABILITIES

Given the strategic and operational deficiencies of Australia's current innovation system, it is important to ask what our innovation system should be designed to achieve.

Ultimately, the purpose of a national innovation system is to transform knowledge and resources into dynamic capabilities at the level of firms and organisations, which are then better placed to contribute to the innovation performance of the economy as a whole. Integral to this process are three key innovation drivers: a business environment conducive to innovative activity; building education and training systems to provide people with skills to become innovative; and enabling collaboration and diffusion of knowledge between different sectors of the economy.

A national innovation system transforms knowledge and resources into dynamic capabilities

The Business Environment

Innovative capabilities are strongly influenced by the business environment in which firms compete and innovate. The BCA's *New Concepts in Innovation* report highlighted the critical importance of policy frameworks that affect this business environment. These frameworks include general macro-economic policy settings, competition policy, regulatory frameworks, infrastructure systems, workplace relations frameworks and taxation policy.

The report highlighted business concerns that many of these existing policy frameworks are inhibiting innovation in Australia. For example, firms expressed increasing concern that the overall regulatory environment in Australia is reducing their desire to engage in entrepreneurial risk and affecting their ability to transform their businesses.

The poor state of the nation's infrastructure assets was also raised as an inhibitor to innovative activity in Australia. In particular, continued focus needs to be placed on further developing a quality broadband system in Australia with comprehensive access. Various aspects of the taxation system that failed to adequately support business innovation expenditure and acted as a constraint to the attraction and retention of skilled workers were also highlighted.

These findings emphasise the importance of continued efforts by governments to undertake economic reform to provide the type of business environment in Australia that encourages and enables innovative activity among firms, and the vital nature of such reforms to successful innovation policy.

Importantly, research indicates that ICT has contributed significantly to improvements in productivity and GDP growth over the last 15 years. Policy frameworks need to ensure the appropriate availability and application of ICT in Australia to support our position as a knowledge economy.

Human Capital

A focus on economic reform, however, is not sufficient to provide businesses with the capabilities to perceive innovative opportunities and respond. The development of world-class innovation capacity requires as its precondition a national commitment to invest in human capital and infrastructure, including schools and universities, vocational education and training and provision for life-long learning. Such an investment will ensure a skilled and adaptable workforce, ready to meet the challenge of innovation and change. Such an investment should also be directed at building a more entrepreneurial culture that encourages new ideas and risk taking.

While Australia performs well on some education and training indicators, we must remain vigilant in ensuring that our education and training systems have sufficient resources and effective frameworks to maintain and improve the innovation capabilities of our people. According to an independent working group for the Prime Minister's Science, Engineering and Innovation Council (PMSEIC), China and India, as well as the US and Europe, are increasing the rate of investment in human capital as a matter of priority: 'Today we stand at the brink of a new era – investing in our education and research base now will create opportunities to build a technology-based Australian economy that is internationally engaged.'

A key priority for a national innovation framework is the development of education and training systems that provide people with the capabilities to contribute to innovation success. Research suggests not only the importance of the development of strong technical skills in the workforce but also those associated with communication, teamwork, problem solving, entrepreneurship and leadership.

However, there is evidence to suggest that education and training systems are not meeting the innovation needs of industry. For example, the Allen Consulting report, *World Class Skills for World Class Industries* (2006), found that many employers have difficulty recruiting employees with appropriate levels of 'soft skills'.

Furthermore, the importance of management skills associated with managing knowledge and innovation within organisations is being increasingly recognised.

Education and training systems provide people with the capabilities to contribute to innovation success

Knowledge management entails the development, tracking, measuring and sharing of intangible assets, particularly the knowledge and expertise employees may apply to products and services, and to the operations of the organisation itself. A recent OECD report, *The Significance of Knowledge Management in the Business Sector* (2004), identified key knowledge management practices as:

- (1) creating a knowledge sharing culture,
- (2) incentives policy to retain employees,
- (3) alliances for acquiring knowledge, and
- (4) written knowledge management policy.

The study found that these practices were becoming more widespread internationally, and that a clear association could be observed between such practices and innovation and productivity, though not one that is well researched or understood. A recent Economist Intelligence Unit (2006) world-wide survey of executives and managers found that most identified knowledge and innovation management, in preference to areas such as marketing and product development, as the source of the greatest anticipated productivity gains over the next 15 years.

Evidence suggests that Australian managers need to better develop their innovation management skills. A new international survey of manufacturing firms conducted by Mark Dodgson and Peter Innes for the Australian Business Foundation (2006) concludes that in relation to the local sample that 'while there is evidence of manufacturers engaging in some innovative business practices, especially towards achieving production efficiencies, they generally fail to appreciate and employ innovation as a decisive competitive strategy.'

The success of Australia's national innovation system will increasingly depend on the quality and relevance of capabilities at the organisational level.

Accordingly, as workplaces become more flexible and responsive in a changing competitive environment, the emphasis of economic reform will need to evolve to a new stage – the leadership and management of Australian organisations, and the educational infrastructure and programs required to support the development of innovative capabilities within organisations.

Collaboration and Knowledge Diffusion

As noted above, the level of effective collaboration between businesses and universities and research institutions and more broadly between the private and public sectors is of fundamental importance to innovation success. It is now widely accepted within business that the main sources of innovation are likely to come from outside the organisation. As noted by Howard (2005), 'access to new knowledge through networks is recognised as an important way of accessing and acquiring new ideas, insights and technologies for new products and services, for new approaches to business processes (both within and between businesses), and new ways of responding to consumer behaviour and wants.'

While Australia has benefited from examples of highly effective collaboration, there continues to be considerable scope to improve the level and quality in all sectors – in particular between industry and public sector research institutions and universities. The 2003 ABS Innovation Survey found that only 27% of innovating businesses in Australia were involved in any form of collaboration or alliance. Furthermore, only 6.5% of innovating businesses had collaborative links to universities, governments or research institutions.

A DITR–DEST (2005) report on collaboration and commercialisation of research in the Australian science industry highlighted that the main institutional impediments to more effective collaboration in Australia remain a poor alignment of public research with industry needs, poor interaction between industry and researchers, and high costs associated with transferring IP from the public sector to industry. Similar factors were also identified by the BCA–Australian Vice-Chancellors' Committee report, *Building Effective Systems for the Commercialisation of University Research* in 2004.

Measures aimed at more effective collaboration between sectors of the economy need to be viewed as a priority for a national innovation framework. In this respect, organisations such as the Australian Institute for Commercialisation and the Society for Knowledge Economics (established with the support of Westpac, Microsoft, CPA Australia, the Institute of Actuaries and the Australian Government Information Office) that bring together thought leaders across the public and private sectors have a vital role to play in driving discussion, insight, and collaborative recommendations that can advance Australia's productivity and sustain prosperity through knowledge and innovation. Such organisations represent a new model of working in a highly collaborative, technology-enabled world for the common good of a knowledge-based economy. However, this increasing collaboration at a business and thought leadership level underlines the importance of government playing a more proactive role in developing innovation policy and encouraging stronger linkages between the important agents of innovation.

THE WAY FORWARD TO A NATIONAL INNOVATION FRAMEWORK

Innovation has been encouraged and supported by governments and business in recent years. But despite its growing importance to sustainable growth and competitiveness, it has not been treated as a key priority for the nation.

In the public policy settings required to encourage innovation.

The challenge of innovation is not just for the innovators but for the whole range of stakeholders in a modern and prosperous economy, positioning itself for long-term competitive success in global markets. These stakeholders include government, research and educational institutions, business and individuals. According to *Backing Australia's Ability* (2004), 'People and their interactions are critical in innovation. Collaboration increases the 'interconnectedness' of the system, providing more and varied pathways to use and the marketplace'. It must be accepted and understood that all have a part to play in building innovation capabilities at the organisational level and, as a result, delivering high performance across Australian industries and services.

The priorities outlined in the National Innovation Framework are underpinned by the need for a clearer understanding of roles and responsibilities around building Australia's innovation system and capacities, including at the state and regional levels. The framework and its recommendations recognise that only with a clearer understanding of these roles and responsibilities will a sustained and strategic effort to improve our innovation capabilities be possible.

In summary, these roles and responsibilities are:

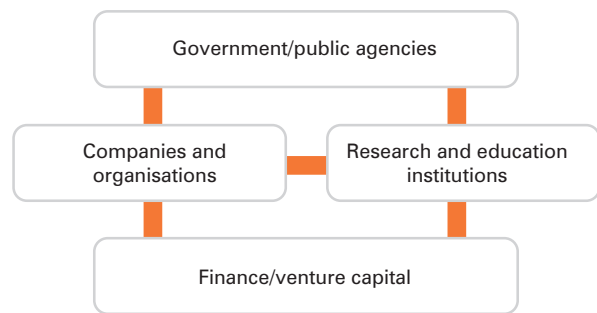
+ **Governments** have responsibility for establishing, prioritising and leading the development of key elements of the national innovation system. Because the effectiveness of the framework is dependent on collaboration and coordination, the role of government is critical in creating environments that remove bureaucratic barriers to collaboration and promote strategic policy objectives and initiatives that facilitate the linkages needed to bring innovation to the marketplace.

+ **Research and education institutions** must prepare graduates for a labour market that values knowledge and skills, identify research with commercial application and join innovation partnerships. They, too, have an important collaboration role, at an intellectual, technological and cultural level.

+ **Business** must develop innovation capabilities internally and in collaborative networks and clusters, so that knowledge may be deployed as a source of competitive advantage, and create workplaces that enable people to innovate to their potential.

+ **Finance and venture capital** is vital for innovation success in Australia. Both the government and the private sector play a role in ensuring sufficient access to capital resources for innovative activities. We need to address issues and determine appropriate roles for both sectors in areas where there is currently a lack of investment in innovative activity.

FIGURE 2: THE NATIONAL INNOVATION SYSTEM – ROLES, RESPONSIBILITIES AND LINKAGES





CONCLUSION

Harnessing our innovation potential is vital if Australia is to build on its current advantages and sustain prosperity in the long term.

Continuing success in the global economy, on which Australia now increasingly relies for jobs and investment, will depend on Australia's ability to compete with other economies on the basis of value delivered by innovation in the production of goods and services. Innovation is a key driver in lifting productivity. Australia becoming a more innovative economy is critical if we are to continue to improve our standard of living and competitiveness.

Australia needs to elevate innovation development to a position of high policy priority. Business obviously has a critical role, as do education, university systems and the research sector, in producing the intellectual and market outcomes for successful innovation. But ultimately it is governments that bring the direction and means to facilitate the systems and structures that maximise the potential and opportunity for these intellectual and market processes to occur in a sustained way. The National Innovation Framework outlined in this paper is an important step in recognising the importance of clarifying and joining these roles and responsibilities into a coherent and sustained innovation system.



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