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Twenty-Five Years of Reviews: The Evolution of Australian Innovation and Industry Policy

A PUBLIC POLICY NARRATIVE

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SUMMARY

The issue

In 1995 a researcher at the Parliamentary Research Service observed (James, 1995)

> Creating an Innovative Australia
>
> Australia requires a regeneration of skills and expertise in finance, marketing, engineering, management, distribution and service. These have been eroded by many decades of isolation from the rest of the world. The catch-up period will be traumatic both for individuals and enterprises, but, at least a start has been made and the signs of change are evident. S&T assists and services national needs and objectives and so requires substantial ongoing support to help the nation. We have many capabilities, such as in biotechnology, environmental science, high-tech engineering, and process technologies. These involve many disciplines, organisations and professional groups. A coordinated strategy will best suit such efforts and current programs represent a start in this direction (p.16).

Looking back from 2018 the question must be asked "how far have we come?" It seems that instead of progressing we keep making starts. The Cooperative Research Centres program, initiated five years before the above observation, and the R&D Tax Incentive (10 years before) are the only substantive S&T support programs that have stood the test of time. Instead, the period is dominated by a landscape of announcements, policy statements and reviews and further announcements - rather than a thread of continuous S&T support. Support tends to be announced in 'funding programs' rather than a commitment to strategies enshrined in a long term vision. This may change with the 2030 Strategy announced this year (Innovation and Science Australia, 2017b).

At conclusion of World War II the Government released an Economic White paper, Full Employment if Australia that foreshadowed, among other things, a movement from a wartime manufacturing sector to a civilian one built around self-sufficiency and import replacement supported by tariff protection and quotas.

Because of Australia's lack of a strong manufacturing base it was considered to be a 'developing' economy with a 'mix' of public intervention for delivery of infrastructure and market drivers for the growth of subsidised 'infant industries'. Public investment in infrastructure was supported by access by state governments to concessional loans through the Australian Loan Council.

For 25 years Australian manufacturing industry survived under government protection. There was little evidence, however, that any of the protected industries were on track to grow into mature and globally self-sustaining industrial sectors characterised by superior levels of efficiency, quality, productivity, research and development, and innovative governance and management. A culture of protection became embedded. Similarly, in agriculture, the sector was characterised by a strong government presence though statutory marketing boards, extension services and subsidies. A commodity culture also became embedded.

With the oil shock and ballooning public sector deficits in the 1970s Australia entered a period of stagflation. A courageous decision to cut tariffs by 25 per cent in 1973 was not followed by further efforts to move industry away from a culture of protection. The economy was cushioned to some extent with the resources boom at the end of the decade. The 1980s were characterised by efforts to retain industrial peace and initiation of moderate adjustment plans under Industry Minister John Button.

In the early 1990s the Government committed to a process of microeconomic reform and adjustment, but the momentum was largely lost at the change of government in 1996. For the next 10 years industry policy proceeded under the cloak of innovation policy but the necessary adjustments that would lead to productivity improvement and entrenched global competitiveness were glossed over. Policy was dominated by a 'market centric' approach of small government and trust in private enterprise and easy options available with revenues from the mining boom and sales of public enterprises (e.g. Telstra).

From 1996, in the absence of a clear and overarching vision for Australia's economic future, there was a view among Ministers and policy makers that something needed to be done – but no-one was clear on what it should be.

It was during this time that Australia developed a largely piecemeal approach to innovation and industry policy around commissioning reviews, issuing policy statements, and committing to expenditure programs that rarely exceeded the forward estimates period (four years).

There were no less than 40 such documents over the period 1997-2007 which, from an industry and innovation policy perspective, showed very little consistency. They tended to come from different perspectives – business, science and research, higher education, vocational education and training, trade – with very little cross over. There was no overarching vision – only confusion. From an industry development perspective it was a lost decade.

The following five years (2008-2013) can be characterised as 'policies, strategies and reviews everywhere'. Over 40 policy, strategic and review documents made it to the public domain. But there was very little attention given to the ongoing need for industry restructure, change and removal of a of a culture of protection embedded in the business landscape. This oversight has mean that Australian industry has been ill prepared for the forces of global competition and competitiveness that have gathered strength over the last five years.

During the period 2013-15 innovation and industry policy were largely off the policy radar. The period did see the removal of expensive and wasteful subsidies for an 'old economy' steel industry and an automotive manufacturing sector, producing 'commodity cars' for consumers who no longer wanted them.

The period 2015-2018 can be characterised as 'innovation reinvented', but it may have been too little too late. During the 2016 election innovation became linked to job losses and there was a failure to develop a message about the socio-cultural aspects of innovation. Innovation is being seen as something to do with startups and venture capital, and while this may be true, there has been a risk of overlooking the broader impact of an innovation imperative throughout the economy, industry, and society.

Innovation is being driven and enabled by the pervasive impact of digital technologies - computing, analytics and data science. These are the foundation for other technologies such as animation, augmented and virtual reality, artificial intelligence, robotics, machine learning, and biometrics.

Innovation will also be informed by creativity and ingenuity and cannot be relegated to something that is only of interest to scientists and engineers. Innovation must be seen as inclusive across the economy and society, and its adoption must be part of a vision for Australia's future.

About this paper

This paper started off as an inventory and a brief commentary on innovation policy statements, reviews and reports undertaken by, or commissioned for, the Commonwealth Government over the 25-year period – from 1993 to 2018 – and which are on the public record[1]. It covers reviews and reports in the broad field of innovation, science, research, technology, and tertiary education. It followed from a list published in the Report for the Senate Innovation System Inquiry, *Australia's Innovation Future*, that identified and listed 60 reports and papers (Green and Howard, 2015a)

In providing assistance to the Board of Innovation and Science Australia (ISA) in the preparation of the 2030 Innovation Strategic Plan, *Australia 2030: Prosperity Through Innovation* (Innovation and Science Australia, 2017b), it was through useful to undertake a more detailed and in-depth analysis of the

[1] Comments are sourced from primary sources as well as various citations, including http://www.voced.edu.au/

industry and innovation policy history as a *policy biography* that chronicles the actions of policy makers in the development, implementation, review and renewal of innovation and industry policy.

For the purpose of the biography, the actions of policy makers are reflected in policy statements, commissioning of reviews, and release of reports into the public domain. It presents a *public administration* perspective drawing attention to matters concerned with strategies, structures, and resource allocation arrangements intended to achieve outcomes and results. The biography refers to the *political* processes that determine the strategies, or policies on which implementation and delivery is based.

The biography adopts the starting position that innovation is, quite simply, ideas successfully applied. Innovation policy is directed towards the nurturing, application and use of new ideas.

Our economic system is predicated on the notion that *entrepreneurs* adopt and apply new ideas and insights to sell more goods and services to customers. Innovation policy currently reflects an orientation towards the adoption and application of ideas that come from investment in public science. Current research indicates that recent disruptive innovations are closely connected with knowledge generated through investments in public science. But the connections are complex and "non-linear".

Policy domains

Innovation is a key component of industry policy. *Industry policy* is concerned with actions to stimulate growth, employment, and lift productivity in specific industrial sectors. During the period under review innovation policy and industry policy became disconnected. Industry policy was associated with protecting jobs through subsidies and government handouts. Innovation policy sought to draw on *innovation systems* analysis that created a research-business-government link and became a much more palatable platform to promote industry growth. Innovation and productivity became inextricably linked.

Innovation is a policy domain that connects to other policy domains including, but not limited to:

- Science and technology policy
- Research policy
- Intellectual Property policy
- Education, training, and skills policy
- Enterprise development and business maintenance policy
- Digital economy policy.

It is rare to find all of these domains combined into one area of policy responsibility[2].

In some discussions innovation policy is conflated to include some or all of the domains, even to the extent, for example, that "science, technology and innovation (STI) policy" are considered to be one and the same. They are of course linked, and it is well known that science is an important sources of ideas for innovation, and technology is often critical to bringing ideas to fruition, but ideas are sourced from multiple sources not least of which are the insights and creativity of human beings. Some of these people may be scientists and engineers, but they may also designers, architects, and artists.

Fortunately, the connection between Art and Science, a feature of the Industrial Revolution is now being recognised again in some areas of policy.

There is now a well-entrenched argument that investment in science and research (research and development) will lead to productivity improvement and, in turn, industry development and economic

[2] This occurred briefly between 2011-2013 with a Minister responsible for "Industry, Innovation, [Climate Change], Science, Research and Tertiary Education".

growth. Research indicates that this is the case, *over the longer term*. Of course, investment in R&D also addresses a number of other outcomes which are well known but very difficult to measure.

Innovation has tended to be associated with *manufacturing industry* policy – a specific sub-category of industry policy. But manufacturing accounts for only 10 per cent of the Australian economy. It follows that innovation policy must have a broader remit across industry sectors. Innovation, as the application of new ideas, is present in a range of other production oriented policy domains – for example:

- Defence innovation – the source of many ideas that have broader industrial application
- Rural Innovation – covering rural industries across the research-production-marketing-distribution value chain
- Financial system policy
- National infrastructure policy (covering civil construction, transport, communications, logistics)
- Minerals and Energy policies
- Health and well-being policies
- Social policies for inclusive growth
- Environment, biodiversity, and sustainability policies
- Urban policy, including human centred design

Each of these policy domains falls with the responsibility of different Ministers and departments. Some, but by no means all, have a specific innovation focus. There are some connections but operations typically run in the siloised environment of Public Administration practice.

A search for policy coherence

There is an argument that specific innovation policies are unnecessary in a market centric economic context. Many economists argue that entrepreneurs will make wealth creating innovation investment decisions in supportive macro-economic and micro-economic policy contexts. According to this view "the best thing that governments can do is get out of the way". This perspective is coming under increasing challenge from research that looks at high performing regions and firms and a growing interest in inclusivity as a key value in innovation and growth (Best, 2018, Mazzucato, 2015, Jacobs and Mazzucato, 2016).

Over the last 25 years the assignment of policy responsibilities and accountabilities to Ministers and portfolios has been the subject of continuous change and evolution. This has created an environment of short term outlooks and significant policy instability.

It is seen in a continuous stream of policy statements, new (and re-badged) initiatives, reviews and evaluations. Fragmentation and discontinuity are now frequently used adjectives.

It has also seen a dissipation of organisational and loss of policy talent as functions shift backwards and forwards between portfolio jurisdictions in machinery of Government changes. The expression having been "MoGed" has entered the popular Canberra bureaucratic lexicon. This organisational instability has not been good for developing effective innovation policy.

There has also been an ongoing re-alignment of roles and responsibilities between the Commonwealth and the States/Territories with the Commonwealth taking a greater policy interest and funding responsibility in areas that have traditionally been a State preserve. Since 2000, State Governments have embraced active innovation policies. Several State Governments are of the view that their policy capability now surpasses that within the Commonwealth.

The Australian situation varies significantly from the US and the UK, where there has been relatively stability in the Machinery of Government, and in the unitary European and South East Asian nations that are so often the seen as benchmarks for Australian innovation performance.

After examining 25 years of policy statements, reviews and inquiries for this Paper, it is apparent that in the present policy and public administration environment innovation policy will be, at best, an amalgam, or aggregation, of policy positions taken across a number of distinct and largely independent policy domains that fall within the responsibility and accountability of more than a dozen different Ministers and departmental advisers. Achieving any form of coherence in this complex environment is

a major challenge. It would require exceptional leadership a commitment to policy collaboration and a strong focus on the future.

The evolution of Innovation policy is thus a story in Public Administration and Ministerial reshuffling as new governments come to grips with what they want to try and achieve in narrowly defined policy areas whilst largely ignoring cross sectoral connections and interactions. Inevitably, innovation policy is subsumed into economic policies that carry a catchcry of "creating jobs", which is assumed to have strong electoral appeal. This means not getting too far outside mainstream macro-economic policy and strategy. Even the commitment to micro-economic reform has waned in recent years.

The perspective taken in this Paper is that Innovation policy should set out to promote innovation across all industry sectors, all organisations, private, public and social, and in laws, rules, and administrative processes and procedures.

Innovation should seek to simulate inclusive growth through greater investment in (and take-up) of ideas, stimulation of creativity, and defining new vocational and lifestyle opportunities. The jobs of the future will have a strong human creativity element.

The major policy domains that form the major focus of this paper are:

- Economic and industry policy
- Innovation policy (where specifically defined)
- Science and Research Policy
- Education, training and skills policy
- Trade and Foreign investment policy.

A significant gap in this policy portfolio is the absence of a robust and *information and communications technology policy* capable of driving the modern day digital economy and digital transformation across business, government, and the broader community. Responsibilities have sat uneasily in statutory authorities and portfolios with poor connectivity with the many others having innovation remits.

Over two and a half decades, the policy space has become increasingly crowded with numerous research organisations, professional services firms, lobbyists, and think tanks contributing to the policy debate. Universities, research organisations, and the science community have also become policy active around the link between knowledge, innovation, and growth.

It has reached the stage, however, that very little that is proposed in the policy space is actually 'new'. What is advanced as 'new' is often a re-packaging of much that has gone before, but without back referencing and reflecting on experience in either policy direction or implementation. Very few initiatives and actions have been evaluated in terms of results achieved, and assessed against overseas benchmarks.

Continuing themes, gaps, and concerns

There are several common and continuing themes addressed in the policy initiatives and inquiries, reviews, and reports covered in this Paper:

- Microeconomic reform, from 1991
- End of the mining boom, and the need to find new sources of growth and wealth creation
- A continuing focus on manufacturing, manufacturing employment, and the need to preserve a manufacturing sector.
- Changing structure of industry, and the move away from large domestically based mass production organisations to smaller, more specialised firms in global value chains
- The progressive movement to a services oriented economy, and requirement for knowledge based professional and technical skills
- Growing attention to industry-research collaboration – but a continual statement of the problem, perhaps reflecting a poor understanding of the fundamental difference in missions between business and university organisations.
- Commercialisation of publicly funded research and a greater role for universities in driving industrial innovation.

There are some gaps in the thematic profiles:

- The emergence of global integration of industry and research, and the significance of Asia, and its growing knowledge economy, although addressed in the Gillard Statement (Prime Minister, 2012)

- Comparatively little attention to services, including the growth in International education, professional and knowledge based services. The States and Territories seemed to have picked this up well before the Commonwealth.
- The potential for innovation in services concerned with the built environment, including 'green buildings' and 'smart cities'.
- Innovation in government, and the potential to create value for consumers of government services through effective use of technology and data.
- Very little attention to the 'demand side' including the role of design and design practice in innovation.

There are some other concerns:

- Incremental rather than 'bold' and transformational change.
- Very little new money – often a re-orientation of existing funding through a 'slice and dice' approach to existing commitments.
- Limited attention to execution and the cost of implementation.

Notwithstanding the *desirability* of a national innovation system policy, there are questions concerning the extent to which such a policy is *feasible* and *practical* – in terms of across the board agreement, commitment, resource allocation and implementation.

The default position may be to ensure that innovation is a high priority within each of the policy domains and to look for connections and connectivity across domains where there are clear synergies and interrelationships. These connections may be, for example, around enabling technologies, that are not necessarily constrained by specific policy domains.

1 OVERVIEW OF AUSTRALIAN INNOVATION POLICY DEVELOPMENT

1.1 A context of complexity

In an overall sense, the innovation policy space reflects a complex interplay of policy priorities, actions and approaches across several policy domains. Not all of these domains have innovation as a primary focus, and innovation outcomes might be tangential to planned policy outcomes. The principal domains are outlined below.

1. *Economic policy* – from a macroeconomic perspective, to achieve full employment, stable currency, and external balance, and a microeconomic perspective, to achieve productivity and competitiveness outcomes.
2. *Industry policy* – to stimulate and support industrial development and growth, with a focus on job creation (retention), particularly in target sectors, including manufacturing, agriculture, mining and energy. There has, from time to time, been active industry policies in ICT, health, and creative industries.
3. *Innovation policy* - nurturing, application and use of new ideas, from whatever source, to encourage and stimulate entrepreneurship and the formation and growth of new technology based and creative firms. Access to startup and risk capital is a major plank in this area of policy.
4. *Science and technology policy* – the generation, translation and transfer of knowledge for national benefit, including, but not limited to, industrial application.
5. *Education, training and skills policy* - development of talent and skills for innovation and industrial application as well as knowledge for a civil society.
6. *Trade policy* – generating national well-being through international trade and commerce.
7. *Public expenditure policy* – to manage the expenditure side of the budget, including a priority for balanced budgets through expenditure control and securing savings.

The interplay of policy emphasis and direction in these areas over the last 25 years has generated an innovation policy platform that appears to lack long term consistency, coherence, and commitment. Policy has changed direction over time depending on emphasis and priority in these and other domains such as infrastructure, the environment, and regional social, and cultural development. These domains may also have substantial innovation components.

Across these policy areas, innovation policy has been approached through three principal 'lenses':

1. Economics – a focus on markets, market failures, and lifting national productivity and international competitiveness. This includes both macroeconomic, and microeconomic approaches, including removal of regulation and freeing up the operation of markets
2. Strategy – a focus on goals, objectives, and performance. It borrows from the methodologies of business strategy, which involves concentration on key results areas and strategic capability investments ('picking winners', which businesses always do – based on market and customer research)
3. Science and research – a focus on the importance of knowledge in driving the technological developments that underpin economic growth. National innovation systems thinking is an important aspect of this this approach.

These approaches tend to focus on the supply (investment) side of the economic system, which is considered to be of primary importance over the longer term. Economic history however points to the importance of the demand side – such as rapid population growth, improvements in public health, rising incomes through trade, and stability in government and legal institutions, such as recognition and enforcement of private property rights, the law of contract, and containment of sovereign privilege.

There is an emerging innovation policy lens around *design thinking* and arts based learning. This is being reflected in various ways in international policy and practice. This is an opportunity, and a challenge, for Australian innovation policy. Design thinking approaches are being adopted and applied across a range of government portfolios, including defence.

Arts-Based Learning

Arts-based learning is the instrumental use of artistic skills, processes and experiences as educational tools to foster learning in non-artistic disciplines and domains.

During the past decade, a substantial body of practice has been established around the use of arts-based learning in K-16 and graduate education, large corporations, small and medium sized enterprises and a wide range of informal learning environments. This trend has been fuelled globally by studies demonstrating correlations between engagement in the arts and academic achievement in students; SAT scores; and scientific accomplishment and innovation in adults. During the same period, clear theoretical frameworks have been developed linking arts-based learning to effective innovation processes and the development of innovative leadership.

In business, arts-based learning has emerged as a widely used approach to enhancing employee skills in areas such as high performance teamwork, change management and intercultural communication, with more than 400 of America's Fortune 500 companies using artistic skills, processes and experiences to foster creative thinking and strengthen innovation processes. Arts-based learning is also used in more than half of U.S. medical schools to improve student observational skills.

It has also proven a successful way to strengthen the communications skills of engineering students and is being integrated with increasing frequency into graduate level management education and executive leadership programs.

Growing numbers of science centres and museums have successfully integrated the arts into informal science learning and, as the value of arts-based approaches to the promotion of scientific literacy has gained broader acceptance, arts-based learning has emerged as an experiential and interdisciplinary approach to STEM education that is increasingly seen to offer a distinctive new set of tools to advance creativity and engagement among STEM learners.

http://www.artofsciencelearning.org/arts-based-learning/

1.2 The intensity of innovation and industry policy development

Over 25 years innovation policy development and implementation has occurred in an environment of:

- 42 Government policy statements, strategies and plans
- 62 public inquiries, investigations and evaluations
- Six Productivity Commission Reports
- 18 reports from the Chief Scientist and the Commonwealth Science Council (or predecessor organisations)
- Two Parliamentary Inquiries
- Insights from the Learned Academies, including the Securing Australia's Future (SAF) initiative
- The work of Commonwealth Government supported policy research agencies, including the Office of the Chief Economist.

There have also been a range of unsolicited policy reviews and papers prepared by industry and professional organisations, roundtables and think tanks, unions, consultancy forms, and advocacy organisations (lobbyists).

1.3 Review focus

The profile of reviews, reports and papers identified for this paper tend to focus on supply side aspects of innovation, with very little attention being given to demand side factors such as design, the impact of new media, changing demographic profiles, the democratisation of public communication, and emerging areas such as citizen's democracy which is having an impact on public sector innovation.

In summary, the policy and review work tends to focus on:

- Domestic issues rather than addressing trade and foreign investment. The 1997 Mortimer review did take up this challenge (Australia. Review of Business Programs, 1997), as did Australian in the Asian Century (Prime Minister, 2012)
- Sector specific issues round portfolio responsibilities. A large number focus on manufacturing, with separate approaches to health, agriculture, defence, and the information economy.
- The link between SRI policy and international trade and investment is not well made in much of the review work. Only one (internal) review of Austrade is identified.
- There has been limited coverage, comparatively, of the information and digital economy, particularly since the work of Goldsworthy (1997) and NOIE.
- Reviews and inquiries have tended to focus on Investment in science, research, and research capability. It tends to reflect a 'science push' and 'linear flow' paradigm, which probably derives from the early innovation systems and knowledge economy thinking.
- More recently there has been a focus on education and skills, around entrepreneurship and employability. The role of VET and technical skills is STEM seems to be have been largely overlooked.
- There is little material that specifically addresses demand side issues, including design and design innovation. A major exception is the work of PMSEIC *Imagine Australia* (PMSEIC, 2005) and *Design for Manufacturing Competitiveness* (Buculo and King, 2014).
- Reference is often made now to 'hidden innovation' (Cunningham, 2014).
- There has been little attention given to structural and institutional re-alignment to enable implementation of new initiatives. There is a presumption that implementation can be accommodated within pre-existing administrative structures.

The recent Innovation System Audit had a strong supply side and domestic focus. The depiction of the Innovation System is that of a closed Australian operation.

1.4 The Federal system

The Australian innovation policy framework is further complicated by a complex federal system of government which includes six sovereign States each with their own policy frameworks in the policy areas identified above.

State Governments have maintained industry policies over many decades (including generous subsidies for industrial development), and are increasingly moving into areas once seen as the constitutional preserve of the Commonwealth (such as Defence) in an effort to procure State based employment generating defence contracts.

With increasing awareness of the growth and employment opportunities in a knowledge based economy, State and Territory Governments have been pursuing science, technology and innovation policies. Victoria was the first off the mark with the STI policy initiated by the Brumby Government, followed by the Beattie Government in Queensland with the Smart State Strategy.

Most States and Territories are currently implementing STI policies and strategies and have appointed Chief Scientists or Lead Scientists.

After many decades of ambivalence, since the Commonwealth takeover of university funding, State Governments have been taking a renewed interest in the potential contribution of research and academic learning to economic and industry development. This interest has a strong regional development focus, and in many regions universities are working in partnership with State and Local Governments.

1.5 Concentration and fragmentation: Resources for Science, Research and Innovation, 2005-2017

In consultations being undertaken to assist the ISA Board develop the 2030 Innovation System Strategic Plan, reference was often made to the discontinuity and short-term commitment to Science, Research and Innovation (SRI) policies and programs.

To shed some light on this claim, an analysis of available reported expenditure from the Commonwealth budget over the period 2005-06 to 2016-17 was undertaken. The analysis indicates that funding support for SRI has amounted to $104.2 billion (in nominal terms) over the period. This is reported in Table 2 below which classifies expenditure according to socio-economic objective.

Of the total funding, 25 per cent has been allocated to R&D Incentives that support business R&D and a further 21.7 per cent has been allocated to Commonwealth Science agencies that support public R&D. A further 19.8 per cent has been allocated to universities to support university determined research priorities (block grants). The proportion allocated to Health has amounted to 10.7 per cent.

Table 1: Commonwealth budget allocation to socio-economic categories, 2005-2017

Socioeconomic category	Total expenditure 2005-16 to 2016-17 ($m)	Proportion of Total (%)
00. Tax incentives	26,018.1	25.0
00. Multiple research categories	22,613.9	21.7
01. Exploration and exploitation of the earth	2,033.1	2.0
02. Environment	673.9	0.6
03. Exploration and exploitation of space	375.3	0.4
04. Transport, telecommunications and other infrastructures	122.3	0.1
05. Energy	2,309.3	2.2
06. Industrial production and technology*	7,241.8	7.0
07. Health	11,107.9	10.7
08. Agriculture	4,286.4	4.1
09. Education	9.7	0.0
10. Culture, recreation, religion and mass media	4.4	0.0
11. Political and social systems, structures and processes	1,095.8	1.1
12. General advancement of knowledge – block grants for universities	20,158.5	19.3
12. General advancement of knowledge - other	926.4	0.9
14. Defence	5,148.9	4.9
Total inactive programs	104,125.7	100

*Includes $2.1 billion for Automotive assistance (2.0 per cent of total SRI expenditure) and $2.1 billion for Cooperative Research Centres Program (2.0 per cent)

Much has also been made of fragmentation of program activity. An analysis of 'program stability' indicates that here has been a total of over 350 expenditure programs have supported over the period 2005-06 to 2016-17. The analysis is summarised in Table 3.

Table 2: Expenditure programs 2005-06 to 2016-17 (currently active)

Socioeconomic category	Number of active	Average number of years active	Average funding per	Proportion of total SRI pend (%)

	programs 2016-17 ($m)		program p.a. ($m)	
00. Tax incentives	3	6.0	1,426.2	16.4
00. Multiple research categories*	8	12.0	235.6	21.7
01. Exploration and exploitation of the Earth	2	9.0	60.0	1.3
02. Environment	10	6.2	4.3	0.3
03. Exploration and exploitation of space	2	9.0	7.1	0.1
04. Transport, telecommunications and other infrastructure	4	7.5	1.2	0.0
05. Energy	5	7.8	50.9	1.6
06. Industrial production and technology**	12	6.6	37.5	3.8
07. Health	28	6.6	35.2	9.1
08. Agriculture	18	9.6	20.8	4.0
09. Education	1	1.0	7.1	0.0
10. Culture, recreation, religion and mass media	2	5.5	0.1	0.0
11. Political and social systems, structures and processes	29	5.0	3.6	0.9
12. General advancement of knowledge – Block Grants	10	8.7	281.5	17.9
12. General advancement of knowledge – Other	11	6.3	2.9	0.2
14. Defence	8	5.8	53.1	4.9
Total Active Programs at 2016-17	153	7.0		82.2
Inactive Programs	201			17.8
Total programs				100.0

*Covers: Australian Research Council (ARC) - National Competitive Grants Program; Commonwealth Scientific and Industrial Research Organisation (CSIRO); Australian Nuclear Science & Technology Organisation (ANSTO); Geoscience Australia; National Collaborative Research Infrastructure Strategy; Australian Institute of Marine Science (AIMS); Bureau of Meteorology Research Activities; Australian Institute of Aboriginal and Torres Strait Islander Studies (AIATSIS). Whilst structures have remained stable, funding has fluctuated widely.
**Includes the CRC Program ($2.1 billion) and the Automotive Transformation Scheme ($1.0 billion)

It is apparent that stability varies across socioeconomic (portfolio) areas, with the Multiple Research Categories and Agriculture being the most stable. Most of these programs are legislated, although funding varies from year to year. Programs identified as inactive in 2016-17 indicated much shorter longevity. Many of these were one-off grants and payments. Nonetheless, the analysis indicates a very substantial, and potentially fragmented, scope of program activity.

An analysis of currently inactive programs, but programs that operated during the period 2005-06 to 2015-16 indicates that programs operated for an average of 4.23 years.

1.6 Concluding comment

2 THE POSTWAR ERA: CREATING A MANUFACTURING INDUSTRY

2.1 1940s – Post-war Reconstruction

World War II had a great profound impact on the Australian economy and permanently changed how the economy operated. Prior to 1939, the Commonwealth Government had little role in the management of the Australian economy. The state governments levied most of the income tax, and Australia's international trade was dictated by its relationship with the British Empire.

The Japanese attack on Australia in 1942 led the Australian Government to adopt an "All In" war policy, which dictated the full mobilisation of the Australian economy and workforce. To that end, a range of economic and industrial controls were adopted: rationing, production controls, military and industrial conscription.

The new powers were generally administered by the Commonwealth Government assisted by government appointed boards of control, including the Commonwealth Munitions Board (CMB) which directed the expansion of the Australian munitions (defence) industry. Chaired by Essington Lewis, the General Manager of BHP, the CMB was by the end of the war indirectly managing some of the largest manufacturing concerns in the country. Direct Commonwealth involvement in defence production continued under various iterations of the Department of Supply and concluded with corporatisation and privatisation in the 1990s.

The Department of Post-war construction was formed in 1942 with a role was to plan and coordinate Australia's transition from a war economy with the goal of achieving and maintaining full employment. Treasurer Ben Chifley was appointed the first Minister and H.C. 'Nugget' Coombs became the department's first director-general.

The department was initially given a wide range of responsibilities including overseeing the Government's commitment to full employment, introducing new social welfare payments, establishing the Commonwealth Employment Service, working with the state governments to provide housing and hospitals, and providing financial support to state universities.

Most of the department's employees were young economists who had been conscripted into the Australian Public Service during the War. This group of public servants had a major influence on industry policy over coming decades. They included HC Coombes Sir John Crawford, Sir Allen Brown, Sir Roland Wilson, Sir John Bunting, Lennox Hewitt, Peter Lawler, and Geoffrey Yeend. A Secondary Industry Division and Economic Division operated in the Department.

The 1945 White Paper: *Full Employment in Australia* (Australia., 1945) which set out an agenda for post-war growth, strongly supported measures for readjustment in manufacturing from a wartime to a peacetime footing. A major focus was on renewal of capital equipment, manpower planning and training, and opportunities in exports and new markets. An extract from the *White Paper* relating to manufacturing industries is of interest.

> **(b) Manufacturing Industries**
>
> 111. In many factories, the transfer from war to peace production cannot be accomplished overnight. Machinery used for wartime production will need to be altered, added to or replaced, and time will be required for other industrial re-adjustments. The Government has surveyed the needs of industry for preparatory planning and also for re-organization and reconditioning of plant and machinery, installation of new equipment and tooling-up for civilian production. This survey has indicated that about 9,000 men are needed for preparatory planning and about 18,000 men for the actual conversion of plant. These estimates cover the requirements of all manufacturing industry, including small enterprises to whose needs the Government will give sympathetic consideration.
>
> 112. An instalment of men is being made available during the first six months of 1945 for the preparation and execution of plans by private manufacturers for post-war civilian production. The position will be kept under review to see that, as far as is consistent with the effective prosecution of the war, key manpower is made available to manufacturers to enable them to prepare for post-war production and employment. The unavoidable demands of the Pacific War may mean, however, that our manufacturing industries may not be as well placed at the end of the war as those in countries where considerable re-allocations of manpower will be possible now that Germany is defeated. This is the inevitable result of Australia's special geographical position.
>
> 113. Advance preparations for transfer and conversion are particularly important for the heavy and engineering industries. The detailed problems involved are at present being closely examined by the Secondary Industries Commission.

Opportunities will continue for the executive employment in these industries of considerable numbers of skilled workers. Many process workers, however, will have to seek alternative employment, which they will find in other industries provided production gets under way quickly enough. Special re-training and transfer measures may be necessary, and this problem is being examined in conjunction with the unions concerned. Employment in the heavy and engineering industries has been greatly expanded during wartime, and it will be necessary to expedite the process of conversion, so that employment can be provided on the necessary scale. Export markets and new types of production should help to maintain employment in these industries.

http://www.billmitchell.org/White_Paper_1945/index.html

The predominant vehicle for industry policy in Australia until 1973 was tariff protection. It was administered through the Tariff Board (set up in 1921), later the Industry Assistance Commission, and now the Productivity Commission. The *White Paper* commented:

> 72. While the tariff and other methods of protection are legitimate devices for building up industries appropriate to our economy, *the grant of protection by the Government to producers is a privilege which carries with it the responsibility for maintaining the highest possible level of efficiency*. Protection must not be protection of excessive costs, inefficient methods and obsolete equipment, nor should it encourage the practice of relying on rings, cartels, tariffs and guaranteed home markets, rather than on efficient production. Protection in the past has been granted upon the advice of the Tariff Board, and the Government proposes to continue to rely upon this body. The Tariff Board has ample powers to instigate and report upon the efficiency of protected industries. It is the Government's intention that the Board shall carry out these investigations and make regular reports.

In these terms the *White Paper* rejects the notion of subsidised import replacement and 'guaranteed home markets' as a basis for industry policy. Issues concerned with the efficiency of Australian manufacturing industry continued for many decades.

The economic policies of the Labor government greatly stimulated the economy by increasing production and ending unemployment. A wide range of industries, including motor vehicles, metal processing, TCF (textiles, clothing and footwear) and chemicals all benefitted from government contracts and regulations, tariff protection, and import controls. The Government policy stance meant that the government would maintain control over certain segments of the economy to continue economic growth, restrain inflation and institute full employment.

Post-war economic reconstruction was also underwritten by a decisive policy of national development - in line with the general socialist ideals that the ALP held and were then widely supported within the broader labour movement. A number of Australian companies such as QANTAS were nationalised in this period, while a range of government run enterprises such as TAA and the ANL were set up to expand the government sector. In 1948 the Snowy Mountain River Project was commenced.

International conditions also favoured the post ware policy, as Australia enjoyed favourable terms of trade and an increase in the amount of foreign (largely US) investment into the economy. However, it was assumed that the agricultural and mining sectors would be geared towards international markets, and manufacturing would serve the domestic "consumer" market. Import replacement remained a policy focus into the 1950s and 1960s. This meant that Australians were paying substantially more for goods and services that might have been otherwise the case.

This immediate post war policy achieved high economic growth, but led to growing political opposition, especially after the failure of the government to nationalise the banking sector in 1948. Political opponents also capitalized on the retention of rationing of food and petrol. As a result, in 1949 the government was replaced at national elections with a more conservative government committed to supporting a *mixed economy*.

2.2 1945-67 - the Long Boom: Industry Protection and Agrarian Socialism

The new Australian Government, led by Liberal leader Robert Menzies, continued to regulate economic activity, but preferred to manage the economy "indirectly" where possible. More encouragement was given to private industry, but where public enterprise was deemed "necessary" it was retained, and in some cases expanded. The Department of Post-war Reconstruction was abolished and the Economic Division transferred to the Prime Minister's Department (and subsequently abolished) and the remaining Divisions became part of a new Department of National Development which operated until 1972.

The new Department was expected to plan for the supply of basic commodities, promote decentralisation and regional development, undertake surveys of natural resources, and plan for the development of primary and manufacturing industries and the stimulation of housing construction – principally through the Commonwealth-State Housing Agreement.

The Department also had a role in relation to “Development planning in conjunction with the various States and, where necessary, co-ordination of such development planning, including the investigation of such national works as are referred to the Department by the Government” and “in conjunction with Treasury and other interested Departments, to make arrangements with the respective States and Other Governmental authorities with regard to the cost and execution of development projects”.

The Department of National Development did not function as an ‘economic development powerhouse’. It was a Country/National Party Portfolio. The Tariff Board, established in 1920, had responsibility for advising on the post-war conversion of Australian industries – not well equipped to do this.

The pragmatic approach of the conservative Menzies Government was underlined with the establishment of the Reserve Bank of Australia, the continuance of the mass immigration policy, which began in 1946, and the signing of a range of new trade agreements with nations outside the British Empire, including West Germany (1955), Japan (1957) and the USSR (1965).

In 1955 Australia began exporting coal to Japan, and by 1967 Japan had surpassed Britain as Australia's main market. Symbolically in 1966 Australia abandoned the pound and adopted the Australian Dollar.

Economic growth, high employment levels, growing foreign investment and the development of new markets led Australia to enjoy a high level of economic prosperity in the post-war period. Rationing was abolished in 1950. High population growth, high government spending, the introduction of television (1956) and the gradual relaxation of government controls over "hire purchase" helped Australia to develop into an affluent society in the 1950s and 1960s.

Rising income from taxation receipts eventually allowing the Australian Government to fund a large expansion in higher education, the development of Canberra, the national capital, and the host the 1956 Melbourne Olympics. By the time of Sir Robert Menzies's retirement in 1966, the Australian economy seemed stronger and wealthier than ever before.

In 1965 the Government released the Report of the *Committee of Economic Inquiry (the Vernon Report)* (Inquiry, 1965). The Committee was tasked to report on a range of specified matters, including trends in population, physical resources, overseas investment in Australia, trends in costs, prices and wages, trends in the standard of living, the situation with respect to the external balance of payments, imports and exports, and "the effect of customs tariffs and other forms, direct or indirect, of protection on the disposition of resources" (Nethercote, 2015).

The Report concluded -

> It cannot be said with certainty that the tariff has ensured higher total incomes or incomes per head than might have been possible under some alternative system

But observed -

> The tariff has been important in the expansion and increased diversity of industry, the development of labour skills, the advance of technology, the ability to absorb a rapid increase in population, involving a high rate of immigration, and the steady increase in capital investment essential to all these achievements."

The report's findings on the tariff have been interpreted as: "For one reason or another, the tariff in general has been either a Good Thing or cannot be proven to have been a Bad Thing." (Nethercote, 2015). But free trade with devaluation would probably not have been practicable.

In the expectation that public investment would continue to play a large part in total capital formation, the Report proposed a special projects commission "with power to investigate proposals for major development projects" and equipped with a skilled staff to carry out cost-benefit analyses, which the committee considered basic to project planning.

The report's most famous recommendation was the creation of an advisory council on economic growth to review the economy's experience and prospects of growth, and to provide a forum for debate, consultation and communication about various matters concerning the economy (Nethercote, 2015). The recommendation was rejected by the Government.

During this period rural production was dominated by extensive public support and assistance through government research and development, extension services, and government marketing boards.

The Australian governments of this period, dominated by the conservative Liberal Party and socialist Country Party, were broadly successful in maintaining economic growth and unemployment, but were criticised by opponents for failing to effectively control inflation, instituting periodic "credit squeezes" (1952 and 1961), and rejecting national economic planning. During the 1960s an increase in tariff protection for new industries protected jobs and profits, but lowered the need for productivity and innovation, and by 1966 foreign investment was shifting to the less heavily regulated mining and pastoral sectors.

Charles Massey, in *Breaking the Sheep's Back* (Massy, 2011), observes:

> By 1967-68, on the calculation of the Tariff Board itself, Australian manufacturers were cosseted behind a massive tariff wall worth $2700 million a year. To put this huge protection cost in context, the $2.7 billion tariff bill was 20 per cent higher than the total annual expenditure by all Australian governments (federal, state, local) on education, health, social security, welfare and defence. The huge tariff burden equated to an average effective tariff for manufacturers of 46 per cent, with some firms receiving 120 per cent protection (Massy, 2011) p.52

The failure to gradually remove protection would have lasting consequences. The strategy of providing *assistance* for industry to grow and prosper, as envisaged in the 1945 White Paper, eventually came to be seen as an *entitlement*, on the part of industries that failed to adjust, that should be preserved in an unreconstructed state. The protected manufacturing industry lobby became quite powerful using weapons of job creation and strategic significance.

But the job creation rationale largely failed as large factory based manufacturing enterprises became uneconomic and unviable in a globally competitive environment. Strategic significance is important for industries that have committed to adjustment and modernisation.

2.3 1967-73 - The End of the “Mixed Economy”

After 1967 the favourable conditions that Australia had enjoyed in the international economy began to change. From 1962 Britain progressively abandoned the system of Imperial Preference adopted in 1932 and move towards membership of the European Economic Community. Australia's privileged access to the British market was drawing to a close.

In the era of the Vietnam War the rate of U.S. investment into Australia began to decline and Australia began to face greater economic competition and a steady decline in its terms of trade. In this context the governments that followed the Menzies government in the period 1966–1972 increasingly found it hard to manage the rising expectations of consumers and industry in the ‘developing nation’ ideal of the ‘mixed economy’.

In the period 1972–1973 Australia began to experience the beginnings of "stagflation" as unemployment and inflation began to rise simultaneously for the first time. In 1973, with Australia experiencing sharply rising inflation, Fred Gruen, special consultant to the Whitlam Government, proposed a 25 per cent across the board tariff cut, which was adopted by the government. The 1973 oil crisis had caused prices to spike and, according to government figures, inflation topped 13 per cent for the year 1973-1974.

The beginning of 1973 was not the time to recommit to a socialist agenda.

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3 1973–91 – THE SLOW ROAD TO STRUCTURAL ADJUSTMENT

3.1 Administrative Arrangements

1972-74: Department of Secondary Industry

- *[1972-1975: Department of Science]*
- *[1972-1983: Department of Education]*

1974-85: Department of Industry and Commerce

1974-75: Department of Manufacturing Industry

- *[1975-1975: Department of Science and Consumer Affairs]*
- *[1975-1978: Department of Science]*

1975-1984: Department of Industry and Commerce

- *[1976-1980: Department of Productivity]*
- *[1978-1980: Department of Science and the Environment]*
- *[1980–1984: Department of Science and Technology]*
- *[1983-1984: Department of Education and Youth Affairs]*

1984-1991: Department of Industry, Technology and Commerce

- *[1984-1987: Department of Education]*
- *[1987-1996: Department of Employment, Education and Training]*

3.2 Economy and industry

The rapid change in economic conditions in 1972-73 was not countered by a change in government policy. In particular Whitlam's desire to increase the wages and conditions of the federal public service was not checked. This fed into a 30 per cent increase in imports and a $1.5 billion increase in the trade deficit by the end of 1974.

Primary producers of commodities such as beef were caught in a credit squeeze as short-term interest rates rose to extremely high levels. Unemployment also rose significantly despite continuing government spending.

The failure of the Whitlam Government to effectively manage the Australian economy was a factor in its demise in November 1975. The new Fraser government promised greater control of government spending, and an end to inflationary pay increases in the public sector. But its close links with industry and commerce made it reluctant to institute deep seated economic reform.

While a growing number of economists and business leaders began to call for economic deregulation the Fraser Government preferred to promote policies similar to those adopted in the earlier post-war period; chiefly wage and credit restraint, and tighter government economic regulation of the economy. In 1982 the Government dismissed the findings of the Campbell Commission into Banking which had had recommended deregulation of the banking industry (Australia. Committee of Inquiry into the Australian Financial System, 1981).

Ratigan Review, 1973

In 1973 a Committee Chaired by Alf Rattigan had recommended a 25 per cent across-the-board reduction in all tariffs. It argued that a tariff cut would have long-term benefits in terms of improving resource allocation. The Committee estimated that the tariff cuts would require changes in employment for up to 30 000 people and recommended that a range of adjustment and assistance measures be made available for both the employees and the industries affected.

Rattigan passed the Committee's report to the Prime Minister on 16 July 1973 and the Government announced acceptance of its recommendations the following day. “The largest adjustment to Australia's tariff protection had been achieved without reference to the Tariff Board, without public inquiry and within a matter of weeks”[3].

[3] http://www.aph.gov.au/About_Parliament/Parliamentary_Dept.s/Parliamentary_Library/pubs/rp/rp9900/2000RP07

By mid-1974, the economy was slowing and some affected industries were quick to blame the tariff cuts. Leyland closed its Sydney motor vehicle plant with the loss of 2600 jobs and Philips claimed 12 000 electronics industry workers would lose their jobs over the next 18 months. In October, the South Australian Government argued that implementation of the recommendations on the car industry threatened 15 000 jobs.

Jackson review

In July 1974, a committee of inquiry on Policies for Development of Manufacturing Industries in Australia (Australia. Committee to Advise on Policies for Manufacturing Industry, 1975) was established, chaired by Gordon Jackson, chief general manager of CSR Ltd. Its Report in May 1975 recommended (Emmery, 1999):

- tariffs should be reduced to selected benchmark levels 'by small, gradual and predetermined instalments over five to fifteen years. The reduction instalments should be inexorable, except for suspension during any period of significant unemployment'
- positive assistance measures should be introduced to promote new investment in efficient, internationally competitive and export-oriented industries, and
- establishment of both Commonwealth and State Industry Councils to involve the key stakeholders in the design of the adjustment process.

The Committee reported just prior to the dismissal of the Whitlam Government but the broad thrust of its assessment of a desirable industry policy framework was incorporated in the Fraser Government's subsequent White Paper on Manufacturing Industry.

The 1975 recession led to increasing pressures from manufacturers, supported by the unions, for protection to be by quantitative restriction, rather than by the tariff and for temporary protection by way of import quotas. The operation and impact of quotas in motor vehicle and textile clothing and footwear led to a decline in competitiveness and increased costs to the consumer.

For most of the Fraser Government's time in office the Industry Assistance Commission came under the responsibility of the Minister for Business and Consumer Affairs. In 1983 responsibility passed to the Minister for Industry and Commerce (John Button) and from 1987 onwards responsibility has been held by the Treasurer. This reflects the broader economic remit of the Commission.

Industrial Restructure Plans 1980s

The following commentary is largely sourced from *Australian Manufacturing: A Brief History of Industry Policy and Trade Liberalisation* (Emmery, 1999)

In the early 1980s, large parts of Australian manufacturing were recognised as seriously lacking in international competitiveness and in urgent need of restructuring to promote innovation, modernisation and efficiency. In 1983 Jihn Button, the new Labor Industry Minister noted that the Australian manufacturing industry was still focused on the domestic market. However, factories were closing and people were not prepared to think much about longer term solutions. There was an absence of an export culture.

Over the ensuing five years a series of initiatives were taken to open up the Australian economy to greater international competition with the main steps being on the macro-economic front with the floating of the exchange rate, deregulation of the banking sector, and controls on capital movements.

The approach to industry policy was based on the implementation of a series of industry restructuring plans for the main industries facing difficulties with foreign competition, namely the PMV, TCF, heavy engineering, steel, and shipbuilding industries. The plans were designed to be temporary and to inject generous positive assistance to help these industries to modernise, innovate and find new markets and at the same time to wind down the high levels of protection on most of their products.

The basis of the assistance packages was a view that Australia industry had been so heavily protected that it was not up to the task of competition. However, many businesses failed to adjust and continued to advocate for protection and subsidy. It became a self-defeating strategy.

In 1988, the Government introduced an across-the-board program to phase down all tariffs (except for PMV and for TCF which had their own tariff reduction programs) to either 10 per cent or 15 per cent by 1992.

The general tariff reduction program was extended in 1991 as a key plank in the policy initiative *Building a Competitive Australia*. This is the starting point for a more detailed analysis of a *25 Years of Reviews: the Evolution of Australian innovation and Industry Policy* that begins in the next section.

3.3 Knowledge and innovation

Committee of Inquiry into technological change in Australia (Myers) 1980

In December 1978 the Government announced that it was establishing a Committee of Inquiry into Technological Change in Australia. The findings of the Inquiry, reported in 1980[4]

- The Committee emphasises that it is essential for Australian industry primary, secondary and tertiary to keep up with technological developments if it is to compete internationally and if we as Australians are to realise the full potential of our economy.
- In presenting its assessment of the economic, social and other effects of technological change the Committee stresses the strong links between change, economic growth and improved living standards. In doing so it points out that the process of adjustment to change will not necessarily be calm or easy. Many of its recommendations, therefore, are aimed at ensuring that the benefits of change are maximised and adverse effects minimised.
- The Committee points out that if the community is to obtain the greatest benefits from new technologies, a more co-operative and mutually supportive approach than has generally prevailed in Australia in the past will be needed.
- The future introduction of new technology without undue and potentially costly industrial resistance, Is likely to depend importantly on labour force and community understanding and acceptance, which will in part depend on how those affected by technological change are, treated, and how they see themselves and are seen by others as being treated.

The Government indicated that it strongly supports the general objectives of fostering a more consultative and facilitative approach, as well as a wider understanding and acceptance of technological change.

ASTEC

April 1977 the *Australian Science and Technology Council* was formed to advise the Australian government on matters relating to science and technology.

The council was Composed of leading academics and industrialists, although scientists from other government agencies, notably the Commonwealth Scientific and Industrial Research Organisation (CSIRO), were excluded.

In 1997, the Australian Science and Technology Council changed its name to the Australian Science, Technology and Engineering Council. The council was abolished in 1997, and its functions were transferred to the Prime Minister's Science, Engineering and Innovation Council (PMSEIC).

ASTEC's report portfolio covered -

1981
- "Basic Research and National Objectives"

1983
- "incentives for Innovation in Australian Industry"
- "Operation of National Research Granting Schemes"

1984
- "Guidelines for the Operation of National Research Facilities"

1985
- "Public Investment in R&D in Australia"
- "Future Directions for CSIRO"

1986
- "The Defence Science and Technology Organisation and National Objectives"
- "Mechanisms for Technology Transfer into Australia"

1987
- "improving the Research Performance of Australia's Universities and Other Higher Education Institutions"
- "Improving Aust.'s Competitiveness Through Industrial R&D"

1988:
- "Government Purchasing Policy and Industry Innovation"

Full ASTEC referencing at https://trove.nla.gov.au/book/result?q=%22Australian+science+and+technology+council%22

The troubled trajectory of the Science Portfolio and long term implications

A separate Department of Science was established by the Whitlam Government in 1973.

A *Department of Science and Technology* was established by the Fraser Government in November 1980. It was responsible for Science and Technology including research, support of research and support of

[4] http://pmtranscripts.pmc.gov.au/sites/default/files/original/00005408.pdf

civil space research programs, Productivity of industry, patents, trademarks and designs, meteorology, and analytical laboratory services.

The Department of Science and Technology was abolished by the Hawke Government in December 1984, making way for a new *Department of Industry, Technology and Commerce*. A separate *Department of Science* was established, which continued until 1987 (five years). It had a specific responsibility for *science policy* and research. It was the third time a separately named Department had been established.

The Department of Industry, Technology and Commerce was a substantial expansion of the previous Department of Industry and Commerce. Hawke had reasoned that including responsibility for technology and civil offsets in the new Department would enable better integration of Australia's industry and technology policies and would increase the competitiveness of Australian industry stimulating growth and employment opportunities.

Some information technology initiatives were taken up in various iterations of the Department of Communications.

In 1987 science functions were absorbed into a new *Department of Industry, Technology and Commerce* - for patents, science and research policy, the civil space program, weights and measures and the Commission for the Future. Under the new arrangements –

- Marine Science went to the Department of Primary Industries and Energy
- Coordination of research policy, research grants and fellowships, the Anglo-Australian Telescope Agreement Act 1970 and associated agencies went to the Department of Employment, Education and Training
- Meteorology, ionospheric prediction and analytical laboratory services went to the Department of Administrative Services

The Department of Industry, Technology and Commerce was abolished in March 1993 to become the Department of Industry, Technology and Regional Development, which lasted until March 1994, when it became the Department of Industry, Science and Technology (which lasted until March 1996, then the Department of Industry, Science and Tourism to October 1998, and then the Department of Industry Science and Resources, until November 2001. In 2001 science policy moved to the Department of Education Science and Training, which had responsibility for research policy.

During this period, with constant 'bureau shuffling' Australian science and technology policy lacked focus and commitment. A long term result has been that 'science and technology policy' has morphed into 'research policy'. The administrative arrangements up until 2001 ensured a connection between *science, technology and innovation*, including *industrial research and development.* But after S&T policy became more closely connected to research policy it became increasingly disconnected from industry. Industry found the dominant culture in the Education Department difficult to deal with[5].

This integration of science, technology and research policy has been unfortunate, and underplays the broader remit and longer-term commitment to a national science and technology effort in an industrial context. It has, rightly or wrongly, placed universities in a framework that envisages a major role for them in innovation and industry development.

S&T policy has not been sustained as a separate policy stream with a focus on industry development, particularly in new industries and across industries. The major exception would be biotechnology, which has a strong base in academic research, but Australia has lagged in information and communication technology policy, with responsibilities held across multiple portfolios. Even ow digital transformation policy is unsettled.

[5] This came through in the consolations for 2003 review of the CRC program which after 2001 had been allocated to the DEST portfolio.

4 1991-1996: COMPETITION AND MICROECONOMIC REFORM

4.1 Administrative arrangements

1991–1994: Department of Industry, Technology and Regional Development

1994–1996: Department of Industry, Science and Technology

4.2 Economy and industry

Competitive Australia, 1991

The Hawke Government's *Competitive Australia Statement* (Australia. Department of the Prime Minister and Cabinet, 1991) drove the micro-economic reform agenda over the next five years.

This early period saw some significant research and policy insights including *Managing the Innovating Enterprise* (Carnegie et al., 1993) and research projects supported by the former Bureau of Industry Economics (Australia. Bureau of Industry Economics, 1995, Australia. Bureau of Industry Economics, 1996).

One Nation: statement by the Prime Minister, P. J. Keating, 26 February 1992

One Nation announced an Australian Government program of infrastructure development to be carried out under the Keating Government from 1991 to 1996 (Australia. Prime Minister, 1992). Much of the program was implemented as a means of stimulating the economy in the aftermath of the early 1990s recession. The major infrastructure projects announced in *One Nation* provided the foundation for future development.

National Competition Policy Review, Hilmer, 1993

This Report recommends implementation of a national competition policy for Australia. The Committee of Inquiry was established in October 1992 by the Prime Minister following agreement by all Australian governments on the need for a national policy and its basic principles (Australia. National Competition Policy Review, 1993). This group was led by Warrick Smith, and included Roger Brake, Daryl Quinlivan, Michael Warlters and Kirsten Embery.

The Review recognised that Australia, for all practical purposes, is now a single integrated market, increasingly exposed to domestic and international competition. A national competition policy aims to promote and maintain competitive forces to increase efficiency and community welfare, while recognising other social goals.

The opening paragraphs set out the challenge:

> Australia is facing major challenges in reforming its economy to enhance national living standards and opportunities. There is the challenge of improving productivity, not only in producing more with less and deploying scarce assets wisely, but also in becoming better at making and exploiting new discoveries, whether in technology, resources, fashion or ideas. A possibly more difficult challenge is to develop in a Way that creates new jobs and growth rather than the economy shrinking to an efficient but diminishing core of activity.
>
> Coping with these challenges is an enormous task for any country, and Australia is not alone in finding the process of reform testing and early benefits elusive, particularly when world economic growth is negligible. However, Australia faces an additional complexity in tackling these challenges, as most reforms require action by up to nine governments. This is particularly true in competition policy, an area central to micro-economic reform which aims at improvements at the front line of the economy.

Working Nation, 1994

The 1994 *Working Nation* White Paper describes the Commonwealth Government's plan for achieving economic growth in Australia, and increasing employment opportunities for urban, rural and regional Australia (Keating, 1994). The policies were intended to reduce the number of unemployed, and aimed to reach an unemployment rate of five per cent by the end of the century and to set new goals for education and training, for economic efficiency, for income support arrangements and for industry.

Specific policy initiatives covered:

- Reforms to labour market assistance to help unemployed Australians get their fair share of jobs in the recovery.
- Training and education reforms to broaden and deepen the skills base and equip young people for work in the modern Australian economy.
- A restructured Social Security system from which disincentives to work have been removed.
- A strategy to help the regions of Australia more effectively share in the nation's prosperity and contribute to the national effort.
- Agreements in the workplace to produce a more flexible and responsive workforce.
- Microeconomic reforms and an industry policy to remove impediments to competition and create an environment that will enable firms to perform at their best and assist them to develop international markets.

The Statement also noted –

> The success of Australian industry lies at the heart of economic growth and job creation. The Government encourages the development of efficient enterprises in every sector of the economy - manufacturing, services, mining and agriculture.
>
> Firms operate in a very different environment to that of 20 years ago. Communications and transport have brought them closer to their customers, the distinction between the goods and services sectors has become blurred, product cycles are shorter, and products are increasingly tailored to individual customer needs. Successful enterprises need to be innovative in all aspects of their activities, in their use of technology, in skill formation, in their workplace arrangements, in their marketing. Most importantly, they have to be responsive to the needs of their customers. Increasingly, it is the smaller and medium-sized enterprises that are successful in this new environment.
>
> Government policy recognises these changes in the way business operates and aims to build enterprises that can succeed in a competitive environment. This means a role for Government both in fostering an environment conducive to the growth of firms and in eliminating, or compensating for, impediments deriving from market failure.
>
> A key to Australia's more efficient and productive economy has been the Government's successful microeconornic reform program. These reforms are reducing costs for Australian business and creating a more efficient economy by making better use of scarce resources. Microeconomic reform is an essential element in the economic transformation of Australia. It sharpens our productive capacity and improves our growth performance.
>
> We will continue to build a more efficient and productive economy through further microeconomic reform. The result should be Australian firms at the forefront of international best practice.

Enterprising Nation, 1995

In 1995 the Karpin Report, *Enterprising Nation: Renewing Australia's Managers to Meet the Challenges of the Asia Pacific Century*, was released (Karpin, 1995).

Following three years of consultations, study missions, research and analysis, the Task Force prepared this report to provide insight into the way Australia prepares its managers for work and leadership. It also presents policy recommendations and options based on its findings. Special attention was given to the need for an enterprise culture, small business, globalisation, diversity, lifelong learning and enterprise and education institution best practice. The Taskforce identified its approach in the following terms:

> The general philosophy of the Task Force has been to find pathways to lasting change and improvement through seeking enterprise and individual-driven solutions to the problems and challenges facing Australia's business leaders, managers, educators, trainers and government policy makers.

The Chairman of the Task Force asserts in his introduction that permanency of reform and constructive change will depend on recognition that excellent leaders and managers require well structured, systematic education and continual development, so that they can add maximum value to the national economy through their performance within the enterprise

Much of the material covered in the Report remains relevant to this day.

The National Commission of Audit, 1996

The Commission of Audit, appointed by the incoming Howard Government, aid out principles for "market based" economic development in the following terms[6]:

> In broad terms, the case for government involvement can be based on social and economic arguments.

[6] A copy of the report is located at http://www.michaelsmithnews.com/2013/10/the-howard-government-national-commission-of-audit-march-1996.html

- There is a social case for government involvement when the community demands that specific social objectives such as a humane society, a more even distribution of income and the provision of assistance to those genuinely in need warrant government action. Some law and order activities, social welfare assistance to individuals in genuine need, and some education and health services, are examples where governments are generally regarded as having a legitimate role to play.
- There is an economic case for government involvement when there is clear evidence of market failure; that is, private provision of the goods and services in question would be substantially inadequate or excessive without such involvement. The assignment and regulation of property rights and the provision of national defence services are examples where the private sector is unlikely to adequately do the job, left to itself.

The Commission did not review the activities of the range of industry related research and development or marketing organisations where Commonwealth Government funding or other support is involved. However:

> … the Commission recognises that in some cases Commonwealth Government support for such organisations will be appropriate. For example, where there is clear evidence of underinvestment in research and market promotion because it is difficult for individual firms to capture the full benefits of such investment, some government funding support or other role may be justified. However, where marketing or research and development benefits can be captured by a specific group of producers the Government's role could be limited to facilitating the setting and collection of appropriate levies from the producers to fund such activities.

The Commission considered that some government support for business and for individuals neither reflects an emphasis on support in cases where market failure is evident nor on helping those most in need. Naturally, the beneficiaries of such support will argue for its retention.

The Commission's Report recommended that a number of programs should be transferred to the States in areas such as education, services to Aboriginals and Torres Strait Islanders, family services, housing, the environment, regional development, workers compensation and industrial relations. The Commission also recommended in its Report that Commonwealth review the need for continuing government ownership of all government business enterprises and reconsider its involvement in the provision of services to other government agencies such as the Legal Practice of the Attorney-General's Department.

The Report stimulated a program of privatisation, outsourcing, contracting. It also saw the "devolution" of programs to the States and Territories, such as business assistance and support programs.

Young Australia: federal government initiatives for young people, 1996

Young Australia[7] forms a statement of initiatives by the Labour Government aimed at providing more support to young people, to recognise their abilities, to develop and encourage their talents and to ensure Australia offers improved opportunities and a better quality of life for young people. This statement outlines strategies to ensure young people can achieve a smooth transition from school to work.

It contains measures to encourage employers to take on young people, and initiatives to provide more help for the young unemployed. These initiatives build on the Youth Training Initiative and the other employment and training measures that were introduced to help young people in Working Nation.

The aim of these initiatives is to give both young people and employers a range of choices in employment and training. The statement also details initiatives to assist young people to play a more active role in enterprise activities in schools, training programs, further education and the small business sector.

4.3 Knowledge and innovation

Managing the Innovating Enterprise: Australian Companies Competing with The World's Best, 1993

The report aimed to promote acceptance of the concept of innovation as a practical business issue for Australian business. The BCA undertook that research because it was concerned at the time that there was a general lack of understanding outside business circles of what it meant to be innovative in business, about the processes of innovation in businesses and about the factors that determined business innovation success (Carnegie et al., 1993)

[7] http://www.voced.edu.au/content/ngv%3A38789

National Design Review, Competing by Design, 1995

The National Design Review (The Australian Academy of Design, 1995) arose out of an emergent view proposing the development of a new industry focused agenda which would install Design in an integral role within the process of research and development, production, marketing and sales.

The Review reported that

> … the Commonwealth Government recognised the importance of Design, particularly as it relates to the challenges facing Australian industry, in the white paper, *Working Nation* (May 1994). The Government reaffirmed this commitment in the cultural policy statement, *Creative Nation* (October 1994), which recognised "the importance of Design in adding value to manufactured goods, improving export performance, developing elaborately transformed manufactures and succeeding in niche markets". Senator Peter Cook's Innovation Statement (November 1994) further extended the Commonwealth Government's commitment to Design.

The Review Report pointed out:

> Design is the 'missing' third component of R&D. It has tended to be considered very much as a peripheral activity. The position of design is not secured firmly in the R&D milieu and this could help explain why many innovations are conceived, but not commercialised in Australia. Failure in the innovation process in Australia occurs largely at the commercialisation stage.
>
> Design is, in reality, a core element of R&D, a key part of the continuum, not merely a support activity, and this is worthy of recognition by industry and government. The R&D process is more correctly described as research, design and development. This redefinition has obvious implications for design industry policy, practice, financing, taxation and research funding.
>
> While the Department of Industry, Science and Technology has accepted design as an important element in innovation, the linkage to R&D is not so well enunciated. Theme papers prepared by the department for a forum on Innovation in Industry, when identifying aspects of technological innovation, positioned design as an incremental rather than a competitive or strategic influence.

The Review identified a requirement for design to be elevated to be a core element of the technological innovation process and, therefore, to emerge as a major source of business innovation and competitiveness.

While other nations had picked up this messaging, it was largely lost in Austrlian science, research ad innovation policy settings.

Innovation Statement, 1995

In 1995, the Government released an *Innovation Statement* and a response to the Industry Commission report on Research and development. *The statement cannot be located on any websites*.

Science and Technology Budget Statements

From the mid 1990s the Government released, at Budget time, a Science and Technology Budget Statement. This practice was later discontinued.

In the 1993-94 Statement the Minister wrote "Our most urgent task is to build an innovative culture in industry … Above all, we need a cultural change – among business leaders, decision-makers and the community generally – which recognises the major significance innovation has for building national competitiveness"[8].

The 1995-96 S&T Budget Statement envisaged that the *Innovation Statement* would seek to foster an innovative culture which will firmly establish Australia as the premier location for science and innovation in the Asia Pacific region. The Statement ranged broadly over issues relating to the development, acquisition and application of technologies to national welfare. Its ambit addressed:

- The concerns of economic and social development, health and the environment.
- How the different elements of the national innovation system, including the business sector, financiers, educators, research institutions and the public sector, interact with each other to enhance the effectiveness of the system.
- The social values, education and training which underpin an innovative culture, Australia's development as the premier location for science and technology in the Asia-Pacific region
- The many issues associated with technology development and commercialisation.

[8] https://www.industry.gov.au/innovation/reportsandstudies/Documents/1993-94-Science-Technology-Budget-Statement.pdf

This has turned out to be familiar territory. The Statement covered:

- generating ideas;
- commercialising them;
- how Australia then links to the world;
- and new ideas of business in the workplace;
- accelerating ideas, bringing us all into convergence with the superhighway.

Australian business innovation: a strategic analysis, 1996

Australian business innovation[9] provides detailed background information and discussion on the output or impact of resources allocated for science and innovation in the Australian business sector as well as analytical comparisons with other OECD nations. It complements other publications which provide the corresponding "input" information. It covers:

- Concepts and measures of business innovation
- An R&D related view of trade in manufacturing
- Diffusion of advanced manufacturing technology
- Patents : innovation and internationalisation
- Business sector research and development
- Science for industry: literature indicators

The analysis was prepared by Kevin Bryant, Department of Industry, Science and Technology, Science and Technology Policy Branch. It was published by the AGPS in a series, *Measures of science and innovation* (No 5).

4.4 Science and Research

Research and Development, Industry Commission inquiry report, 1995

The proposals in this report are directed at enhancing the contribution of R&D to national welfare by more clearly defining government's roles, improving funding processes and making research more responsive to users and community needs (Industry Commission, 1995).

Key policy proposals included:

- CSIRO — a need for wider community influence on its priorities and a greater role for government in monitoring its performance;
- the universities — an enhanced role for the ARC in funding research according to performance;
- business — more widespread R&D support for smaller companies unable to use the tax concession; and
- the rural sector — changes to enhance the role of the RDCs in rural research.

4.5 Trade and investment

Emerging exporters – Australia's High Value Added Manufacturing Exporters, 1993

Emerging exporters - Australia's high value-added manufacturing exporters was prepared by McKinsey & Company and the Australian Manufacturing Council Secretariat to the Australian Manufacturing Council (McKinsey and Company and Australian Manufacturing Council Secretariat, 1994).

Winning Enterprises: How Australia's Small and Medium Enterprises Compete in Global Markets. 1995

Winning Enterprises - How Australia's Small and Medium Enterprises Compete in the Global Market Place was produced by the Department of Foreign Affairs and Trade (Australia. Department of Foreign Affairs and Trade, 1995). Key findings included:

- Within Australia, it is beginning to become part of the culture of competitive SMEs to extend their operations internationally and not be constrained to operate only in the domestic market.
- Lower costs in communications and travel, combined with advances in communication and information technologies, have made it easier for SMEs to operate internationally. Government efforts to secure increased market access and facilitate trade are also important in facilitating international activities by SMEs.
- The main reasons why Australian SMEs go international are the limited opportunities in the domestic market and the need to achieve economies of scale. Personal contacts are an important means for entering international markets, and these can be developed in a structured way through attendance at international exhibitions and trade shows.

[9] http://catalogue.nla.gov.au/Record/2544952?lookfor=innovation%20policy%20australia&offset=9&max=889

- The strategies used by SMEs to internationalise need to be tailored to the operating environment faced by individual firms. There is no single strategy which provides a sure-fire recipe for success. Most successful internationalised SMEs use a combination of strategic options. These options may include 'going it alone', appointing agents, and using distribution networks, strategic alliances, licensing and joint ventures.
- To sustain competitiveness requires not only producing a world class product, but also good marketing, innovation, and paying close attention to customer needs.
- Major constraints on the ability of SMEs to operate internationally include difficulties in accessing timely information on market opportunities and the ability to manage uncertainty and risk.

Supermarket to Asia Strategy, 1996

The Supermarket to Asia Strategy was developed jointly by industry and government to meet the challenges of growing Australia's food sales to Asia.

The Supermarket to Asia Council, comprising senior representatives of government and industry, was established by the Prime Minister in September 1996 to provide the leadership and drive necessary to do this. Supermarket to Asia Ltd services the Council by coordinating the various elements of the Strategy and undertaking a work program on its behalf.

The May 1998 Commonwealth Budget provided funding to continue the Supermarket to Asia Strategy for another three years. The role of Supermarket to Asia was expanded to include the new Food and Fibre Chains Program.

Supermarket to Asia undertook a catalyst role aimed at:

- developing a market-led export culture,
- identifying and removing barriers to trade,
- building points of product difference, and
- improving competitiveness through the chain.

The Strategy was replaced by the National Food Industry Strategy in 2002.

http://www.regional.org.au/au/abts/1999/kennedy.htm

5 1997-2007: INNOVATION LED INDUSTRY POLICY

Howard Government.

5.1 Administrative arrangements

1996–1998: Department of Industry, Science and Tourism

- *[1996-1998: Department of Employment, Education, Training and Youth Affairs]*
- *[1998-2001: Department of Education, Training and Youth Affairs]*

1998- 2001: Department of Industry, Science and Resources

2001-2007: Department of Industry, Tourism and Resources

- *2001-2007: Department of Education, Science and Training]*

5.2 Economy and industry

The Howard Government, elected in 1996, had a concern that micro-economic reform strategies weren't delivering enough in terms of productivity and employment growth. However, the Government saw industry policy as "picking winners". Innovation policy offered a way in.

Intellectual underpinnings

During the early 1990s economists became increasingly aware of the crucial role that technology plays in economic growth and sought to incorporate it into growth models. This gave rise firstly to 'new growth theory' or 'endogenous growth theory'. Technology was modelled as an *internal* outcome of R&D investment and investment in human capital (talent formation). Technology and human capital were considered to exhibit increasing returns to scale, as the engine of growth.

New growth theory provided an argument for government investment, but not necessarily defining a specific strategy. That is, new ideas were endogenous to a firm, rather than from external organisations that could transform ideas into products (exogenous growth). However, the increasing emphasis on relationships between technical change and growth encourage policymakers to continue investing in public R&D, developing business R&D support programs, and investing in education and training to foster growth (Mazzucato, 2015).

The 1990s saw the development and implementation of innovation led growth policies to support the knowledge economy – a term used to denote the greater importance of investing in knowledge creation to promote economic competitiveness.

Studies had shown a direct relationship between the market value of firms and their innovation performance, as indicated by R&D spending and the level of patenting.

In 1982, a ground breaking work, *An Evolutionary Theory of Economic Change* (Nelson and Winter, 1982), drew on the work of Shumpeter to propose an *evolutionary* approach to understanding growth. It delved inside the 'black box' of the production function approach (reflected in both erogenous and endogenous growth concepts) to understand *how* innovation occurs and impacts on competitiveness and growth. Innovation became seen as a constant process of differentiation based on different abilities to innovate due to distinctive routines, and competencies and capabilities. *Innovation is thus firm specific.* There is no 'representative' firm.

The evolutionary approach led to the *systems of innovation* approach where what matters most is how firms are *embedded* in a system at sectoral, regional and national levels. It is not so much the quantity of R&D as the way it is distributed and the role of the government in influencing that distribution. Systems of innovation are defined as 'the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies (Freeman and Soete,

1997), or as 'the elements and relationships which interact in the production, diffusion and use of new and economically useful knowledge (Lundvall, 2007). The network is the unit of analysis – not the firm.

The policy implication is that Government should act to correct *system failures* rather than market failures – inefficiency and ineffectiveness of a system to perform its core functions such as fostering entrepreneurship, learning, knowledge diffusion, market formation and resource mobilisation. But this might not be enough.

The innovation systems approach does not, of itself, deliver a policy imperative of a strategy. Depiction of an innovation system may be simply an artefact.

Government has a role to lead the process of innovation and industry development by developing strategies for technological advance in priority areas. Policy is directed not so much at addressing certain types of market or systems failure but to create and shape markers and systems (Mazzucato, 2015).

The work of leading academics was also reflected in the work of international organisations and particularly the OECD (Hauknes, 1996, OECD, 1996d, OECD, 1996a, OECD, 1996c, OECD, 1996b, Freeman and Soete, 1997).

This developmental view of innovation has been accepted among multiple countries and regions where government takes a lead role in the process of industrialisation. It has occurred through investments in particular technologies ('picking winners') and the creation of specific business strategies to win in international markets. It is at odds with a neoclassical/conservative economics market centric strategy of letting the private sector lead the innovation trajectory.

Australian governments were keen to explore the developmental view of innovation but have been unwilling to fully embrace it, or commit to it over the longer term. State Governments, particularly Victoria (STI Initiative) and Queensland (Smart State and Advance Queensland initiatives) have been far more engaged.

With the change of government in Canberra in 1997 there a groundswell of policy papers emerged from industry organisations and think tanks, including an influential Australian Business Foundation paper advocating a shift in policy direction, *The High Road or the Low Road: A Report on Australia's Industrial Structure* (Marceau et al., 1997) and *Make or Break: 7 Steps to Make Australia Rich Again* (Economist Intelligence Unit, 1997). This followed a series of reports and papers prepared by the Australian Science and Technology Council (ASTEC, 1996b, ASTEC, 1996a).

Over next 10 years Australian governments took policy initiatives, based on inquiries and reviews, aimed at strengthening the innovation system. But most areas of review activity and policy initiatives have been in specific policy domains, rather than looking at ways of strengthening the innovation *system.* It has been a process of experimentation, learning, and adaptation. There were regular changes in direction with changes in governments and Ministers. These aspects are explored in the remainder of this sector by making reference to policy statements, information and issues papers, and reviews.

5.3 Knowledge and innovation

Going for Growth: Business Programs for Investment, Innovation and Export (David Mortimer) 1997

An early Report embracing the new thinking (Australia. Review of Business Programs, 1997) made several recommendations for Government to:

- Adopt a target per capita income growth of 3.4 per cent per annum to be achieved through increasing national savings and investment, maintaining low inflation and microeconomic reform.
- Develop 'action agendas' in priority areas to be jointly formulated by industry leaders and government using 'Supermarket to Asia'[10] as a model. Supermarket to Asia aimed to improve access to Asian markets and cut costs of exporting.

[10] Supermarket to Asia was superseded by the National Food Industry Strategy Limited.

- Consolidate business support programs into *five key programs, from the roughly 70* that Mortimer looked at, with guaranteed five-year funding arrangements costed at $20.75 billion, up $0.84 billion on forward estimates. The five key programs would be:
  - Investment. A proposed 'Invest Australia' would be responsible for promoting and attracting investment, including foreign investment, identifying global investment proposals suited to Australia and formulating strategies to win investments where there is a net economic benefit. Tailored investment incentives would be developed and administered in this program subject to a five-year spending ceiling of $1 billion.
  - Innovation. To manage Innovation Rebates, Venture Capital, and Public Research Infrastructure
  - Exports. This program would absorb existing programs such as Austrade and the Export Market Development Grants Scheme. Austrade would be better focused by getting out of 'mature markets', other than on a user pays basis. Austrade should also work harder to promote an export culture and promote Australian capabilities.
  - Business Competitiveness. To include the sub-programs, farm business, adjustment and competitiveness rebate.
  - Sustainable Resource Management This would include land and water natural heritage trust programs, energy efficiency, forest industries and fisheries management[11].

In many ways this Report set an agenda for the next decade.

The Global Information Economy: The Way Ahead (Ashley Goldsworthy) 1997

Report from the Information Industries Taskforce chaired by Professor Goldsworthy of Bond University (Australia. Information Industries Taskforce, 1997). Goldsworthy put forward seven challenges with proposed action agendas built around them.

- National Leadership. Appoint a Cabinet Minister for Information Industries, establish an Information Industries Council, pursue a national agenda working with State and Territory Governments, and establish an information industries fund to undertake feasibility studies on identified opportunities. Use government as a leading-edge purchaser to maximise industry development opportunities from government procurement.
- Proactive Investment Attraction through a proposed investment attraction agency to attract foot-loose investments and encourage the transfer of technology and skills. Access to capital should be encouraged through the development of venture capital and development finance, including through assistance to get businesses 'investor ready'.
- Going Global. This includes efforts to try to overcome external barriers through trade bargaining and similar initiatives, enhancing the capacity of firms to export through an 'Export Ready Program,' improved coordination among industry and government bodies at all levels, and support for globalisation through the development of contacts abroad, and a proposed outward investment facilitation program.
- Getting On-line. Government as champion for going on-line and the promotion of exciting case studies as well as the Government itself acting as a leading-edge user. Government should also encourage electronic commerce as both desirable and as an industry development matter.
- Enhancing Skills Formation. Government to enhance the links between education providers and business as well as increasing the resources going into information and communications training and education.
- Enhancing Research, Development and Innovation. Introduce a 'competitive R&D tax concession' and ensure there is more information and communications focus in the R&D institutional structures. Australia should actively participate in standards development processes and disseminate information and intelligence to industry. Support should be provided for major international projects and key infrastructures.

Many of the recommendations would involve close personal collaboration between industry and industry's global leadership, and the Australian Government at the highest levels. There is an important sense that personal relationships and negotiation between business and government can play an important part in industry policy[12].

It was disappointing that the Government failed to embrace an information and communications strategy that was closely linked to a broader innovation strategy. Arguably, this has been a major gap in Australia's innovation capability. But ICT was handled in a different policy portfolio to Innovation (as was agriculture and health – both having important innovation dimensions).

The Economic Impact of Venture Capital, 1997

A Coopers & Lybrand survey (Coopers & Lybrand, 1997), funded by AusIndustry and AVCAL (Bill Ferris Chair), created a great deal of interest in the policy arena.

- Launched by Hon John Moore, Minister for Industry
- Initially discounted by public service economists as not being statistically robust, Ministers became interested in the issues of venture capital investment and the finance of new technology based firms.

It coincided with a groundswell of interest that led to a range of initiatives including the introduction of the Innovation Investment Fund (IIF) Program in 1998.

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[11] See http://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/Publications_Archive/CIB/CIB9798/98CIB04

[12] Reference is often made to the personal efforts Senator John Button used to put into the relationship between key businesses and government.

Ideas for Innovation, 1999

Occasional paper No 2. (Prime Minister's Science, Engineering and Innovation Council). The Paper covered

- Science, engineering and technology for employment
- Innovation as a key driver of growth
- Links between science, engineering and technology, and employment growth
- The Council's Nexus Working Group
- The Working Group's first report, December 1998
- Education in science, technology and entepreneurial skills
- Government programs to encourage innovation
- Venture-seed capital for emerging growth businesses
- The Working Group's second report, June 1999
- Key factors in the environment for innovation
- Primary, secondary and tertiary education in science, technology and enterprise
- Proving technology and development of working prototyes
- Technology incubator proposal
- Preparing for the National Innovation Summit.

Interactions between Universities and Industry, Coordination Committee on Science and Technology, 1999

The Committee (Australia. Coordinating Committee on Science and Technology University-Industry Interaction Working Group, 1999) made several generalised recommendations in the areas of:

- Responding to and participating in global networks
- Innovation networks and collaborative linkages
- Capital to support research commercialisation
- Incentives and rewards for academic researchers and research students to be entrepreneurial
- Better linkages between researchers and business in research training
- Coordination of support programs to facilitate growth and elaboration of collaborative partnerships
- Monitoring and information systems around the development of interactions and link innovation networks internationally.

New Knowledge, New Opportunities, Minister for Education, Training and Youth Affairs, 1999

A discussion paper that provided a policy framework for research and research training in higher education (Australia. Minister for Education Training and Youth Affairs (Hon. David Kemp MP), 1999b). The proposals put forward were intended to benefit people participating in the generation and application of research.

Knowledge and Innovation, Minister for Education Training and Youth Affairs, 1999

A major policy statement on research and research training. It announced measures involving excellence and diversity, inter-university collaboration, commercialisation, research strength, training and skills (Australia. Minister for Education Training and Youth Affairs (Hon. David Kemp MP), 1999a)

Specific measures included major changes to funding of higher education research with the aim of achieving the objectives outlined in ‘New knowledge, new opportunities’ paper (above).

Australia's Information and Communications Technology (ICT) Research Base: Driving the New Economy, 2000

The Report (PMSEIC, 2000) recommended:

1. Increase the level and quality of public sector ICT research and development and enhance the scope for commercialisation of research outcomes: Total Cost $555 million over 5 years
2. Significantly improve the capability of Australia’s ICT research and development infrastructure: Total Cost $161 million over 5 years
3. Increase the level and quality of private sector ICT research and development. Total Cost $30 million over 5 years

The Chance to Change, Chief Scientist (Dr Robin Batterham), 2000

The general thrust of the arguments was that it is “vital that appropriate mechanisms and incentives are in place” to ensure that ideas and technologies generated by the science, engineering and technology (SET) base are converted into wealth and jobs so that the community can get the best possible return on its investment”. The discussion paper states:

> This involves strengthening the links in Australia's innovation network by bringing universities and businesses closer together, and by providing researchers with the skills and incentives to take their ideas to the market – that is, encouraging commercialisation and connectivity in Australia's SET base (Australia. Chief Scientist (Dr Robin Batterham), 2000a)

The report recommended:

- Provision of 200 HECS scholarships for students undertaking combined science and education qualifications, and 300 for students of the enabling sciences such as maths.
- An increase in the number of postdoctoral fellows and the redesign of the research and development Start Gradate program.
- The culture associated with science, engineering and technology also needs to change
- More support should be directed for those who encourage children to study science and maths as well as increased public awareness and support.

Investing in Knowledge for the 21st Century, Chief Scientist (Dr Robin Batterham) 2000

A paper prepared by an independent working group for PMSEIC (Australia. Chief Scientist (Dr Robin Batterham), 2000b). The opening paragraphs were:

> To be successful in the 21st century Australia will need to develop an ideas-based, can do economy and society. This means an economy and society that is proficient at both creating ideas and translating a substantial proportion of them into new business opportunities - the payoffs are jobs, wealth and a better quality of life. Australia will be a nation where the words science, innovation and entrepreneurship are synonymous with excitement.
>
> In the last five years many OECD countries and the rapidly industrialising countries in Asia have already concluded that their future relies on increasing investment in the underlying capability of the knowledge economy and creating an environment favourable to the rapid translation of new ideas into new business opportunities

The report added:

> If Australia is to take its place among the top ten countries in the world at creating ideas and successfully turning them into businesses, jobs and wealth, an effort must be made which matches those being made by the leading countries in the world.

It advocated for a change of culture, operating principles, a greater emphasis on contestability and investment outcomes. The package of measures proposed focus on four main areas:

- Culture and image
- Building enterprise an innovation skills
- Generating ideas
- Commercialisation

Unlocking the Future, Report of the Innovation Summit Implementation Group, 2000

Innovation - unlocking the future, is based upon the recommendations of the National Innovation Summit. It represents recommendations in three critical areas: creating an ideas future, generating ideas, and acting on ideas. The Group reported (Australia. Innovation Summit Implementation Group, 2000) that:

- Maximising the outcomes of investment in public sector research will create new business opportunities, jobs and exports. However, there is a perception that public sector research in Australia is somewhat less than commercially orientated and that this needs to be addressed.
- Where there is a commercial orientation, there is often a lack of expertise in valuing and managing Intellectual Property, business planning and business management. If we do not have the skills to manage commercialisation well, we cannot expect healthy returns from our investment and efforts.

Commercialisation of Public Sector Research, PMSEIC, 2001

A Report from a PMSEIC Working Group (PMSEIC, 2001). The report makes recommendations on four key issues:

- Information Exchange—facilitate information linking intellectual property (IP) to market opportunity, and help industry and researchers find a 'common language', for example, through a regular 'trade fair of ideas'
- Confidence to Commercialise—give researchers and their business partners the skills to commercialise, by raising researchers' awareness of commercial reality, educating industry about the potential returns from investing at the pre-seed stage, and providing both with the tools to better manage the risks.
- Incentives for Success—provide appropriate incentives to encourage researchers to consider the commercialisation potential of their work and remove obstacles such as the taxation treatment of share options, media and political beat up for perceived failure; and

- International Development—establish profitable international developments to optimise the benefits of global collaboration, and showcase Australia's innovation potential to the world, while increasing local awareness and appreciation of research, innovation and commercialisation.

Backing Australia's Ability - 1: Real Results, Real Jobs, Prime Minister, 2001

The Report (Australia. Prime Minister, 2001) contains a recognition that the role of government in a modern economy is incompatible with conducting activities too close to the market. The role of government is -

- Building up infrastructure – including human resources
- Support for networking activities – such as human mobility
- Financing research programs in basic pervasive technologies – promoting the notion of generic technologies
- Provision of science and technology services, education and training at the national level – leading to better public understanding of S&T.

The Report has an orientation towards encouraging growth in the life sciences (specifically biotechnology) and information technology and communications industry sectors through encouragement and support for "centres of excellence" and major research facilities.

A major focus is on pre-competitive research and generic commercialisation strategies, thus avoiding the criticism of "picking winners".

The Government reported progress the following year (Australia. Prime Minister, 2002).

Innovating Rural Australia: Research and Development Corporation Outcomes, 2001

A Report in 2001 (Australia. Department of Agriculture Fisheries and Forestry, 2001) and updated in 2005 (Australia. Department of Agriculture Fisheries and Forestry, 2005)

Research and Innovation Systems in the Production of Digital Content and Applications, NOIE, 2003

The report (Cutler and Company and QUT CIRAC, 2003) argues that the nature of R&D and innovation within the creative and content industries generally has not been closely examined:

> This largely reflects the sorry fact that these industries have tended to be at the fringes of national discussions about science and innovation policy, and of related funding and industry programmes. A further complication is that there is little systematic data about the extent and nature of R&D activity and funding in the creative industries in general and for digital content production in particular.

The report suggests that use of the term "digital content" implies a marriage of content and technology. Also obviously, digital content represents a new and emerging market, an "innovation frontier". Thus digital content constitutes a case study in innovation and change in those industry domains within which digital content firms operate, and for those industries in which digital content is becoming an important input and enabler, particularly education and other service sector industries.

This current study has been part of a multi-stage programme of work examining digital content production and applications within creative industries, and the extent to which an industry cluster is developing, or could develop, around digital content activities. The programme's focus on possible clustering provides a natural springboard for extending the study into this area of innovation systems and the role of research and development.

Embracing Change: Incremental Innovation Case Studies, 2003

Embracing change case studies looked at how Australian firms use incremental innovation to support growth , was prepared for the Department by Dr Lyndal Thorburn, Advance Consulting & Evaluation and Dr John Langdale, Macquarie University, as part of the science and innovation mapping study. The report, was released in 2003.

- The report focused on gradual (incremental) business change and improvement by examining how Australian firms innovate in ways that are not related to R&D and barriers to these forms of innovation.
- The findings are based on 30 case studies involving mostly small firms, across a range of industries and Australian regions.
- All firms were committed to continuous business change and improvement.

Report conclusions:

- Incremental innovations was mainly directed towards higher quality or customised products/services and niche markets; and that listening to customers was very important.
- The main barriers to innovation were those of growing a small business, obtaining finance, finding staff, marketing overseas and relying too much on the founder.
- Most of the firms studied, struggle with the challenges of growth and with the conversion of tacit knowledge to codified knowledge.

The report is no longer on the Department of Industry Science and Technology website.

Our Universities: Backing Australia's Future. Review of Higher Education in Australia (Nelson Review), 2003

This review (Australia. Minister for Education Science and Training, 2003), announced by the Howard government in April 2002, incorporated a range of different reports and discussion papers. The review commenced with a discussion paper, *Higher Education at the Crossroads*, followed by six issues papers and a Productivity Commission report, *University Resourcing: Australia* in an International Context.

The Report, based on the outcomes of the review process, presented the Government's blueprint for reform. It proposed increased Commonwealth investment of $1.5 billion over four years linked to progressively introduced reforms in areas such as teaching, workplace productivity, governance, student financing, research, cross sectoral collaboration and quality.

ICT Use and Productivity: A Synthesis from Studies of Australian Firms, Productivity Commission, 2004

The Report (Australia. Productivity Commission, 2004) made the following points:

Compared with their overseas counterparts, Australian firms have been active in their uptake of ICT and successful in their efforts to turn it to productive advantage.

- Australian firms invested more in ICT, especially from the mid-1990s, as technological advances provided cheaper and readier access to more accurate, timely and useful information.
- The gains from use of ICT stem from the opportunities it provides firms:
  - to undertake existing tasks more quickly, cheaply and effectively by substituting ICTs for other inputs, especially labour; and
  - to improve multifactor productivity (the efficiency and effectiveness of input use) by using ICTs as a means to innovate - to develop and introduce new value-adding and efficiency-enhancing products, processes and organisational structures.
- Many of these gains do not come automatically — from the mere purchase and installation of new hardware and software.
  - There can be costly and time-consuming adjustments, for example, in staff dislocation and (re)training.
  - Product, process and organisational innovations require investments in design, development and implementation.
  - Skilled staff and high-order management skills and qualities are needed if potential gains are to be realised.
  - The gains also depend on the accumulation of experience in and learning from the application of ICTs and from the investments in ICT-enabled innovations.
- The acceleration in use of ICT in the 1990s raised the rates of growth in Australia's labour productivity and multifactor productivity. Although the available estimates suggest that the acceleration in use of ICT contributed a relatively small amount to Australia's 1990s productivity acceleration, the estimated productivity gains (especially in multifactor productivity) are high by international standards.
- Firms and industries differ in the intensity of their use of ICTs and in their realisation of productivity gains. This is largely due to differences in the nature and amount of their investment in ICT-enabled innovation, in their access to skilled staff and management, and in their accumulation of learning and experience.
- Countries differ in the intensity of ICT use and associated productivity gains. This is largely due to differences in costs of using ICT, in the ability of firms to absorb new technology and in the policy and institutional environments in which firms operate.
- Tapping ICT's future productivity potential is predominantly in the hands of firms. *Whilst specific issues require ongoing government attention, the strong performance of Australian firms suggests that additional widespread government support is not warranted*.

The Report suggested that the main role for governments remains one of ensuring that markets are competitive, firms have flexibility to adjust and to experiment*, innovation is appropriately supported and needed skills are developed.*

There may have been some failure in the latter aspect.

Backing Australia's Ability – 2: Building our Future through Science and Innovation, Prime Minister, 2004

Backing Australia's Ability (Australia. Prime Minister, 2004) provided a comprehensive and integrated package representing an additional Government investment of $2.9 billion over five years. It will fund major initiatives to stimulate innovation, including:

- providing an additional $736 million for Australian Research Council competitive grants, doubling funding by 2005-06;
- boosting research infrastructure funding by $583 million;
- committing an additional $176 million for world class centres of excellence in the key enabling technologies of Information and Communications Technologies (ICT) and biotechnology;
- providing $155 million to support investments in major national research facilities;
- continuing the R&D Start Program with funding of $535 million over five years;
- reforming the R&D tax concession including the provision of a premium rate of 175per cent for
- additional R&D activity, and a tax rebate for small companies;
- expanding the Cooperative Research Centres Program with an additional $227 million and encouraging greater access by small and medium enterprises;
- increasing funding to universities by $151 million to create 2000 additional university places each year, with priority given to ICT, mathematics and science – to be backed by adjustments to existing immigration arrangements to attract more migrants with ICT skills; and
- delivering $130 million to foster scientific, mathematical and technological skills and innovation in government schools in those States where the Enrolment Benchmark Adjustment (EBA) is triggered.

It was estimated that the Government's investment of $2.9 billion would underpin business and research organisation expenditure of approximately $6 billion.

Some, but by no means all, of these investment commitments were delivered.

Growing Technology Based SMEs, PMSEIC, 2005

A report for the Prime Minister's Science, Engineering and Innovation Council (Miles and Adams, 2005).

This report is no longer on the Department of Industry, Science and Technology website.

Imagine Australia: The Role of Creativity in the Innovation Economy, PMSEIC, 2005

To be globally competitive, Australia needs to formulate a comprehensive approach to fostering Creativity by implementing the political, economic, social and technological infrastructure that facilitates relationships amongst creative industries sectors and between creative industries and other sectors (PMSEIC, 2005).

> Such implementation is vital because the methods and processes employed by designers and creative artists will get innovators closer to end-users in markets.

To address these issues the report recommends that PMSEIC should consider how to:

- Enhance innovation policy by the inclusion of design, creativity and creative industries;
- Review existing government programs for research and innovation to ensure that design and creative processes are not excluded;
- Facilitate a critical mass of activity through the Creative Innovation Fund; and
- Facilitate greater cross-disciplinary and cross sectoral research collaborations between SET and
- HASS sectors.

This report is no longer on the Department of Industry, Science and Technology website.

Knowledge Exchange Networks in Australia's Innovation System: Overview and Strategic Analysis, 2005

Knowledge Exchange Networks is a report of a Study Commissioned by the Department of Education, Science, and Training undertaken by Howard Partners in 2005 (Howard, 2005).

The Report defined knowledge exchange networks (KENs) as structured intermediary mechanisms for users to locate, exchange and acquire knowledge in a systematic way, with a view to development of new products, processes and services. They may be virtual/electronic or actual/physical communities of interest, public or private, free or subscription based.

The project has assessed knowledge exchange networks in three broad categories:

- Knowledge communities – involving the sharing of knowledge through what have become known as 'communities of practice' and 'knowledge or science and technology 'clusters.

- Knowledge markets – involving the trading of knowledge between sellers and providers, often through Internet based exchanges, but increasingly involving knowledge brokers.
- Knowledge organisations – entities established to facilitate the application of knowledge by developing skills and capabilities on the part of users through specific programs and initiatives. These organisations manage the relationship between the creators and users of knowledge.

The Report concluded that the most effective networks, in terms of the transfer of knowledge from the creators of knowledge (research providers) to industry users are those that are sponsored and supported by industry through industry associations. The research found best practice in networking activities in cluster (technology consortia) initiatives, some of which were supported by Government grants.

The Report also concluded that Industry sponsored and supported research and development networks have been important to Australian economic and industrial development particularly in the animal and plant production sectors. The mining industry had demonstrated the benefits of knowledge exchange and collaboration through the Australian Minerals Industry Research Association (AMIRA) and the wine industry has demonstrated similar benefits through knowledge a cluster that creates and shares product related knowledge through the Wine Research Institute.

The Emerging Business of Knowledge Transfer: Creating Value from Intellectual Products and Services, 2005

The Report proposes a framework for identifying, tracking and understanding the economic contribution of universities and research organisations in the twenty-first century. This framework is characterised by the emphasis placed upon the plurality and the complexity of the channels and mechanisms through which universities and research organisations generate economic benefits (Howard Partners, 2005).

The Report argues that the 'standard' research commercialisation model, associated with a linear sequence linking basic research to commercial outcomes, is largely specific to the biomedical sciences. Like the 'linear model' of research and development (R&D) itself (basic research—applied research—experimental development) to which it relates, the standard model is easily grasped, and the outputs easily measured, which in turn helps to secure funding

The standard model also has the advantage that it is compatible with the current emphasis on performance metrics within government. As 'capitalised knowledge', patents and licenses are easy to count—and the temptation to set targets, such as a planned numbers of patents and associated spin-out companies, can be hard to resist.

The challenge for policy-makers is that the standard model does not adequately reflect the wide range of circumstances through which universities impact upon the economy. Consequently, if performance measures are based exclusively on this standard model, then there is a risk that other, perhaps more important channels for generating economic benefits, will be given insufficient recognition, thereby potentially distorting policies and practice, including misallocation of resources across the spectrum of research-industry interaction.

The report addresses this challenge by proposing a more comprehensive and realistic framework for understanding research commercialisation and knowledge transfer. The framework consisted of four 'ideal typical' models:

- *Knowledge diffusion*: Universities and research organisations generating useful economic and social outcomes via encouraging the broad industry-wide adoption of research findings through communication, building capacity within industry through extension, education and training, creating standards relating to production and distribution.
- *Knowledge production*: Universities and research organisations generating useful economic and social outcomes by selling or licensing the results of research in the form of commodified knowledge—directly exploiting 'knowledge products' embedded in intellectual property and other explicitly codified formats. This is a 'standard' model of research commercialisation.
- *Knowledge relationships*: Universities and research organisations generating useful economic outcomes by providing services that indirectly exploit broad intellectual property (IP) platforms consisting of trade secrets, know-how and other forms of tacit knowledge. This approach centres on cooperation, collaboration, joint ventures and partnerships.
- Knowledge *engagement*: Universities and research organisations generating useful economic outcomes as a by-product of shared interests and concerns that transcend the boundaries of the university per se.

The Report shows how current Australian Government support for science and innovation covers all four of these areas. It is therefore not desirable to restrict measures of performance to 'knowledge production' processes— the easiest area to measure performance.

The report argues for separate approaches to *performance measures* and *performance indicators*.

- Performance measurement is undertaken on the basis of assessment of overall program performance, having regard to purpose, resources, processes, impacts and effects. This involves using a range of *program evaluation methodologies and techniques*.
- Performance indicators, by contrast, are intended to inform policy-makers, managers and stakeholders at regular intervals about progress in relation to achieving purpose and objectives. This task is rendered difficult if purpose and objectives are unclear or ambiguous.

Nonetheless, 13 years later there is still a tendency for policy to focus on measuring knowledge production. Identifying, agreeing and adopting workable metrics in the other areas remains a challenge.

SMEs Taking Innovation to the Global Market, 2005

In February 2005 the Industry Research and Development Board (now the Board of Innovation and Science Australia) completed SMEs Taking Innovation to the Global Market a study of 25 firms participating in the Australian Government's R&D Start and Biotechnology Innovation Fund programs. These firms had either been sold to or merged with foreign companies; established an overseas holding company or headquarters; or sold or transferred IP to an overseas company.

The key message that emerged from the research was that: "Innovative SMEs which are established in countries with small markets, such as Australia, will generally seek to take their novel product, process or service to the global market. This is done via a number of mechanisms, including offshore sale or establishment of a holding company."

Knowledge Transfer and Australian Universities and Publicly Funded Research Agencies, 2006

This report to the Department of Education, Science and Training was prepared by the consulting firm PhillipsKPA and completed in March 2006, it explores the nature and dimensions of the practice and value of knowledge transfer within Australia, as practised by universities and PFRAs, against a background of international and domestic developments. (PhillipsKPA 2006)[13].

The Report begins by examining questions concerning the definition and scope of knowledge transfer and follows with a systematic analysis of current policies, programmes and funding arrangements to determine the extent to which knowledge transfer activities are currently supported and promoted in Australia.

It includes a gap analysis, identifying areas where there is insufficient or inappropriate support for such activities. It also presents a range of case studies of knowledge transfer for commercial benefit and for other material, human, social and environmental benefits.

The Report concludes with a series of observations about the nature of knowledge transfer and its effects. It draws many of its concluding observations from the more than a dozen case studies it presents.

Absorbing innovation by Australian enterprises: the role of absorptive capacity, 2007

The Report (Scott-Kemmis 2007), prepared for the Department of Industry, Science and Research, found that:

> Innovation is becoming increasingly important as a driver of competitiveness. At the same time firms are becoming more specialized as industries move away from vertical integration towards networks of production. As a result of this specialisation, firms are less likely to hold knowledge and capabilities required for innovation in-house, and must increasingly look outside for new knowledge.

Absorptive Capacity refers to a firm's intent and ability to recognise opportunities presented by new knowledge. Firms may develop Absorptive Capacity through explicit measures, such as hiring trained

[13] The full report is not available online. A summary is at https://transferoflearning.com/knowledge-transfer-and-australian-universities-and-publicly-funded-research-agencies/

staff, R&D activities or establishing strategic alliances. Absorptive Capacity may also develop as the by-product of other business activities, for example through learning associated with problem solving, innovation, and collaboration for other purposes.

The Report suggested that firms face particular challenges in external knowledge acquisition where:

- they have few linkages with the firms or organisations from which they seek to acquire knowledge;
- the fields of knowledge and innovation are new to the firm; and
- the pace of change in technology is rapid and unpredictable.

The more firms face such challenges the greater the need to strengthen Absorptive Capacity with strategies and sustained investments, and often organisational and managerial innovations, to raise the capacity to learn and innovate. It is worth noting that firms with more highly qualified managers tend to invest more in training and establish more external links.

The Report notes that while *clusters* are sometimes suggested as a means of stimulating innovation in SMEs, without the capabilities to absorb and use knowledge, membership of a network is of little value. Thus cluster-based inter-firm links do not guarantee knowledge acquisition.

A review of selected successful programs suggested a set of functional criteria for a program focused on strengthening Absorptive Capacity in SMEs:

- be focused on the more innovation-active SMEs committed to growth;
- be located near to firms, be linked into local networks, and be integrated into national information and support networks;
- have a strong emphasis on developing innovation capabilities, along with technological and market knowledge, but in association with a specific development objective, usually linked to an innovation project;
- have a requirement that the SMEs contribute a significant share of overall costs;
- provide access to a broad spectrum of credible experienced professional advisory services;
- facilitate the development of linkages to local, national, and international information sources, service providers, potential business partners and research organisations;
- have a broad portfolio of services (e.g., advice, finance, networking) but a flexible delivery customised to the needs of the SME; and
- delivery through capable experts who work with the firm to develop an effective and sustained combination of objective performance assessment and flexible delivery of services.

These criteria are now reflected in many Commonwealth and State innovation and business support programs.

The role of intermediaries in support of innovation, 2007

The *Role of Intermediaries in Support of Innovation* (Howard, 2007) assesses the role of, and benefits created by, intermediaries in the Australian innovation system. The main focus of the study was to understand the way in which intermediaries assisted companies in accessing knowledge and technologies available in universities, research organisations and other businesses.

Innovation intermediaries are seen as independent third parties that play an integral part in collaborative activities supporting any aspect of the innovation process. They can play a key role in the 'market for knowledge' in relation to the transfer and translation of knowledge and technologies from creators to users in a business (commercial) context. In this sense creators include universities, other research organisations and other businesses.

The study draws on an analysis of the activities and performance results of two pilot programs. In addition, the study undertook a review of the literature on intermediaries, both in Australia and overseas, and took into account international experience with intermediaries.

The Study found that Intermediaries address a number of gaps in the innovation system, categorised as follows:

- Information gaps—gaps encountered by firms in identifying relevant, useful and applicable techniques for product and service development.
- Access gaps—difficulties encountered by firms in accessing technologies and knowledge which they know to exist but are unsure about how to go about acquiring it.
- Transfer gaps—negotiation of licence and consultancy/contract agreements, as well as project management. may be beyond the capability of businesses, particularly small to medium businesses.
- Translation gaps—developing and transforming knowledge embedded in a technology into a form and format that can be used in product, service and/or business development.

There are also a range of 'institutional gaps' that are addressed by intermediaries. These include: gaps in university technology transfer capability; researcher orientation in industry-academic collaborations; and, limited funding for research organisation—SME collaborations. The Study demonstrated that intermediaries had been particularly valuable in addressing these institutional gaps.

A major finding was that intermediaries need to have excellent communication skills and be exceptionally well networked across industry and the research sector, as well as possessing reputation, integrity, and credibility with business, research organisations, and government program managers. They must also understand how a research organisation works—in terms of its mission, its structure, systems, and processes, and the way it measures its achievements and rewards success.

Industry Statement. Global Integration: Changing Markets, New Opportunities, 2007

The Statement, released in May 2007, cannot be located from public records (Australia. Minister for Industry Tourism and Resources, 2007). The Parliamentary library provided the following summary[14]:

> The Industry Statement marks a re-commitment to the current policy settings which were fashioned by the policy statements, Backing Australia's Ability Mark I and II. But in recognition of the potential for export growth and gains from greater integration into the global economy, the Statement provides increased support to Australian industry to compete internationally
>
> The funding measures are predominantly geared to assist small and medium enterprises (SMEs) in developing new market opportunities and in undertaking innovation and R&D[15].

The Statement includes new initiatives and enhancements to current programs worth $1.4 billion over 10 years. The key industry initiatives are:

- $254.1 million for the *Global Opportunities* program to help SMEs identify opportunities to bid for work on international projects and integrate into global supply chains.
- $351.8 million to establish *Australian Industry Productivity Centres* to assist SMEs improve their performance and international competitiveness.
- More than $500 million to extend eligibility of the 175 per cent *premium R&D tax concession* to foreign-owned SMEs undertaking additional R&D in Australia.
- $90.3 million to support the *Commercial Ready Plus Program* for emerging companies and spin offs from public research organisations.
- $21.5 million for the development of a *National Nanotechnology Strategy* for expanding Australia's manufacturing base and $36.2 million to develop manufacturing industries based on nanotechnology.
- $54.2 million to support R&D in *the food processing industry* and $20.1 million to encourage technology transfer through the *Intermediary Access Program*.

The Statement was release only months before the change of Government in December 2007.

5.4 Science and Research

Priority Matters (Chief Scientist, John Stocker) 1997.

Priority Matters is a report to the Minister for Science and Technology, on arrangements for Commonwealth science and technology (Australia. Chief Scientist (Dr John Stocker), 1997)

Review of greater commercialisation and self-funding in the Cooperative Research Centres Programme, 1998

This review of the CRC Programme (Mercer and Stocker, 1998) focussed on issues of commercialisation and self-funding within individual CRCs and has made several recommendations to improve the management of centres within the Programme.

It confirmed the role of the Programme in enhancing collaborative activities between research providers and industry and the significance of effective linking mechanisms in the national innovation system.

[14] http://trove.nla.gov.au/work/18731953?selectedversion=NBD42574482

[15] Source: http://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/pubs/rp/BudgetReview_2007-_2008/Industry_Statement-_Re-commitment_to_current_policy_settings

The Virtuous Cycle: Working Together for Health and Medical Research, 1999

Health and Medical Strategic Review, Report from the National Health and Medical Research Council (Australia. Health and Medical Strategic Review, 1999). The Review noted:

- Collaboration between top researchers and new business enterprises has a positive effect on the enterprise's products in market, products in development and employment growth
- A comparatively low level of involvement by Australian researchers in new business enterprises.

Enabling the Virtuous Cycle: Identifying and Removing Barriers to Entrepreneurial Activity by Health and Medical Researchers in the Higher Education Sector, 2000

Enabling the Virtuous Cycle: Identifying and Removing Barriers to Entrepreneurial Activity by Health and Medical Researchers in the Higher Education Sector (Johnston, Matthews, and Dodgson 2000)

Research in the National Interest: Commercialising University Research in Australia, Australian Research Council, 2000

The Council (Australian Research Council, 2000) endorsed an action plan in six key areas to boost the commercialisation performance of university research in Australia:

- create the right academic environment;
- develop effective commercialisation support structures;
- develop and expand relationships with existing companies;
- facilitate and increase the number of new spin-off companies derived from university research activities;
- strengthen the corporate base; and
- increase the amount of finance available for the commercialisation of research and technological innovation.

These have become familiar themes in discussion, analysis, and proposals for greater commercialisation of university research. Notwithstanding much advocacy and representation Governments have not invested in building university capacity for research commercialisation.

International Trends in Public Sector Support for Research and Experimental Development: A Preliminary Analysis, 2000

This report discusses the findings from a preliminary study of international trends in public sector, and private non-profit sector, support for research and experimental development (R&D). The brief was to examine significant initiatives in a range of countries and to assess the implications of these trends and initiatives for Australian policy (Matthews and Johnston, 2000).

The study suggests that there is compelling evidence of convergence both in policies and in R&D expenditure profiles during the 1990s. This convergence involves moves towards a more balanced emphasis on supporting discovery and linkage-building. The Department of Education, Training and Youth Affairs proposals to improve this balance are therefore in line with overseas trends.

The caveat is that the time-frame and budget for this preliminary study have not allowed a particularly extensive and detailed analysis to be carried out. The convergence finding should therefore be treated as a hypothesis to be tested via a more extensive and detailed study.

A Study of Government R&D Expenditure by Sector and Technology, 2000

The study of government R&D expenditure by sector and technology was prepared for the Department of Industry, Sciences and Resources by Mark Matthews and John Howard of Howard Partners, as part of a series of occasional papers on issues relating to emerging industries and technologies (Matthews and Howard 2000).

The Report examines how R&D and innovation support is deployed across industries; research fields and technologies; and socio-economic objectives. It also examines the implications for emerging areas of economic activity. The analysis is based on Commonwealth support for research and development in the 1996-7 income year.

The study highlighted how the programs available in 1996-7 to deliver Commonwealth support for R&D, tended to disperse R&D support in small amounts across a wide range of socio-economic objectives and fields of research. The study concluded: that from a policy perspective, the allocation of the Commonwealth's R&D support might be too thinly spread to achieve sufficient economies of scale to

commercialise research. However the R&D Tax concession stood out in that it facilitated large scale experimental development and helped counteract the dispersion of R&D investment.

The study also found that the emerging industries analysed tended to exhibit greater private sector R&D investment than Commonwealth R&D investment and that the R&D Tax Concession could be expected to become increasingly important in facilitating R&D in emerging industries.

The Study has not been updated to test the current validity of the findings, although the discussion in the Introduction to this Report would support the observation about research resources being thinly spread.

Mapping the Nature and Extent of Business-University Interaction in Australia: A Study for the Australian Research Council, 2001

The Report notes that the trends in the public funding of higher education, pressures for commercialisation of university generated intellectual property, new approaches to R&D management within corporations, a changing culture of learning, and the growth in small companies in the high technology industries, has led to the emergence of new forms of research and development that require close working relationships between people located in different institutions – not all of whom need be scientists (Howard Partners 2001).

The Report pointed to the emergence of new formally designed interactions of university-based researchers with business people, venture capitalists, patent lawyers, production engineers, as well a research engineers located outside the university. This has invariably involved shared use of academic and industrial facilities. Under these conditions, technology is more likely to be trans disciplinary, and to be carried out by people who are able to rise above disciplinary and institutional loyalties.

The consequence of these developments has been a new way of generating, managing and exploiting knowledge with significant implications for the science, technology and innovation infrastructure. Because the emergence of this new way of working had not been clearly foreseen or visualised and did not quite fit the linear management models of the day, the creation of trans- and interdisciplinary science clusters, which were task or sector specific, evolved more or less by trial and error. The report noted:

> Science clusters are often firm specific and need not be limited by geography: they are defined in terms of the interactions and relationships of scientists and their respective fields of expertise. With information technology, such clusters may reflect a combination of regional, national and international dimensions.

At the same time, however, the Report noted that a science and technology cluster may be seen in a geographic sense where separate institutions, in combination and collaboration, build a critical mass of utilisable knowledge. This can be observed in areas such as molecular biology, a field of inquiry that has evolved as a result of the way questions are framed and research undertaken in immunology, genetics and cell biology across a number of organisations. It is also an area that is of intense interest to companies.

There is probably more to be done, the Report concluded, in promoting collaboration and cooperation between scientists and attracting and sustaining corporate interest and involvement. Some large companies have argued that the lack of collaboration between scientists and institutions is a major disadvantage in innovation in drug discovery in Australia.

> The competitive process and the low rate of funding for projects have also been seen as disincentives for collaboration. Vertical collaboration between multi-disciplinary sciences is critical in drug discovery.

This has continued to be a theme for the next 18 years.

Report of the Science and Innovation Mapping Taskforce, 2003

In November 2002, the Prime Minister identified science and technology as a vital area of Government strategic policy interest. He announced that the Minister for Education, Science and Training, Dr Nelson, was to undertake the major initiative of mapping Australia's science and innovation activities across the public and private sectors.

On 28 November 2003 Dr Nelson released the Mapping Australian Science and Innovation report (Australia. Science and Innovation Mapping Taskforce, 2003). Both a summary of the report and the full

report were made available. A number of additional papers were commissioned and background papers were prepared to provide depth on particular themes, complementing the breadth of the mapping study and illustrating the dynamism of science and innovation. These papers were also made available.

The report is no longer available on public websites.

Evaluation of the CRC Program, 2003

The Evaluation (Howard Partners, 2003) noted that there had been a profound change in Australia's research and innovation culture since the Programme was introduced in 1991. There has been, for example:

1. A widespread recognition of the role of public-private research partnerships, based on the generation and utilisation of "applicable knowledge", in industrial innovation.
2. In the context of the "knowledge economy", an acceptance of a role for the public sector in supporting new business development through the commercialisation of publicly funded research.
3. A greater understanding of the contribution of science to the design and implementation of public programmes, particularly relating to the environment and public health.

The emergence of public-private research partnerships was seen to reflect a fundamental change in the way in which knowledge is generated and applied as well as changes in approaches to the management of industrial research and development. The CRC Programme sits well in the developing system of industrial research built around the production of "knowledge in application", or "applicable" knowledge.

The CRC Programme, which started as a "bottom up" collaborative venture between researchers provided a strong basis for developing trust-based relationships between organisations. With increasing internal resource constraints and the need to set priorities, the Programme has now moved to the next level where collaboration between universities, publicly funded research agencies, business and government is being approached at a more strategic level.

The Programme had attracted international attention and has become one of the notable features on Australia's distinctive science and innovation landscape. At the same time, however, CRC participants and stakeholders agree that it is now necessary for government to act decisively to build upon the strengths of the Programme and to adapt to some of the recent developments in the industrial research and the research commercialisation framework.

The Evaluation captured a a view expressed by many stakeholders, particularly those in the private sector, that the Programme had been too focussed on research with an insufficient emphasis upon meeting industry and other end-user needs through attention to adoption and application of research results. Some, but by no means all, of this criticism is justified. It is in this context that the Evaluation recommended that the Programme should be clearly positioned as an "investment" vehicle in which research is seen as a means to an end ("an end use"), not an end in itself.

Consistent with the trends in research and innovation culture, the Evaluation finds that three distinct types of CRC have evolved with the implementation of the CRC Programme:

- The delivery of *national benefits*, predominantly in relation to the conservation, repair and replenishment of Australia's natural capital, maintenance of biodiversity and promotion of public and environmental health. CRCs that operate on these lines have a strong focus on resource sustainability.
- The delivery of *collective industry benefits* through the creation of applicable knowledge to improve and/or enhance industry performance in the light of global competition and demands for increased quality. These outputs are delivered through what are effectively public-private industrial research partnerships, or industrial research collaborations and have a strong focus on industry performance improvement.
- The delivery of *commercial benefits* through the expansion and creation of new businesses based on the transfer and/or sale of intellectual property rights and reflected in new products and services. CRCs that operate on these lines have a strong focus on business development and research commercialisation.

The Evaluation noted that there has been a discernible trend towards a greater emphasis on national benefit CRCs over the life of the programme. The increasing role of national benefit CRCs reflected a e "demand pull" of research users involved in the application of scientific knowledge for resource sustainability, natural resource management, bio diversity and, more recently, biosecurity.

There was a subsequent view within Government that the resources available under the CRC program should not be allocated to support research which should be funded from other agency budgets. It has

no emerged that agencies are using the CRC 'model' to fund collaborative research – as in the recently established CRC for Northern Australia.

Best Practice Processes for University Research Commercialisation, 2003

The primary objective of this study was to inform consideration of performance and appropriate policy with regard to research commercialisation in Australian universities, in particular by the Ministerial Committee oversighting implementation of the "Backing Australia's Ability' (BAA) Program (Johnston, Howard, and Grigg 2003).

The major findings included:

- Australian universities have significantly strengthened their research commercialisation capabilities and performance in the past five years. The research-intensive universities (predominantly the Go8) display a level of performance well above the average of American universities, and approaching that of the highest performers in America and Europe. However there is great variability in performance.
- Scale is crucial; effective research commercialisation depends first on a sufficient portfolio of research, based on both quantity and quality of researchers; second, it requires sufficient breadth and depth of capacity in the research commercialisation function. This presents a significant challenge to smaller and regional universities.
- Even in the best-case research commercialisation can only generate 3–5% of a university's revenue. Hence neither governments nor universities should pursue research commercialisation solely or primarily as a major source of revenue. However the direct and indirect benefits to the university and the economy can be considerable.
- Australian industry, with its fragmentation, small size and low R&D investment in general has a relatively poor capacity to absorb university generated technology. For this reason, many linkages have to be established with overseas firms.
- The establishment of spinoff firms is an important commercialisation mechanism to hold and develop IP in the absence of suitable receptors or where a high return can be anticipated from future sale. They are most common in the biosciences and IT fields. Despite public perception, spinoffs that generate a huge growth in value, such as Genentech, are rare, unplannable, and usually about 20 years in gestation.
- The most common financial needs for universities in research commercialisation are for pre-seed capital to fund proof-of-concept and prototype development, and for funds to support adequate IP protection. Given the extreme pressures on the block grant, the only sources of this finance are the new pre-seed funds, angel investors, and in a few cases, returns from previous investments.
- Assessment and exploitation of IP is most effectively conducted by a centralised commercialisation office with a concentration of relevant expertise; performance of research commercialisation offices improves with scale, breadth of expertise and experience.

These findings remain relevant 15 years later, although they are often stated in subsequent reports, papers and statements without reference to the 2003 findings.

Report of the National Research Infrastructure Taskforce, 2004

The National Research Infrastructure Taskforce (Australia. National Research Infrastructure Taskforce, 2004), Dr Mike Sargent, Chair recommended *inter alia* -

1. That investments in research infrastructure should be developed around a Framework of principles, and that these principles be adopted by all universities, publicly funded research agencies and research funding agencies
2. A National Research Infrastructure Council (NRIC) be established to further develop, implement, review and monitor this Framework and to develop and implement a national process to identify and prioritise research infrastructure needs.
3. A regular national process, under the auspices of a Strategic Research Council, be established to enhance coordination and to integrate the disparate research strategies and priorities of the Australian Government, regions, institutions, and thematic groups.
4. For major research infrastructure, research infrastructure funding programmes should ensure that both capital costs and standing operating costs are funded to maintain viability of the infrastructure.
5. The Government provide ongoing research infrastructure funding for four categories of infrastructure defined in the Framework: Australian Foundation Facilities, Australian Landmark Facilities, Australian Major Research Facilities, and Australian Research Sector Facilities

National Research Infrastructure Strategy (NCRIS), 2004

The National Collaborative Research Infrastructure Strategy[16] was established to drive research excellence and collaboration between 35,000 researchers, government and industry to deliver practical outcomes.

Since 2004, the Australian Government has invested over $2.8 billion to deliver world-class research infrastructure. This has attracted more than $1 billion in co-investment from state and territory

[16] https://www.education.gov.au/national-collaborative-research-infrastructure-strategy-ncris

governments, universities, research facilities and industry. For a list of infrastructure projects funded by NCRIS, go to funded research infrastructure projects.

The NCRIS network currently supports national research capability through 27 active projects and is comprised of 222 institutions employing well over 1700 highly skilled technical experts, researchers and facility managers. NCRIS facilities are used by over 35,000 researchers, both domestically and internationally.

The 2016 National Research Infrastructure Roadmap (2016 Roadmap) outlines national research infrastructure required over the coming decade so that Australia's world class research system continued to improve productivity, create jobs, lift economic growth and support a healthy environment.

Review of Closer Collaboration Between Universities and Major Publicly Funded Research Agencies, 2004

This Review (Department of Education Science and Training, 2004) investigated a range of collaborative activities between Public Funded Research Agencies (PFRAs) and universities and considered different approaches and models for closer collaboration, commercialisation and funding involving the four major PFRAs, the 38 universities and industry.

The Review found that while the existing level of collaboration is extensive between universities and PFRAs at the individual researcher level, there is an opportunity to enhance the level of collaboration at the organisational and higher strategic level. The Review recommended

1. Prior to any major capital expenditure by a Publicly Funded Research Agency or university, co-location with an appropriate research provider will be the default position. Any exception to this position must be justified through reporting instruments to government.
2. The Australian Government establish a Strategic Research Council to enhance collaboration and coordination across the research system.
3. A performance measurement framework be introduced as a priority for Publicly Funded Research Agencies, universities and other science-based organisations and funding programmes. An expert group be convened to develop core performance measures relevant to all sectors
4. A contestable Collaboration Fund be established to finance world-class Centres of Excellence. The Fund would be open to joint applications from Publicly Funded Research Agencies–university–industry or other non-public sector research organisations as partners.
5. An expert group reconsider the National Principles of Intellectual Property Management for Publicly Funded Research, including ways to publicise the Principles more widely to encourage greater utilisation.

Aspects of these recommendations have been taken up over ensuing years.

NCRIS Strategic Roadmap (NCRIS Advisory Committee) 2006, 2008

In the 2004-05 Budget, the Government announced that the National Collaborative Research Infrastructure Strategy (NCRIS) would be implemented to provide the greater focus and coordination required. The need for the Roadmap was identified in the following terms:

> The need to strategically plan investments in research infrastructure has been recognised on a disciplinary basis for some time, with a number of individual research communities developing strategic plans as a guide to potential capabilities.
>
> More recently there has been a move beyond discipline-based strategies to planning on a national (and even multi-national) scale that goes across discipline boundaries. There is international recognition that the support and growth of a strong research and innovation system is reliant upon provision of access to world-class research infrastructure, and that planning for investment in that infrastructure will ensure that the maximum benefits are gained.

The purpose of the Roadmap was to inform decisions on where Australia should make strategic infrastructure investments to further develop its research capacity (Australia. NCRIS Advisory Committee, 2006). The Roadmap was intended to facilitate a coordinated approach to infrastructure investment across governments and agencies that:

- Concentrates effort nationally on areas of greatest strategic impact;
- Increases collaboration within the research system, and between it and the wider community; and
- Reduces the duplication and sub-optimal use of resources arising from lack of co-ordination.

In developing the Roadmap, the NCRIS Committee drew on expert advice and consultation with the research and wider communities. Development proceeded through several steps: consultation on an

initial concept; more comprehensive scoping of the options; an expert advisory process; and further consultation on an exposure draft.

192 submissions were received on the exposure draft and considered in drafting this final version. The Roadmap provided a framework of capabilities, prioritised on the basis of the NCRIS principles, that represents the Committee's view as to where medium to large-scale research infrastructure investment should be focused over the ensuing 10 years. It identifies the capabilities that Australia should strive to develop, rather than specific infrastructure, and also make some recommendations on the appropriate means to support them.

The Roadmap was updated in 2008 when policy responsibility was moved from the Education portfolio to the (Department of Innovation Industry Science and Research, 2008)

5.5 Trade and investment

In the National Interest: Australia's Foreign and Trade Policy White Paper, 1997

The White Paper identifies globalisation and the continuing economic rise of East Asia as the two most profound influences on Australian foreign and trade policy over the next fifteen years (Australia. Minister for Foreign Affairs and Minister Trade, 1997). It emphasises that Australia faces a much more competitive global trading and investment environment, a changing strategic environment, as well as uncertainties in some key regional countries. As the countries of East Asia grow, Australia's relative economic standing in the region will change.

The White Paper set out the broad framework for Australia to meet these challenges. It was said to represent a significant rearticulation and rebalancing of Australian foreign and trade policy. Its key elements included:

- a declaration of commitment to the Asia Pacific, and particularly East Asia, as the Government's highest foreign and trade policy priority;
- an emphasis on bilateral relationships as a means of advancing Australian interests;
- a more selective approach to Australia's involvement in multilateral issues, concentrating on areas where Australia's national interests are closely engaged;
- a recognition of the contribution that trade liberalisation makes to Australia's standard of living, and the Government's commitment to a jobs foreign and trade policy;
- the adoption of a whole-of nation framework which recognises that Australia's international competitiveness in a global economy will be closely linked to a more flexible labour market, investment in research and development, strong education and training systems, good infrastructure and effective savings and taxation policies.

The White Paper emphasises that the Government's foreign and trade policy objectives will be geared towards exercising leadership on the issues which advance Australia's economic and strategic interests. This includes ensuring that the economic, strategic and cultural assets of Australia which are identified in the White Paper are properly marshalled and strategically directed.

Supermarket to Asia Strategy, 1996

The Supermarket to Asia Strategy was developed jointly by industry and government to meet the challenges of growing Australia's food sales to Asia. The Supermarket to Asia Council, comprising senior representatives of government and industry, was established by the Prime Minister in September 1996 to provide the leadership and drive necessary to do this. The May 1998 Commonwealth Budget provided funding to continue the Strategy for another three years.

Supermarket to Asia undertook a catalytic role aimed at:

- developing a market-led export culture,
- identifying and removing barriers to trade,
- building points of product difference, and
- improving competitiveness through the chain.

The Council recognised that Asia is not one homogenous market and that each country provides unique opportunities for Australian food exports.

The National Food Industry Strategy, 2002

A report for the Prime Minister's STA Council in November 2000 identified globalisation of food processing and retailing as the key force exerting pressure on the industry. It considered that the emergence of global retail chains would result in major changes to the structure and operation of the food industry (Australia. Auditor General, 2006).

The Government decided on a *food industry action agenda*, as the vehicle for establishing a National Food Industry Strategy to succeed the STA Strategy. The purpose of the action agenda process was to engage stakeholders in the development of the Strategy, with industry identifying the actions and tasks that needed to be taken to realise its full potential

The Strategy envisaged that, by 2007, the Australian food industry would be a significant global player with a sustainable and profitable role in the global food product system. It was to commence on 1 July 2002 and included:

- the establishment of a high-level industry council to oversight the development of the industry and the implementation of the Strategy;
- a product and service innovation strategy, which would build on Research and Development (R&D) activities and infrastructure, and establish a Food Innovation Grants (FIG) programme;
- a food trade initiative to develop and implement an international food market entry strategy with a focus on market access, trade development and promotion; and
- a strategy to build more competitive supply chains and improve national food safety and quality systems.

The Strategy was intended to provide the framework for developing and implementing a partnership between the food industry and the Government through a shared vision of increased output, profitability, investment, innovation, export sales and employment in the Australian food industry. The Government budgeted $114.4 million to deliver the Strategy over a five year period (1 July 2002 to 30 June 2007).

Funds were channelled through the Department of Agriculture, Fisheries and Forestry (DAFF), for industry-led programmes, delivered by National Food Industry Strategy Limited (NFIS Ltd) in the following categories:

- Food Innovation Grants: match dollar for dollar funding for Australian-based food processing firms to undertake R&D projects;
- Food Centres of Excellence: provide grants to Australian food R&D centres to attract and develop world-class capability;
- Food Market Development: undertake collaborative market development projects, between the food industry, State food agencies and the Australian Government, to facilitate an integrated food market strategy; and
- Food Chain: provide funding for food industry demonstration projects, which assist to disseminate chain knowledge and experience to the wider industry, and to support activities aimed at building and strengthening chain management capabilities in the Australian food industry.

These programmes are overseen by a number of advisory committees.

The strategy did not survive the change of government in 2007. The Government released a National Food Plan in 2011. However, the Strategy is reflected in the industry Growth Centre, *Food Innovation Limited*, formed in 2013.

6 2008-2013: STRATEGIES EVERYWHERE

The 2008 Global Financial crisis is connected with a number of initiatives around Innovation and transforming the Higher Education System and Innovation. This included the introduction of the demand driven funding system for universities, the introduction of the Higher Education Endowment Fund (HEIF), later to become the Education Investment Fund (EIF) and the innovation policy statement *Powering Ideas* (which drew on the Cutler Review *Venturous Australia*.

Many of these initiatives were also connected around the expected ending of the construction phase of the mining boom.

6.1 Administrative Arrangements

2007-2011: Department of Industry, Innovation, Science and Research

- *[2007-2013: Department of Education, Employment and Workplace Relations]*

2011-2013: Department of Industry, Innovation, Science, Research and Tertiary Education

- *[2013-2014: Department of Education]*

2013-2013: Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education

6.2 Economy and industry

Building innovative capability: review of the Australian textile, clothing and footwear industries, Roy Green, 2008

The review (Green, 2008) ran concurrently with the Review of Australia's National Innovation System by Dr Terry Cutler. The review made 15 wide-ranging recommendations to promote Research and Development (R&D) and investment in the growth sectors identified by the review.

The Parliamentary Library reported the key recommendations as:

- the establishment of a new TCF Innovation Assistance Package 2009–2015 with a budget of $250 million
- a $200 million TCF Innovation Capability Program should be introduced to replace the TCF Post-2005 (SIP) scheme
- the definition of the TCF industries should be expanded and government-funded assistance should be available to a broader range of TCF firms and organisations
- the establishment of a TCF Innovation Council to advise government on funding categories with funding of $12million
- the scheduled tariff reductions in 2010 and 2015 should be allowed to take their course.

The recommendations formed the blueprint for the Government's TCF assistance package announced in the 2009–10 Federal Budget. The package included a Clothing and Household Textile Building Innovative Capability Program based on the TCF Post-2005 (SIP) Scheme, with $25 million additional funding and a new $30 million TCF Strategic Capability Program to support large projects and the establishment of a National TCF Innovation Network.

Management Matters in Australia: Just How Productive Are We? Roy Green, 2010

Management Matters presents findings from the Australian Management Practices and Productivity global benchmarking project (Green 2009)

This report reviews management practices in Australian manufacturing firms and the link between these practices and the productivity performance of firms. The study found that while Australian management practices are not in the top rank of performance worldwide, they are also not among the worst. They currently rate as only moderately above average when benchmarked globally, leaving significant scope for consistent and sustained improvement across key areas.

The research shows that the quality of management practices has a measurable impact on labour productivity, as well as sales and the number of employees in firms. The study also found that there is considerable variance in management practices within Australian firms.

Building Defence Industry Capability: A Policy for a Smarter and More Agile Defence Industry Base, 2010

The Statement was prepared following an extensive submission and consultation process (Australian Government. Department of Defence, 2010). It includes policy proposals to:

- Build skills, innovation and productivity
- Establish a PIC Innovation Program
- Establishment of a Defence Industry Centre
- Establish a Defence Industry Innovation Board

The Statement mentions innovation 128 times.

Smarter Manufacturing for a Smarter Australia: Report of the non-Government members of the Prime Minister's Taskforce on Manufacturing, 2012

In the Executive Summary, the non-Government members advise –

> … Australia's future will be brighter with a broad-based national economy, built on more than a few industries in more than a few regions. A broad based national economy is one that is stronger, more resilient, more innovative and ultimately more able to provide for the needs of Australia and Australians.
>
> It is how we can break the cycle after the 'lost decade' in which apparent prosperity has boomed, while underlying productivity growth has stalled and competitiveness gone backwards. This is particularly important right now because Australia's current development path exposes the country to an increasing reliance on commodity exports. (Australia. Prime Minister's Manufacturing Taskforce, 2012)

The non-government members of the Taskforce proposed the following policy directions.

1. To address the urgent challenges facing many parts of Australian manufacturing, and the real and imminent danger of large losses of jobs and capabilities, specific measures are proposed to boost the public and private investment pipeline, strengthen value capture from large projects in the existing pipeline, and help businesses, workers and communities manage change.
2. To help reboot economy-wide productivity growth, encourage investment and reduce the costs of doing business, a targeted stimulus to demand, and initiatives in transport, broadband, energy, regulation and taxation are proposed.
3. To address Australia's underlying competitiveness, deeper collaboration is needed to not only generate, but also disseminate and apply knowledge. This calls for fundamental changes in behaviour on the part of researchers, research organisations and businesses. As part of a broader overhaul, the nongovernment members of the Taskforce propose the *development of globally-oriented innovation precincts* that build critical mass around our comparative advantages and opportunities and a new Smarter Australia Network linking businesses, research organisations and others is proposed to address systemic barriers to more widespread collaboration.
4. To address the multiple barriers facing SMEs, and to help more SMEs grow into the innovative, global mid-sized firms Australia lacks, a number of steps are proposed: that Enterprise Connect be upgraded and its funding to support manufacturers be increased; that practical and proven new measures are put in place to address the weak contributions both researchers and governments currently make to SME innovation; to lift the capacity of SMEs to absorb new knowledge; to introduce and embed a greater focus on design, and to examine the potential for improving access to finance for SMEs.
5. To sustain productivity growth into the future with continuous innovation in managerial and workforce skills and practices, a new national conversation between industry, unions and government around Smarter Workplaces is proposed. To recognise that productivity gains are ultimately realised in workplaces and firms, a new national partnership for Smarter Workplaces is proposed. This involves a sustained commitment from industry, unions and government to build the managerial and workforce skills and practices – and the innovation culture – that high performance workplaces demand.

Many, but my no means all of these policy directions have been taken up in different contexts over the ensuing six years.

National Food Plan: Our Food Future, Senator the Hon. Joe Ludwig, 2013

The Plan celebrates Australia as having a strong, safe and stable food system and high levels of food security. Every year Australian farmers and fishers produce enough food to feed around 60 million people—far more food than we consume. Australia exports over half of the food it produces yet over 90 per cent of fresh produce sold here is also produced here (Department of Agriculture Fisheries and Forestry, 2013).

> Most Australians can afford to buy the food they need and can access safe and nutritious food. Our enormous range of growing conditions means that we can produce a huge variety of food and have the wealth to import food when we need or want it. We can always do better, but overall Australia is fortunate when it comes to food.

> But the world is changing. In the years ahead Australia's food system will face challenges, such as climate change, population growth, changing economic conditions, competition for resources and diet-related health issues. Along with the challenges there will be unprecedented opportunities for Australia's food industry.

Meeting the challenges and seizing the opportunities will create enormous social, economic and environmental benefits for Australia. To harvest the opportunities of the future we need to focus on four priority areas – *competition, safety, research, sustainability*.

A Plan for Australian Jobs: The Australian Government's Industry and Innovation Statement, 2013

The Government's *Plan for Australian Jobs* (Australia. Department of Industry Innovation Science Research and Tertiary Education, 2013) responds to the report, *Smarter Manufacturing for a Smarter Australia*, by the non-Government members of the Prime Minister's Taskforce on Manufacturing. It included new policy measures to address the concerns of the sector, including 'the current period of intense structural change'.

> The fundamental issues for manufacturing — to innovate and to improve productivity to capture the opportunities of the future — are also important for businesses and jobs across Australia's entire economy. The policies in *A Plan for Australian Jobs* will ensure Australia has a dynamic, diverse and globally connected economy, across a range of industries and regions. These new initiatives reflect the strategy laid out in the Australia in the Asian Century White Paper in which the Government set out its long-term plan to deliver a prosperous and resilient Australia by 2025, achieving growth in income and jobs by lifting national productivity.

The Plan notes that the rise of Asia will be a defining feature of Australia's future in that in coming years, Asia will not only be the world's largest producer, but also its largest consumer. As the populations of Asia's economies become more affluent they will demand a range of quality goods and services — from the dinner table to health care, education and the family holiday.

This is seen to present Australia with great opportunities not only for our manufacturing industry but also for our services sector. We are in the right place at the right time. The Government's policies to improve productivity and competitiveness are positioning Australia in the race to the top, not to the bottom.

The Plan states that to realise these opportunities we will need innovative and dynamic businesses capable of connecting to global and Asian supply chains. Working with industry, unions, educators and the research sector, the Government

Industry precincts initiative, 2013

The Gillard Government committed $504.5 million to establish up to 10 Industry Innovation Precincts to drive productivity, improve connections between business and the research sector and mobilise Australian industry to compete more successfully in global markets.

The Precincts initiative was part of the Government's Industry and Innovation Statement, A Plan for Australian Jobs, and will forge closer links between business and the research sector and help Australian industry to become more productive and competitive.

The aim was to bring together businesses, research institutions like the CSIRO and universities, business service providers and government agencies to foster innovation and generate economic benefits for Australian industry. They will collaborate on identifying new business opportunities, deploying new technology, R&D and carrying out industry-led research projects.

Up to 10 precincts were envisaged in both established and emerging industries, but the first two slots were filled by the manufacturing and food industries.

The Government intended to complement the Precincts with an online Industry Innovation Network that would allow businesses to take part in Precinct activities, and gain access to technology, knowledge, business services and partnerships, regardless of their location."

The Precincts have been subsumed into the Industry Growth Centres Initiative.

6.3 Education and training

Higher Education Endowment Fund (HEIF), Education Investment Fund (EIF), 2008

The EIF was established by the *Nation-building Funds Act 2008* announced in the 2008-09 Budget. It replaced the Higher Education Endowment Fund (HEEF), which was established in 2007. The EIF aimed to build a modern, productive, internationally competitive Australian economy by supporting world-leading, strategically-focused infrastructure investments that would transform Australian tertiary education and research.

The EIF was one of three Nation-building funds – the others being the Building Australia Fund and the Health and Hospitals Fund. The competitive rounds of EIF offered eligible higher education providers, vocational education and training (VET) providers and research institutions the opportunity to compete for funds for their priority infrastructure projects.

As part of the 2009-10 Budget, the Australian Government announced funding for the Structural Adjustment Fund (SAF) in response to the Bradley Review of Australian Higher Education which recommended the establishment of a structural adjustment fund to assist universities in preparing for the new operational requirements of a demand driven funding system and increased quality measures.

The aim of the SAF was to assist universities make the significant structural changes necessary and to establish longer term financial stability and access to high quality teaching and learning for all students.

In the 2011-12 Budget, the Government announced funding of up to $500 million over five years for a Regional Priorities Round of the EIF. This was aimed at supporting regional higher education institutions and vocational education and training (VET) providers to improve their infrastructure, and help improve the quality of training and education regional students receive.

In the 2014-15 Budget, the Australian Government advised the EIF would close from 1 January 2015. This was in response to a recommendation by the National Commission of Audit. Uncommitted funds will now be credited to the National Disability Insurance Scheme Savings Fund Special Account[17].

The EIF has not been evaluated. However, it made a significant contribution to the delivery of collaborative infrastructure across university campuses in metropolitan and regional Australia.

Review of Australian Higher Education, Bradley, 2008

This Review of Australian Higher Education (Bradley et al., 2008) was established to address the extent to which Australian higher education is structured, organised and financed is positioned to compete effectively in the new globalised economy. The panel concluded that, while the system has great strengths, it faces significant, emerging threats which require decisive action.

To address these, major reforms were recommended to the financing and regulatory frameworks for higher education. Key reforms were to increase the number of university graduates by more than one-third and to determine university funding according to student demand using a voucher system.

Several recommendations affecting the vocational education and training (VET) sector:

- VET and higher education providers should continue to enhance pathways for students through the development and implementation of common terminology and graded assessment in the upper levels of VET;
- The Australian government negotiate with the states and territories to expand the national regulatory and quality assurance agency to cover the entire tertiary sector (including VET and higher education) and that the government assume full responsibility for the regulation of tertiary education and training in Australia by 2010;
- the Australian government negotiate with the states and territories to introduce a tertiary entitlement funding model across higher education and VET commencing with the upper levels of VET (diplomas and advanced diplomas) and progressing to the other levels as soon as practicable;
- the government negotiate with the states and territories to extend income contingent loans to students enrolled in VET diplomas and advanced diplomas.

In addition, the Review recommended that the Commonwealth and State/Territory governments agree to:

- establish a single ministerial council with responsibility for all tertiary education and training;

[17] See: https://www.education.gov.au/education-investment-fund

- improve the scope and coordination of labour market intelligence so that it covers the whole tertiary sector and supports a more responsive and dynamic role for both VET and higher education
- expand the purpose and role of the National Centre for Vocational Education Research (NCVER) so that it covers the whole tertiary sector.

These later recommendations have had limited traction.

Transforming Australia's Higher Education System, Minister for Education Employment and Workplace Relations, 2009

In response to the findings of the Bradley Review (Bradley et al., 2008) of Australian Higher Education the government proposed (Australia. Minister for Education Employment and Workplace Relations, 2009) a phased 10-year reform agenda for higher education and research to boost Australia's national productivity and performance as a knowledge-based economy, involving:

1. transforming access to higher education through a major package designed to radically improve the participation of students from low socio-economic backgrounds (SES) in higher education, and enhance their learning experience
2. promoting greater diversity and quality within the tertiary sector by phasing in a new system to allocate funding based on student demand; support to encourage more students to choose teaching and nursing and to study overseas; and support for the renewal of student services and amenities
3. providing funding certainty and creating a more sustainable higher education sector through higher indexation of teaching and learning grants
4. ending historic funding cross-subsidisation by increasing funding for the full cost of university research, and enabling universities to strive for research excellence in areas of strength
5. upgrading university and TAFE infrastructure to meet the teaching and learning requirements of students, teachers and researchers now and into the future
6. establishing the Tertiary Education Quality and Standards Agency (TEQSA), which will provide the foundation for enhancing quality and accreditation in higher education
7. reforming student income support, which will redirect assistance so that it reaches the neediest students to boost both their higher education participation and attainment
8. supporting regional tertiary education provision with a review of regional loading, encouragement to explore new models of delivery and access to new structural adjustment funding for the sector
9. building stronger connectivity between the higher education and vocational education and training sectors; and
10. forging a new relationship between government and educators built on mutual respect, trust and agreed funding compacts.

In the 2009-2010 Budget the Government adopted two key targets recommended by the Bradley review (Bradley et al., 2008):

- A national target of at least 40 per cent of 25 to 34-year-olds having attained a qualification at bachelor level or above by 2025 (Bradley recommended achieving the target by 2020).
- That by 2020, 20 per cent of university enrolments at undergraduate level are for people from low socio-economic status (SES) backgrounds.

The Government also accepted the Bradley review's recommendation to introduce an uncapped student demand-driven system for the funding of university undergraduate places. This is a major policy change to the allocation and funding of student places which to date have been funded through agreements with universities on a set or capped number of places.

Australian Workforce Futures A National Workforce Development Strategy, 2010

The report (Skills Australia, 2010) set out a vision:

> Australia has the workforce capability required for a productive, sustainable and inclusive future. Australian enterprises have the capacity to develop and use the skills of their workforce to maximum advantage for industry and community benefit.

Two years after the GFC, the Report comments that 'as we look towards economic recovery, employers are already raising concerns about the risk that our economic growth will be constrained once again because of skill shortages'. The Report adds 'Looking further ahead, we will need to deepen our skills and lift productivity to enable us to successfully adapt to change and maintain our competitive advantage and a high standard of living, as the emerging economies in our region further advance and industrialise'.

> With an ageing population, labour shortages are also a risk in the future. We need to significantly increase our current rate of employment participation. Often those who fail to obtain work lack basic employability skills. It is vital that we improve core adult language, literacy and numeracy skills if we are to achieve higher participation rates. Moreover, the best way to improve social inclusion is to ensure that all those who want to work can.

The Report argues that Australia can better prepare itself to meet its future skills needs and improve productivity by acting to achieve the following:

- Sustain economic growth and raise productivity by increasing skills and avoiding future skills shortages
- Lift the workforce participation rate to 69 per cent by 2025 to provide the required workforce and improve social inclusion
- Lift the unacceptably low level of adult language, literacy and numeracy to enable effective educational, labour market and social participation
- Increase productivity, employee engagement and satisfaction by making better use of skills in the workplace
- Position the tertiary education sector to ensure it has the capacity to deliver skills for the new economy
- Lead a new partnership approach to workforce development at the government, industry and enterprise level

Development of the strategy involved the input of Phillip Bullock, Dr Glen Withers, Dr Tom Karmel and Dr John Buchanan

Higher Education Base Funding Review, Lomax Smith, 2011

This report defines enduring principles to underpin the long-term funding of Australian higher education as well as specific recommendations and options for a reformed funding model. (Lomax-Smith, Watson, and Webster 2011)

Review of Review of Regional University Loading, DEWR, 2011

The Report found that the following as issues are facing regional higher education in the context of the regional loading scheme:

- the current regional loading formula is not appropriate for the needs of regional higher education
- the cost of regional higher education provision is greater than the funding provided
- regional higher education faces significant economic disincentives
- higher education policy should respond to the individual requirements of each region because regional areas are highly diverse - Western Australia and South Australia have extremely sparse and thin markets outside major cities
- need for greater cooperation between institutions and across sectors, governments and business to address the challenges of higher education provision in regional areas
- the low participation rate of regional students and how to address this issue- support physical campuses in regions or assist students to relocate to major cities
- the preferred mode of delivery and whether to make more use of distance education or to provide more face-to-face education (or a combination) for regional higher education.

Better use of skills, better outcomes, 2012

Better use of skills, better outcomes, was a research report on skills utilisation in Australia (Skills Australia 2012). It concluded that:

> … enterprises developing and utilising the skills of their workforce is a vital ingredient in improving productivity. It takes leadership and sustained effort on the part of individual businesses to improve performance in their workplaces. But the effort is worth it. When an employee feels their skills are being used and their talent nurtured, there is evidence that it pays dividends in business efficiency, productivity and innovation. At a personal level it generates job satisfaction which in turn reduces staff turnover. To put it simply— when an employer cares about the employee, the employee cares about the business.

The research found that those organisations which persistently strive to create and sustain a productive, engaged and adaptable workforce use a range of approaches to make the best use of the skills of their workforce. These strategies address how work is organised and how the skills of workers are aligned to the needs of the business. Specific approaches include supporting employee participation in decision making, redesigning jobs, knowledge transfer and mentoring, job rotation and multi-skilling.

Eleven organisations participated in the research: acQuire Technology Solutions Pty Ltd, The Chia Co, CSL Australia, Dexion, GHD, GM Holden Ltd (Vehicle Manufacturing Operations), Leighton Contractors (NSW/ACT & NZ), Murrumbidgee Local Health District, Pottinger, RSPCA Victoria and Woodside.

The report observed that all of these organisations aspired to excellence in their field and for continuous improvement. “They have imagined and then created workplaces where innovation, adaptability and putting their people front and centre of their business strategy is the norm. Australia’s continued prosperity relies on businesses like these”.

> They are making people management an integral part of their business strategy. They are showing us how to fully utilise and develop the skills and talents of our human resources. This is a very practical way to raise Australia’s economic productivity.

Future Focus: 2013 National Workforce Development Strategy, AWPA, 2013

Future Focus (Australian Workforce and Productivity Agency, 2013) was the second national workforce development strategy for Australia. It built on the work undertaken for Australian workforce futures, published in March 2010.

The report set out a vision to realise Australia's growth potential through a highly skilled and adaptable workforce where skills are used effectively to meet the increasingly complex needs of industry, and individuals can fulfil their potential. It sought to demonstrate how workforce development can help achieve the vision, with benefits for industry, individuals and the national economy.

The report noted that "the changing nature of work poses a new set of challenges for the future, with new technologies, a growing focus on digitisation, and demand for flexibility in both the workplace and the home. AWPA used a scenario approach to gain an insight into possible futures, with modelling to underpin planning for what is likely to occur, and what is more uncertain. The Report pointed out:

> If we are to maximise our productivity and strive for innovation, we will need to ensure that Australia has the right skills in the right place at the right time. But, crucially, we will also need to make sure that individuals, enterprises and industries alike are using those skills to their full advantage.

AWPA proposed initiatives across several areas:

- positioning Australia as a knowledge economy through skills development and targeted planning
- improving productivity in the workplace
- building labour force participation to meet the current and future needs of industry and individuals and promote social inclusion
- equipping Australians with the language, literacy and numeracy skills needed for full participation in community life, education and work
- enabling individuals and the tertiary system to respond flexibly and creatively to change strengthening quality in the tertiary sector
- investing in the tertiary system and workforce development strategies to meet our skills needs.

Regrettably, the AWPA was abolished following the change government in 2013.

6.4 Knowledge and innovation

Venturous Australia – Building Strength in Innovation, Cutler, 2008

Review of the National Innovation System (Australia. Review of the National Innovation System (Cutler Review), 2008). The key message was:

> Innovation is not the problem; it is the answer. Innovation is not the opportunity; it is the imaginative response to opportunities. Our report identifies that the system requires renewal, refurbishment, recasting and where necessary re-imagining.
>
> We are entering an era when the global economy is being transformed before our eyes, with huge local implications. Innovation is pre-eminent in this transformation. New players are emerging, and around the world small countries like our own, which have already grown rich on the spoils of innovation, are renewing their commitment and redoubling their efforts.
>
> We need to take a long term view and respond with sound investments in terms of strategies for Australia.

This Review recommended that steps be taken to stop the decline in Australia's economic performance and to use the opportunity provided by the nation's recent prosperity to develop a more innovative and productive society. The Report notes that the rapidly changing nature of innovation and highlighting the corresponding need to update Australia's existing national innovation system and policy.

A key task for the Review was to identify a set of National Innovation Priorities to complement the broad National Research Priorities already in effect. To this end, the Review Panel engaged in widespread consultation with industry groups and other parties around the country, and used this intelligence to identify areas for attention in terms of those under the direct control of the public sector and those whereby public innovation could overlap with complementary private sector innovative efforts.

The Review process revealed shortcomings in the institutional framework that underpins the innovation system. The Review recommended the following actions:

- the creation of a 'central brain', the NIC, to achieve the coherence, flexibility and responsiveness necessary for effective innovation policy;
- a framework of principles for innovation interventions for adoption by federal, state and territory governments to maximise the impact of public investment in innovation; and
- the establishment of a National Centre for Innovation Research to enhance the rigorous and consistent evaluation of innovation programs.

While some of the initiatives have been followed through with the formation of Innovation and Science Australia, a framework for the principles of innovation interventions has not been established and an independent National Centre for innovation Research remains a major gap in capability of the development, review and renewal of innovation strategies.

Powering Ideas: an Innovation Agenda for the 21st Century, Minister for Innovation Industry Science and Research, 2009

The statement drew on the work of the Cutler Review, *Venturous Australia*, referred to above. *Powering Ideas* (Australia. Minister for Innovation Industry Science and Research, 2009) outlined a vision for a national innovation system in 2020 in which:

- The Australian Government clearly articulates its national priorities and aspirations to make the best use of resources, drive change and provide benchmarks against which to measure success.
- Universities and research organisations attract the best and brightest minds to conduct world-class research, fuelling the innovation system with new knowledge and ideas.
- Businesses of all sizes and in all sectors, embrace innovation as the pathway to greater competitiveness, supported by government policies that minimise barriers and maximise opportunities for the commercialisation of new ideas and new technologies.
- Government and community sectors consciously seek to improve policy development and service delivery through innovation.
- Researchers, businesses and governments work collaboratively to secure value from commercial innovation and to address national and global challenges.

The Government's vision was supported by specific policy ambitions, including:

- increasing the number of Australian research groups performing at world-class levels;
- boosting international research collaboration by Australian universities;
- significantly increasing the number of students completing higher degrees by research over the next decade;
- doubling the level of collaboration between Australian businesses, universities and publicly-funded research agencies;
- a 25 per cent increase in the proportion of businesses engaging in innovation; and continued improvement in the number of businesses investing in R&D.

Empowering Change: Fostering Innovation in the Australian Public Service, MAC, 2010

The Report (Australia. Management Advisory Committee, 2011) (Australia. Management Advisory Committee, 2010)makes 12 recommendations in the following areas designed to support and drive an innovation culture within the APS.

- Strategy and culture
- Leadership
- Systemic/structural issues
- Resourcing and managing innovation in the APS
- Recognition, sharing, learning.

The report is no longer accessible on government websites.

Inspiring Australia Strategy, 2010

The Inspiring Australia report, released in February 2010, proposed a national strategy for public engagement that would help realise the goals articulated *in Powering Ideas: An Innovation Agenda for the 21st Century* (Inspiring Australia Working Group, 2010).

The Inspiring Australia (IA) strategy was developed through consultations with a wide range of scientists, science communicators, educators, journalists, academics and government officers in all states and territories. It is a vigorous, high-level national strategy for public engagement with the sciences and a key element of Australia's innovation agenda.

The strategy aims to build a strong, open relationship between science and society, underpinned by effective communication of science and its benefits. It calls for a partnership approach between

governments, agencies, organisations and communicators throughout Australia to work towards the strategy's goals.

The Strategy involves State and Territory governments and many national bodies including CSIRO, the ABC, the Federation of Australian Scientific and Technological Societies (FASTS),the Council for the Humanities, Arts and Social Sciences (CHASS), the Australian Science Media Centre and the Australian Science Communicators (ASC).

There are currently six National Programs

- Unlocking Australia's Potential
- National Science Week
- Prime Minister's Prizes for Science
- Science and the media
- Developing an Evidence Base for Science Engagement
- Science and Society

Building Defence Industry Capability: A Policy for a Smarter and More Agile Defence Industry Base, 2010

The Statement was prepared following an extensive submission and consultation process (Australian Government. Department of Defence, 2010). It includes policy proposals to:

- Build skills, innovation and productivity
- Establish a PIC Innovation Program
- Establishment of a Defence Industry Centre
- Establish a Defence Industry Innovation Board

The Statement mentions innovation 128 times.

The Government 2.0 Taskforce: Engage: Getting on with Government 2.0, 2009

The Government 2.0 Taskforce's final report*, Engage: Getting on with Government 2.0*, was delivered to the Australian Government on December 22nd 2009 (Australia. Government 2.0 Taskforce, 2009). The Report summary includes the following:

> The use of the internet as a platform for collaboration is already transforming our economy and our lives. Whole industries and sectors are being refashioned by this phenomenon of Web 2.0. Citizens are being empowered to express themselves, organise and collaborate in myriad new ways.
>
> The taskforce came to define its agenda for Government 2.0 in terms of three pillars:
>
> - Leadership, policy and governance to achieve necessary shifts in public sector culture and practice.
> - The application of Web 2.0 collaborative tools and practices to the business of government.
> - Open access to public sector information (PSI).
>
> Government 2.0 presents challenges to some long held government practices and has the potential to change the relationship between government and its citizens.
>
> Government 2.0 will be central to delivering on critical national objectives including delivering on our National Innovation Agenda—including the aspiration for a more innovative public sector. It will be central to addressing the desire of the Advisory Group on the Reform of Australian Government Administration to establish in Australia the world's best public service which puts citizens at the centre of everything it does. It will be an important component of the Department of Human Services' service delivery reform agenda. It can improve social inclusion. And it will enable us to make the most of our huge broadband investment, making Australia a more connected democracy.

Innovation for business success: Achieving a systematic innovation capability, 2010

This Report, prepared by Professor Danny Samson of The University of Melbourne University (Samson, 2010), observes -

> It is possible to be innovative in both large and small companies in Australia, and to derive significant business success from that innovation. These innovative companies have developed a systematic innovation capability, which assures them of a series of innovations that deliver business value.

The Report sets of the important connection between innovation and business strategy:

> Innovation success starts with strategy and leadership, in which innovation is prioritised as important to the business. Guided by this strategic direction, these firms resource innovativeness in their operations, including in their workforces' creativity. They measure innovation and recognise it as important in their workforce, and some reward their staff for contributions to innovation.

> Through strong senior executive leadership of innovation, staff are encouraged to contribute to innovation and the behaviours and culture lead to a deep embedding of the innovation mindset and culture. This innovativeness is attractive in labour markets and allows these firms to attract and retain talented people.

The Report points to the importance of external relationships and participation in supply chains -

> External relationships also reflect the innovation focus. These innovative companies generally match up with customers looking for innovative solutions, and prepared to pay a premium for such innovations. These innovative companies often work with their supply chain partners to extend the domain of their innovation efforts over a broader asset base. They mostly practise various forms of open innovation, meaning that they work collaboratively with a range of partners, with which they can achieve win-win innovation outcomes.

The benefits of innovation are reflected in -

> … all aspects of the profit/loss statement: innovators drive additional sales volume, achieve price premiums and reduce costs through process improvements. In addition to the financial benefits, innovation goes hand-in-hand with sustainable development initiatives, as both require progressive leadership and an appetite for change, combined with a tolerance of experimentation and some risk.
>
> For the companies we examined, the risks and the initiatives that did not work were more than made up for by the wonderful successes, in revenue, growth, price premiums and cost reduction.

The Report provides detailed case studies, from which it deduced common principles of systematically innovative companies. These systematic capabilities are:

> 1. Your *business strategy must be centred on finding innovative solutions to your clients'/customers' problems*. From proactively solving these problems, one creates business opportunities. Strategies need to include looking for new and different ways to solve problems for clients and new and different ways to conduct your own business processes. This means developing brand new products and services too. This work and orientation also allows your firm to win the 'war for talent', because most talented people have a natural affinity for innovation and will be attracted to firms which are sincerely trying to 'do', meaning implement, innovation effectively. It also drives internal process innovation and leads to cost reduction.
>
> 2. Systematic innovation needs to be *properly resourced*, and processes must allow for some experimentation, thinking outside the square, and taking carefully judged and calculated risks when needed. This includes stimulating creativity in all staff, which is a training and skilling-up opportunity. Knowledge management is an opportunity here too, requiring systems capabilities and forums for exchanging ideas between staff.
>
> 3.If a firm is serious about systematic innovation capability as against just paying a 'lip service' approach, then *innovation must be measured and be a central part of the business KPI* (key performance indicator) system of the organisation. Remember the saying that is indeed a truism: "What gets measured gets done!"
>
> 4. The business innovation measures are even more powerful when they are then *translated into personal incentives for all staff*. This means that staff are recognised, rewarded and promoted at least partly on their contribution to innovation capability and innovations. When the business measures are strongly aligned with personal and team success drivers and incentives, a huge amount of energy is unleashed in the workforce!
>
> 5. *Emphatic leadership of the behaviours and culture* works wonders. When we see our senior executives demonstrating some thinking outside the square, trying new initiatives, demonstrating and encouraging some sensible appetite for risk and tolerating the occasional failure as a learning opportunity, then the fear is removed and people get on board with innovation, and it can become a reality.

These capabilities are repeated here as they reflect earlier work of Carnegie (Carnegie et al., 1993), Green (Green et al., 2009) and other authors in the field of management (Drucker, 1994a, Drucker, 1993, Drucker, 1994b, Chandler, 1993), but continue to be 'discovered' by contemporary researchers, consulting firms, commentators and bloggers. Nonetheless, it is something that Australian policy makers do not seem to understand – the fundamental importance of management capacity and capability in driving industrial innovation.

Econometric analysis of the Innovation Investment Fund Program, 2010

An econometric analysis of the IIF program was undertaken by Professor Gordon Murray, Professor Cowling and Dr Weixi Liu, Exeter University, in 2010[18]. The report found that[19]:

- Funds affiliated with IIF managers are more likely to finance start-up and early-stage firms than other types of private funds.
- Because the focus of the IIF program is genuinely on early stage (and thus high risk) firms, supported companies are more likely to fail than comparator firms.

[18] The report can be located at: https://ore.exeter.ac.uk/repository/bitstream/handle/10036/3175/IndependentEconometricAnalysisofIIF.pdf?sequence=2&isAllowed=y

[19] See https://industry.gov.au/industry/IndustrySectors/VentureCapital/Documents/InnovationInvestmentFundProgramProgressReport.pdf, page 65

- IIF supported portfolio firms are more likely to achieve a successful exit than comparator firms outside the IIF program.
- IIF fund managers have developed expertise in financing early-stage firms but not to the extent of their more experienced overseas counterparts.
- IIF investments are significantly more highly concentrated in the biotechnology and internet (new knowledge) sectors when compared to the investments of commercial (non-IIF) funds.
- The program has made modest returns; however, the full value of the program is not captured in any financial measure alone.

The report concluded:

- Due to the extensive monitoring carried out by IIF funds, they add value to their investee firms relative to other types of private funds.
- The program has provided finance that in the absence of the program would not have been available.
- Foreign investors are less likely to support early stage venture capital in Australia.
- The objectives of the program are overly ambitious and do not reflect the challenges faced in the highly challenging venture capital sector. By itself the IIF program will not engender a flourishing venture capital industry in Australia.

Innovation Investment Fund program, Progress Report, 2011

This Report[20] for the Department of Innovation, Industry, Science and Research reviews the operation of the Innovation Investment Fund (IIF) program from its commencement in 1998 to 31 December 2010. In that time, the program has had three funding rounds – in 1998, 2000 and 2006. Only Round 1 had been completed, with Round 2 due for finalisation over the following 2-3 years, and Round 3 was still licensing fund managers.

The program set out to attract private sector investment into the high risk early stages of venture capital in Australia. It did this by awarding licenses to private sector fund managers (venture capitalists) who, as part of the licensing process were required to raise capital from private sources to match capital provided by the Government. The government and private sector capital is pooled in a co-investment fund managed by the fund manager who has responsibility for identifying and investing in the most promising early-stage companies.

The IIF program had attracted bipartisan support since its inception. It was supported the government's strategic policy priorities as articulated in its 10 year innovation statement, *Powering Ideas*.

The Review concluded that:

> The IIF program is effectively responding to an equity gap in Australian venture capital. The equity gap means there is a need to ameliorate the financial and management problems faced by small, particularly high growth innovative Australian companies. And, the program is consistent with initiatives operating in other countries, including those with more established venture capital sectors. Long term patient support by governments is required to provide a functional venture capital industry. Recent research in the USA, for example, has identified that those companies supported by venture capital contribute significantly to the economic development of a country's economy[21]
>
> The progress report finds that the size of licensed funds for the program (~$40 million and unchanged since 1998) is sub optimal to achieve a balanced portfolio – financial support required by investee firms in today's market is higher than it was in the late 1990s.
>
> The report also finds that two factors have impacted negatively on the program's performance particularly for Round 2 - the dot.com collapse in 2000 and the GFC of 2008-09.

This report should be read in conjunction with the independent econometric analysis Professor Gordon Murray et al on the effectiveness of the program (see above).

Review of Venture Capital and Entrepreneurial Skills, 2012

The Review[22], prepared by The Treasury and the Department of Industry, Innovation, Science, Research and Tertiary Education noted that:

> The translation of Australia's good ideas into products, processes and services and new competitive firms is vital if we are to realise the benefits of Australia's innovation effort through improved productivity, economic growth and living standards. Realising these benefits has traditionally involved a funding role for government, albeit a lesser role as projects progress to become commercial propositions and are more likely to attract private sector funding.

[20] https://industry.gov.au/industry/IndustrySectors/VentureCapital/Documents/InnovationInvestmentFundProgramProgressReport.pdf
[21] Josh Lerner, *Boulevard of Broken Dreams*, Princeton University Press, 2009
[22] https://www.avcal.com.au/documents/item/516

> Government can play this funding role in the translation process in a number of ways. Supporting venture capital is one way of doing this which has a number of benefits over more direct forms of assistance, including the ability to leverage broader technical and business experience and attract private sector capital. These advantages could explain why governments around the world have chosen to assist translation activity through support for venture capital, among other mechanisms.
>
> Government support for venture capital could include support for a domestic industry and/or support to attract international venture capital to Australian innovation. However, evidence from consultations indicates that, in the absence of a local partner, relying solely on international capital would not be sufficient to promote Australian opportunities, conduct due diligence, manage investments and provide expertise on local issues. Instead, all stakeholders consulted (even those who were critical of the performance of the Australian venture capital industry) thought that innovation translation activity was best supported by Australia maintaining domestic venture capital capacity and that the Government should play a role through some continued level of support.

The Report also found that:

> The Australian venture capital industry has been affected by global economic uncertainty as well as a range of domestic factors which have seen, and are likely to continue to see, the Australian venture capital industry shrink to a small core of experienced fund managers.
>
> International venture capital is unlikely to be drawn to Australia in the absence of domestic venture capital capacity, with domestic partners playing an important role in promoting Australian opportunities to international investors, conducting due diligence, managing investments and providing expertise on local issues.
>
> It is appropriate that future Australian Government support for the translation of Australian ideas and research into innovative products, processes and services and new competitive firms be provided through continued support for Australian venture capital.
>
> Issues raised by stakeholders as part of this review regarding a lack of incentives for Australian universities to develop their ideas beyond the research stage (either through attracting private sector funding for in-house commercialisation or transferring their ideas for external commercialisation) should be referred to the DIISRTE 'Maximising the Innovation Dividend' process currently looking into this issue, among other matters.

The Role of Management in Lifting Productivity, Roy Green, 2013

Roy Green, in The Role of Management in Lifting Productivity (Green, 2013) points out:

- The main factor in productivity growth is innovation, which includes not just research and technological change, but also non-technology innovation
- A key element of non-technological innovation is management capability, which drives a large part of productivity improvement at the organisational level
- Australia's record in management capacity lags world best practice, especially in people management and 'instilling a talent mindset
- Public policy ad industry leadership should focus on management skills, as well as research and technology development
- High quality management is a necessary condition for invigorating Australia's productivity performance, competitiveness and long-term growth.

The report has been eliminated from government websites[23].

6.5 Science and Research

Collaborating to a purpose: review of the CRC Program, O'Kane, 2008

As a discrete part of the broader review of the National Innovation System (NIS), the Minister for Innovation, Industry, Science and Research, Senator the Hon Kim Carr, announced a Review of the Cooperative Research Centres Program on 22 January 2008 (O'Kane, 2008)

The Review looked at the general issue of collaboration and its place within the NIS; and at how the CRC Program fits with other programs in the NIS in contributing to national productivity and social good through collaboration. The Review took note of some consistent themes coming through the consultations and submissions and sought to understand these in the light of the CRC Program's evolution, as reflected in data on the Program and changes to the selection criteria.

It also considered how changes in funding and incentive systems for CRC participants, especially the public-sector research providers, have affected the way these participants have interacted with the

[23] A Reader version available at http://www.yumpu.com/en/document/view/37755986/the-role-of-management-in-lifting-productivity-awpa

Program. In line with its terms of reference, the CWG also drew on the Productivity Commission's Research Report of 9 March 2007, Public Support for Science and Innovation.

The Report noted that through most of its life the CRC Program has been popular with participants, but pointed to consultations and submissions to this Review and submissions to the 2007 Productivity Commission Report indicated that the Program is less attractive than formerly to some important participant groups, most notably CSIRO and the research-intensive universities, but also some significant end-users.

The concept of end-users and research providers working together on research to produce productive outcomes still draws strong support – the problems centred on the collaboration vehicle itself, and what is allowed and encouraged explicitly and implicitly in the Program.

The Report pointed to a number of problems with the Program:

- The complexity and cost of CRC governance arrangements.
- The high costs of bidding for CRCs, the transaction costs of involvement with them, the lack of flexibility in suiting governance and management to the needs of the partners, and the lack of an adequate return on investment for partners, especially when the CRC is incorporated.
- Intellectual property (IP) arrangements and continuing unrealistic expectations by universities and government research bodies that the IP within a CRC will generate a major financial flow to their institutions - exacerbated by the belief, encouraged by the application process, that the CRC itself will be the commercialiser of the IP resident in the CRC.
- Difficulty in acceptance that the industrial/enduser partners are the logical developers of the IP, with the question of fair and reasonable returns from the industrial partner to the research providers and their institutions a matter to be negotiated, in general terms, at the commencement of the CRC.

Recognising the full cost of university research: a discussion paper, Allen Consulting Group, 2008

The Report (Allen Consulting Group 2008) put the argument for moving to a model of full costing for university research on the basis that universities must be able to perform research of quality on a financially sustainable basis. The key issues relating to a model of full cost of university research are:

- the basic principle that research undertaken by universities should be fully costed and funded, and not cross subsidised from other sources of revenue – ensuring that universities are sustainable and competitive in the longer term;
- the need to support dual system funding for research including through enhanced research block grant funding to support competitive grant programs;
- the current backlog of deferred maintenance – the estimated level of deferred maintenance backlog as part of a university's Capital Asset Management Plan, which involves capital maintenance that has been delayed or not performed when it should have been or when it was scheduled;
- the condition of the higher education estate – anecdotal evidence suggests that research equipment, infrastructure and space are severely stretched in all universities as indexation of grants and funding levels have not kept pace with the growth of university research;
- declining capital expenditure on R&D – ABS data shows a significant trend of declining investment in R&D capital relative to total R&D expenditure.

The full cost of university research project aimed to identify and evaluate the evidence underlying these issues, which have been recognised in the numerous submissions to the Review of the National Innovation System and in the UK Transparency Review.

Employer Demand for Researchers in Australia, Allen Consulting, 2010

This Report from the Allen Consulting Group (Allen Consulting Group 2010) was commissioned by the Department of Innovation, Industry Science and Research (DIISR) to comprehend employer demand for researchers in Australia to inform the Department's Research Workforce Strategy.

The Report findings pointed to:

- a complex blend of project and researcher factors influence employer decisions regarding the mode of employment of researchers that includes casual, temporary, fixed term, part and full time permanent employment. Universities are the largest users of flexible employment, in keeping with the project-based structure of their research activities and funding.
- employers engage researchers with high levels of technical skill and experience (i.e. Doctor of Philosophy (PhD) qualification and Post-Doctoral (Post-Doc) experience), and believe that the majority of newly employed researchers

have the skills necessary to be productive. However, the skills that researchers most frequently need to improve are 'soft skills', such as communication, rather than technical skills; and
- future demand for researchers is positive for all organisational types. However the channels and networks used to convey employer demand, particularly to education and training institutions, appear under utilised.

These points were said to resonate with trends reported in the literature that suggest that significant gaps exist in the soft skills area of most research workforces.

The Report noted that relevant policy initiatives undertaken in other jurisdictions are also informative when developing mechanisms to directly support the Australian research workforce. Some examples to consider would be:

- making the delivery of professional development training an obligatory condition for PhD funding;
- enabling international mobility; and
- incentives to increase awareness and communication of supply and demand needs among employers and suppliers of researchers.

The Report can no longer be located on Government websites.[24]

Focusing Australia's Publicly Funded Research Review: Maximising the Innovation Dividend, 2011

This Report from the Department of Innovation Industry Science and Research, 2011 recommended (Department of Innovation Industry Science and Research, 2011)

- Establishment of an Australian Research Committee
- Refreshing the National Research Priorities
- A feasibility study on research impact assessment
- Encouraging collaboration between universities and the end-users of research.

The Report can no longer be located on Government websites

Productivity Commission: Rural Research and Development Corporations, 2011

The Productivity Commission concluded that while the broad model should be retained, significant changes to the way in which the Government contributes its funding are therefore called for (Australia. Productivity Commission, 2011). Specifically:

- The current cap on dollar for dollar matching of industry contributions by the Government should be halved over a ten-year period.
- A new, uncapped, subsidy at the rate of 20 cents in the dollar should be immediately introduced for industry contributions above the level that attracts dollar for dollar matching.
- A new, government-funded, RDC — Rural Research Australia (RRA) — should be created to sponsor broader rural research. With RRA in place, the other RDCs (except for the Fisheries RDC) should be left to focus predominantly on funding research of direct benefit to their industry constituents.

National Strategic Rural Research and Development Investment Plan, Rural Research and Development Council, 2011

The National Strategic Rural R&D Investment Plan (the Plan) was developed by the Rural Research and Development Council following extensive stakeholder consultation. It outlines a rationale for balancing Australian Government investment in rural R&D and identifies major investment themes.

Examining the Full Cost of Research Training, Deloitte, 2011

This report (Deloitte, 2011) assesses the full cost of research training in Australia based on data collected from universities by DIISR. Research training costs were found to vary significantly across the 31 participating universities.

Costs ranged from around $18,000 per RTS equivalent full-time student load (EFTSL) to $56,000 per RTS EFTSL, with an average cost of $33,788 and a median cost of $32,789. Costs were further broken into direct and indirect costs. The major contributor to direct costs was supervisor salaries and on-costs, ranging from 13% per RTS EFTSL to close to 100%.

The mean difference between RTS funding received per RTS EFTSL in 2009 and the full cost of research training per RTS EFTSL reported by the universities was $10,440 (min=-$1,135 (i.e., surplus funding),

[24] A version is at http://textarchive.ru/c-2263519-pall.html

max=$38,851, median=$8,780). That was interpreted to mean that on average universities are funding 27% of the full costs of research training per RTS EFTSL from sources other than RTS block grants.

The economic, social and environmental impacts of the Cooperative Research Centres Program, Allen Consulting Group, 2012

The report to the Department of Industry, Innovation, Science, Research and Tertiary Education estimated that between 1991 and 2017 almost $14.5 billion of direct economic impacts are estimated to have accrued from CRC produced technologies, products and processes. This included $8.6 billion of impacts already materialised from 1991 to 2012 and a further $5.9 billion of imminent impacts estimated to occur over the next five years.

It was also estimated that the program generated a net benefit to the economy of $7.5 billion over this period, or around 0.03 percentage points of additional GDP growth per annum. The majority of the increase in GDP has come about from increased export earnings.

> Relative to the funds committed to the CRC program by the Australian Government, the CRC program has generated a net economic benefit to the community, which has exceeded its costs by a factor of 3.1.

The report suggested that whereas previous studies have focussed on just the financial contribution of the CRC program, this study has identified significant:

- environmental benefits including impacts on land, ecosystems, pollutants, natural resources, plants, animals and biodiversity; and
- social benefits that affect the Australian community, the health and well-being of individuals and any other social implications.

The Report concluded that the CRC program has proven to be highly important to the Australia R&D scene. By linking researchers with domestic and international end users, the program has delivered significant economic, environmental and social impacts.

Rural Research and Development Policy Statement, 2012

Senator the Hon. Joe Ludwig, Minister for Agriculture, Fisheries and Forestry released a Rural Research and Development (R&D) Policy Statement on 23 July 2012. The Statement was said to pave the way for the future direction of Australian rural R&D. It highlighted the Australian Government's enduring commitment to rural R&D, in partnership with industry.

The Statement is structured around four themes:

- increased transparency and accountability in the Research and Development Corporations Model
- improved coordination and priority setting across the whole rural R&D system.
- an increased range of ways for pursuing productivity growth
- increased operational efficiencies and value for money on research and development investment.

The statement includes the government's final response to the Productivity Commission's (PC) inquiry report on Rural Research and Development Corporations and the Rural Research and Development Council's National Strategic Rural Research and Development Investment Plan.

The statement includes the government's final response to the Productivity Commission's (PC) inquiry report on Rural Research and Development Corporations and the Rural Research and Development Council's National Strategic Rural Research and Development Investment Plan.

Securing Australia's Future Project 2012 – 2016

In June 2012 the Australian Government announced Securing Australia's Future, a $10 million investment in a series of strategic research programs delivered to the Australian Chief Scientist and the Commonwealth Science Council (previous to October 2014, the Prime Minister's Science, Engineering and Innovation Council, PMSEIC).

Coordinated by ACOLA, Australia's four Learned Academies worked together to deliver research-based evidence to support policy development in areas of importance to Australia's future.

Securing Australia's Future was a response to global and national changes and the opportunities and challenges of an economy in transition. Productivity and economic growth will result from: an increased understanding in how to best stimulate and support creativity, innovation and adaptability; an

education system that values the pursuit of knowledge across all domains, including science, technology, engineering and mathematics; and an increased willingness to support change through effective risk management.

Six initial research topics were identified:

- SAF01: Australia's comparative advantage
- SAF02: STEM: Country comparisons
- SAF03: Smart engagement with Asia: Leveraging language, research and culture
- SAF04: The role of science, research and technology in lifting Australian productivity
- SAF05: New technologies and their role in our security, cultural, democratic, social and economic systems
- SAF06: Engineering energy: unconventional gas production

In 2014 and 2015, after the change in government, several new research topics commenced:

- SAF07: Australia's agricultural future
- SAF08: Sustainable urban mobility
- SAF09: Translating research for economic and social benefit – country comparisons
- SAF10: Capabilities for Australian enterprise innovation
- SAF11: Australia's Diaspora Advantage: Realising the potential for building transnational business networks with Asia
- SAF13: Research training system review
- SAF12: Securing Australia's Future: Program Review

A substantial amount of this work informed the Performance Review of the National Innovation System (Innovation and Science Australia, 2016).

Strategic Review into Health and Medical Research, McKeon, 2013

McKeon et al. 2013

http://www.lsq.com.au/Documents/PublicDocuments.aspx?EntryId=150&Command=Core_Download

6.6 Trade and investment

Winning in World Markets: Meeting the competitive challenge of the new global economy, David Mortimer, John Edwards, 2008

The Committee recommended adoption of a new and broad-ranging national export and investment strategy based on the following four pillars:

- International competitiveness: expanding Australia's productive potential and diminishing the impediments to export capacity that we impose in the domestic market
- Market access: opening export and investment opportunities by removing impediments and distortions imposed in other markets
- Market development: supporting the internationalised business sector through export and investment facilitation programs that reflect contemporary needs, including targeted market development strategies
- Coherence and coordination: integrating policies and programs at all levels of government to promote efficient and effective deployment of national trade resources.

http://dfat.gov.au/about-us/publications/Documents/mortimer_report.pdf

Reform of the Australian Trade Commission: Maximizing Our Value, 2011

The key focusing issue for the Review has been the rationale for Austrade in 2010 and beyond, and identification of where and how Austrade can and does deliver greatest value to business. The views of external organisations that work closely with Austrade and the results of independent surveys, indicate a high degree of goodwill and support for the organisation. Client satisfaction with

Austrade's services has been consistently high over many years. This level of commitment was also matched with equally strong views about the strengths and weaknesses of the current operating model.

In particular, consultations confirmed the view that Austrade has spread its resources too thinly and was suffering from a lack of focus, lack of consistency and unnecessary complexity. Accordingly, a new operating model was proposed, the core elements of which were:

- A clearer rationale and purpose - predicated on addressing market failure and focussing resources where Austrade as a government agency can add the greatest value

- A realigned international network – with a different focus in different markets reflecting the commercial potential as well as the nature and scale of impediments to business in those markets and the optimal role for Government
- A service delivery model targeted to internationally ready firms, supported by simpler packaging and pricing of services
- A focus on identifying and bringing tangible foreign business opportunities to Australian business
- Sharper investment promotion, attraction, and facilitation priorities
- A more open and contemporary approach to sharing Austrade information and insight, with new investment in online service delivery and information dissemination and strengthened collaboration with government and commercial service providers
- A commitment to strengthening organisational capability through simplifying the organisational structure, new initiatives to build workforce capacity and streamlining of corporate administration

Australian in the Asian Century: White Paper, Prime Minister, 2012

The White Paper (Prime Minister, 2012) is a plan to build on strengths and shape the future. It details how, by 2025, Australia can be a winner in this Asian century by becoming more prosperous, more resilient, and sharing the new opportunities. It calls on Australians to play a part in becoming a more Asia-literate and Asia-capable nation.

The Paper foreshadowed that the Australian Government would manage and shape change with the aim of providing better opportunities in five key areas:

> Building on our strengths. We need to reinforce the foundations of our fair society and our prosperous, open and resilient economy at home. We need to build on areas where we already perform well, to extend our comparative advantage. Critical to this will be ongoing reform and investment across the five pillars of productivity—skills and education, innovation, infrastructure, tax reform and regulatory reform.
>
> Develop the capabilities that will help Australia succeed. Our greatest responsibility is to invest in our people through skills and education to drive Australia's productivity performance and ensure that all Australians can participate and contribute. Capabilities that are particularly important for the Asian century include job-specific skills, scientific and technical excellence, adaptability and resilience. Using creativity and design-based thinking to solve complex problems is a distinctive Australian strength that can help to meet the emerging challenges of this century. We also need to broaden and deepen our understanding of Asian cultures and languages, to become more Asia literate.
>
> Australia's commercial success in the region requires that highly innovative, competitive Australian firms and institutions develop collaborative relationships with others in the region. Australian firms need new business models and new mindsets to operate and connect with Asian markets. We will work to make the region more open and integrated, encouraging trade, investment and partnerships. Firms will adapt their business models to seize the opportunities created in our region.
>
> Australia's future is irrevocably tied to the stability and sustainable security of our diverse region. Australia has much to offer through cooperation with other nations to support sustainable security in the region. We will work to build trust and cooperation, bilaterally and through existing regional mechanisms. We will continue to support a greater role for Asian countries in a rules-based regional and global order.
>
> Strengthen Australia's deep and broad relationships across the region at every level. These links are social and cultural as much as they are political and economic. Improving people-to-people links can unlock large economic and social gains. Stronger relationships will lead to more Australians having a deeper understanding of what is happening in Asia and being able to access the benefits of growth in our region. In turn, more of our neighbours in the region will know us better than they do today.

7 2013-15: TURNING THE INNOVATION TIDE TOWARDS SCIENCE

Prime Minister Abbott. Fiscal austerity. Saw scope for savings in enterprise and innovation programs. The term innovation banned from the lexicon.

Development of a strong focus on science – became the platform/cornerstone for thinking about innovation, and has continued ever since

7.1 Administrative arrangements

2013-2014: Department of industry

2014-2015: Department of Industry and Science

- *[2014 – Department of Education and Training]*

7.2 The 2014 Commission of Audit

The National Commission of Audit set the scene approaches to industry and innovation policy over the period. It for was announced by the Treasurer, the Hon Joe Hockey MP, and the Minister for Finance, Senator the Hon Mathias Cormann, on 22 October 2013.

The Commission was as an independent body to review and report on the performance, functions and roles of the Commonwealth government. It presented three reports over the period February March 2014, two of which were published (National Commission of Audit, 2014b, National Commission of Audit, 2014a). It provided guidance for the 2014-15 Budget presented in May 2014. The Commission was abolished in May 2014.

The Commission was constituted by the Chair of the Business Council of Australia, a former Secretary to the Treasury, a former Secretary to the Department of Finance, and former Minister (Hon. Amada Vanstone. Almost all of the secretariat staff were all seconded from the Departments of Treasury and Finance. The recommendations in the areas of industry assistance, research and development, and education and training are listed below.

2014 Commission of Audit Recommendations

Recommendation 32: Industry assistance

Rather than relying on industry assistance, commercial discipline drives firms to reduce costs and improve quality to better meet customer demands. The Commission recommends significant changes be made to the approach to industry assistance in Australia including:

1. limiting assistance to areas of genuine market failure and occasional transitional assistance to deal with genuine structural change. In all instances the benefit of government intervention must outweigh the costs;
2. rationalising, phasing out, abolishing or reducing funding for 22 existing industry assistance programmes;
3. amending Australia's anti-dumping system to include an improved public interest test so that dumping protection is only implemented if the benefits to the affected industry clearly exceed the costs to other industries and Australian consumers; and
4. the Government continuing its drive to reduce the cost of doing business in Australia in such areas as labour market reform, deregulation, energy policy and provision of economic infrastructure.

Recommendation 33: Assistance to exporters

As the benefits of exporting accrue primarily to the business undertaking the activity, the Commission considers that there is scope to reduce current Commonwealth assistance for exporters by:

1. abolishing the Export Finance and Insurance Corporation, ceasing funding for Export Market Development Grants, tourism industry grants and the Asian Business Engagement Plan, halving funding for Tourism Australia and significantly reducing the activities of the Australian Trade Commission (Austrade); and
2. moving any residual functions of Tourism Australia and Austrade into a commercial arm of the Department of Foreign Affairs and Trade, with the existing loan book of the Export Finance and Insurance Corporation also transferred to the Department of Foreign Affairs and Trade to investigate options to on-sell or wind up the loans.

Recommendation 34: Research and development

The Commonwealth provides around $9 billion per year to support Australian research and innovation. The Commission recommends the Government take a more strategic, whole of government approach to the funding of research and development, including by:

1. abolishing sector-specific research and development programmes;
2. reducing government support for Rural Research and Development Corporations to better reflect the mix of private and public benefits;
3. consolidating existing research programmes aimed at fostering collaboration;
4. aligning the Australian Research Council and the National Health and Medical Research Council grant processes;
5. streamlining the current system of research block grants and postgraduate scholarships and looking at options for better aligning funding for the direct and indirect costs of research;

6. committing to ongoing funding for critical research infrastructure in Australia, informed by a reassessment of existing research infrastructure provision and requirements; and
7. allowing for more government oversight of the work of the Commonwealth Scientific and Industrial Research Organisation to ensure that resources are being directed to areas of greatest priority.

Recommendation 30: Higher education arrangements

Commonwealth funding of higher education promotes quality and equity of access, while contributing to a more skilled and productive workforce. The Commission recommends a number of changes be made to existing arrangements to better account for the private benefits of higher education and improve performance of the sector including:

1. decreasing the average proportion of higher education costs paid by the Commonwealth through the Commonwealth Grants Scheme from 59 per cent to 45 per cent and increasing the average proportion of costs paid by students from 41 per cent to 55 per cent;
2. tasking the Minister for Education with developing options to increase competition in Australia's education system through a partial or full deregulation of fees for bachelor degrees, taking into account any relevant recommendations of the Review of the Demand Driven Funding System. The Minister should report to the Prime Minister in 12 months' time on progress and a preferred way forward;
3. reducing the cost to the Commonwealth of the Higher Education Loan Programme by:
    a. increasing the interest rate applying to HELP loans from the current rate (equal to movements in the CPI) to a rate which reflects the full cost to the Commonwealth of making the loan (incorporating the government borrowing rate, as well as the cost of bad debts and administration costs);
    b. increasing the repayment of HELP debt through reducing the threshold for HELP repayment from $51,309 per year to the minimum wage of $32,354 (with a low starting repayment rate of only 2.5 per cent);
    c. changing the indexation arrangements for the HELP repayment income threshold from movement in Average Weekly Earnings to movements in the CPI); and
    d. streamlining the five current HELP schemes, including removing SA-HELP and aligning administrative fee arrangements and incentive payments for early repayment.

Recommendation 39: Vocational education and training

Currently the States provide the vast majority of funding to the vocational education and training sector, with the Commonwealth contributing through tied grants to the States and some specific Commonwealth programmes. The Commission recommends that the Government wind back its involvement in the vocational education and training sector by:

1. transferring policy and funding responsibility for vocational education and training to the States, with Commonwealth funding to be provided either as:
2. a single annual lump sum with minimum requirements for national reporting and quality assurance; or
3. as part of a broader reform of federal financial relations;
4. abolishing all Commonwealth vocational education and training programmes including the National Workforce Development Fund and Commonwealth support for apprentices; and
5. requiring the States to continue reforms to achieve demand-driven vocational education and training outcomes and improve occupational licensing arrangements.

Not all recommendations were implemented, but the Commission of Audit exercise set the scene for industry and innovation policy for the next two years

7.3 Economy and Industry

First government to take a serious approach to reducing public subsidies for the motor vehicle industry. All three of the major motor vehicle assemblers has withdrawn from Australia by 2015.

Productivity Commission: Australia's Automotive Manufacturing Industry, Productivity Commission, 2014

(Australia. Productivity Commission, 2014)

Industry innovation and competitiveness agenda: An action plan for a stronger Australia, 2014

The Agenda set out four ambitions that Australia must pursue:

1. a lower cost, business friendly environment with less regulation, lower taxes and more competitive markets;
2. a more skilled labour force;
3. better economic infrastructure; and
4. industry policy that fosters innovation and entrepreneurship.

This Agenda was seen to be an integral step along the path of economic growth and prosperity

(Australia. Minister for Industry and Science, 2014)

https://www.dpmc.gov.au/sites/default/files/publications/industry_innovation_competitiveness_agenda.pdf

7.4 Education and training

Engaging Employers in Work Integrated Learning: Current State and Future Priorities, 2014

(PhllipsKPA 2014)

https://docs.education.gov.au/system/files/doc/other/phillipskpa-wil-research-report.pdf

Review of the Demand Driven Funding System, Kemp, Norton, 2014

The review concluded that funding arrangements did not currently support providers to compete on the quality of teaching and student experience. Fixed Commonwealth contributions and capped student contributions were not designed for a demand driven system.

Key recommendations covered:

- Caps on the number of undergraduate bachelor level places should not be reimposed
- Maximum per CSP funding rates in engineering and health disciplines should be reviewed in the light of cost pressures
- All higher education providers should be eligible for CSPs when they and relevant courses have been approved by the Tertiary Education Quality Standards Agency
- Non-university providers accepting CSPs should do so with the same constraints as public universities – e.g. unable to offer full-fee courses to domestic undergraduates
- Sub bachelor higher education courses should be included in the demand driven system
- Caps on CSPs should be removed from postgraduate courses that have clear community benefit but offer modest financial rewards for graduates. Other postgraduate courses should be offered on an entirely full fee basis.

https://www.education.gov.au/report-review-demand-driven-funding-system

7.5 Knowledge and innovation

The Future of Management Education, ABDC, 2014

In 2012, the Future of Management Education initiative was devised by the ABDC, supported by the Australian Government through the Department of Industry. This initiative was not only in response to a growing consensus that management education needed to recalibrate in line with a changing and challenging business environment, but was set in the context of concerns about Australia's performance in productivity and innovation.

The 18 month initiative has produced a scoping paper, held consultative forums with business and community, and run three Innovative Practice Trials (IPTs) at business schools around Australia. These IPTs brought in business as partners, 'clients' and advisers and involved experience-based as opposed to conceptual learning. (Australian Business Deans Council 2014)

http://www.bhert.com/_literature_174203/2014_Future_of_Management_Education_Report_ABDC

Compete to Prosper, BCA and McKinsey, 2014

Compete to Prosper was the result of a research effort conducted by McKinsey Australia (Lydon et al., 2014). Throughout the process McKinsey tested ideas ideas with multiple sources, including the Business Council of Australia, its President Catherine Livingstone AO and Chief Executive Jennifer Westacott. It is intended as a contribution to determining the ways of enhancing growth in Australia, including as an input to the BCA's program of work.

In the Executive Summary the Report set a scenario in the following terms:

> Australia has enjoyed a prolonged period of economic growth, which has created jobs, raised living standards and funded social services. The unemployment rate and median income compare favourably to most developed economies. The drivers of this economic success have changed significantly – from sustained productivity growth during the 1980s and 1990s to extraordinary demand for Australia's minerals and energy over the last decade. This demand meant 90 percent of Australia's gross domestic income growth from 2005 to 2013 came from capital investment and the terms of trade (the price of exports relative to imports).
>
> Continued success is very far from assured. A new question for Australia's leaders has become all too real and urgent: How to transition to new sources of growth as commodity prices and investments in resources projects normalise.
>
> And there is no escaping that Australian firms are competing in an increasingly globalised economy. Moreover, fundamental changes to supply and demand are reshaping how the economy operates, down to the level of individual jobs.

On the demand side, the rapid and continuing growth of emerging economies, including China, India and Indonesia, has been much discussed in Australia. The global consuming class is expected to grow from 2.4 billion to 4.2 billion people in 2025, and will be around 150 times Australia's expected domestic population.

There are remarkable opportunities for Australian firms to export goods and services to meet the needs of this global market, particularly Asian consumers. But Australia enjoys no guarantee of success. Growth will not come to Australia; Australia must go for growth. And the time to act is now. Other countries are moving and the window of opportunity will not remain open indefinitely.

On the supply side, disruptive technologies will reshape industries and economies. An early example was classified advertising, where the revenue moved from print media to online providers, driven by attackers like Seek and realestate.com.au. Looking ahead, many sectors like financial services, retail, telecommunications and education could be profoundly reshaped by digital disruption. New technologies and techniques, like advanced analytics, additive manufacturing or advanced robotics and autonomous vehicles, will enable innovation and productivity gains. They will also change the nature of work: specifically, reconfiguring which tasks will be performed by people (and which will be performed by computers and machines), and where and how people or machines will perform them.

The Report's recommendations canvassed -

1. Raising competitiveness is job number one for Australia's long-term prosperity
2. Focus on the sectors and tasks where Australia can win
3. Improving the competitiveness of individual sectors
4. Taking a purposeful approach to raise Australia's global competitiveness

These are themes seen in many subsequent McKinsey Reports and input to government innovation and industry policy papers.

7.6 Science and Research

The Curious Country, 2013

The curious country is a collection of essays about the scientific issues affecting Australians today. It is available for download as a free e-book. It was released on 21 November 2013

http://www.chiefscientist.gov.au/2013/11/the-curious-country/

Science, Technology, Engineering and Mathematics in The National Interest: A Strategic Approach, 2013

On July 31 2013, Chief Scientist Professor Ian Chubb released the position paper: "Science, Technology, Engineering and Mathematics (STEM) in the National Interest: A Strategic Approach."

The Paper presents an approach for a national strategy to guide Australia's STEM enterprise.

Benchmarking Australian Science, Technology, Engineering & Mathematics, 2014

On 1 December 2014 the Benchmarking Australian science, technology, engineering and mathematics (STEM) report was publicly released on 1 December 2014. The Report draws on multiple indicators and datasets to provide a comprehensive assessment of Australia's comparative performance in STEM. It was considered at the Commonwealth Science Council meeting in November 2014.

Science, Technology, Engineering and Mathematics: Australia's Future, 2014

On 2 September 2014, Professor Chubb released a series of recommendations for a strategic approach to science and its related fields. "Science, Technology, Engineering and Mathematics: Australia's Future outlines what we need to do to build a stronger, more competitive Australia"

Boosting the Commercial Returns from Research, 2014

Following the release and feedback from a discussion paper *Boosting the Commercial Returns from Research* the Government announced in May 2015 that it will take the following actions to improve the extent of collaboration between research and industry in Australia.

- The Government will develop simpler, more transparent research block grant arrangements
- The Government is identifying further opportunities to enhance collaboration between publicly funded research agencies and industry.

- As part of the tax discussion paper www.bettertax.gov.au , the Government is examining the operation of the Research and Development (R&D) Tax Incentive.
- Work on the establishment of the Medical Research Future Fund, announced in the 2014-15 Budget, is ongoing and will provide a significant opportunity to support collaboration
- The Government is also working with the Australian Research Council and the National Health and Medical Research Council to ensure rules for competitive grants appropriately recognise industry-relevant expertise or research.
- The Government continues to support national world-class research infrastructure to attract the world's best researchers and facilitate collaboration with industry.
- The Research Infrastructure Review is currently underway and will report to the Government in mid-2015.
- The Government is developing an intellectual property (IP) Toolkit, with model contracts and case studies, to facilitate collaboration between research and industry.
- The Government will implement a strategy to provide business with greater online access to research.
- The Government will consider options to consolidate relevant research programmes which focus on industry to increase their scale and effectiveness.
- A whole-of-government policy will be developed for opening business and community access to publicly funded research publications and data.
- Access to information about collaboration and commercialisation outcomes will improve our performance in translating research into economic outcomes.

8 2015-18: INNOVATION REINVENTED

Change of Prime Minister saw increased attention and focus on innovation.

8.1 Administrative arrangements

2015 - Department of Industry, Innovation and Science

8.2 Economy and industry

Competition Policy Review, Ian Harper, 2015

The Prime Minister and the Minister for Small Business announced a review of competition policy on 4 December 2013. On 27 March 2014, the Minister for Small Business released the final Terms of Reference following consultation with the States and Territories and announced the Review Panel.

- The Draft Report was released on 22 September 2014. Submissions closed on 17 November 2014. All non-confidential submissions are available to be viewed.
- The Issues Paper was released on 14 April 2014. Submissions closed 10 June 2014. All non-confidential submissions are available to be viewed.
- The Final Report was released on 31 March 2015.

http://competitionpolicyreview.gov.au/final-report/

The Industry Growth Centres Initiative, 2015

The Centres will enable businesses with winning strategies to self-select and grow, by removing impediments and unlocking potential at the industry level. The Centres will encourage organisations to work closely together to unlock commercial opportunities and reduce risk.

Among other things, the Centres will encourage businesses in these industries to form commercial research and development partnerships with each other, and with the research sector.

The Minister for Industry will seek expressions of interest from business-led consortia to establish five non-profit Industry Growth Centres in sectors where Australia has recognised competitive strengths. The six Centres are in:

- food and agribusiness;
- mining equipment, technology and services;
- oil, gas and energy resources;
- medical technologies and pharmaceuticals; and
- advanced manufacturing
- cybersecurity.

The Centres will have the flexibility to provide services tailored to the needs of their industry. Broadly, the Centres will address sector-wide impediments to productivity and competitiveness by:

- developing and implementing a roadmap of priority actions to lift the competitiveness of the sector and inform Centre activities;
- taking practical steps with governments to improve the regulatory environment;
- facilitating new commercial partnerships through supporting industry-led projects between SMEs and large businesses, and with the research sector, to develop innovative products and services;
- enhancing businesses' ability to enter global value chains and improving workforce skills, building on the services available through the Entrepreneurs Infrastructure Programme; and
- developing annual industry knowledge priorities to inform the research sector of industry needs and commercialisation opportunities.

Department of Industry and Science 2015

https://www.dpmc.gov.au/sites/default/files/publications/IICA_fact_sheet_industry_growth_centres.pdf

https://industry.gov.au/industry/Industry-Growth-Centres/Pages/default.aspx

Agricultural Competitiveness White Paper: Stronger Farmers Stronger Economy, Minister for Agriculture 2015

The Rural RD&E Priorities, as published in the 2015 Agricultural Competitiveness White Paper are:

- advanced technology, to enhance innovation of products, processes and practices across the food and fibre supply chains through technologies such as robotics, digitisation, big data, genetics and precision agriculture;
- biosecurity, to improve understanding and evidence of pest and disease pathways to help direct biosecurity resources to their best uses, minimising biosecurity threats and improving market access for primary producers;
- soil, water and managing natural resources, to manage soil health, improve water use efficiency and certainty of supply, sustainably develop new production areas and improve resilience to climate events and impacts; and
- adoption of R&D, focusing on flexible delivery of extension services that meet primary producers' needs and recognising the growing role of private service delivery.

A common understanding of rural research priorities will better position Australia's agricultural, fisheries, forestry and food industries to embrace innovations and adopt new technologies to respond to market changes, open up new markets and maintain a competitive edge in the face of economic and climatic challenges.

The Rural RD&E Priorities were developed through the consultation process that led to the Agricultural Competitiveness White Paper. State and territory ministers agreed to the Rural RD&E Priorities at the Agricultural Ministers' Forum on 20 May 2016. The Rural RD&E Priorities will enable issues of common concern to be explored in a coordinated and cost effective way.

The Rural RD&E Priorities are consistent with the national Science and Research Priorities announced in May 2015. The national priorities are designed to increase investment in areas of immediate and critical importance to Australia and its place in the world.

The Rural R,D&E Priorities focus R,D&E investment in areas of greatest need and are particularly important in guiding the rural research and development corporations and thus impact significantly on the work of research providers and other research investors in related fields.

The Rural RD&E Priorities replace the national Rural Research and Development Priorities adopted in 2007.

http://agwhitepaper.agriculture.gov.au/SiteCollectionDocuments/ag-competitiveness-white-paper.pdf

Government response to the Competition Policy Review and the Government response on the National Access Regime, 2015

The Government asked Professor Ian Harper and an expert panel to undertake an independent 'root and branch' review of competition policy. This was the first comprehensive review of Australia's competition framework in more than 20 years and delivers on a key election commitment. The Harper Review's Final Report made 56 recommendations for reforms across three key themes: competition policy, laws and institutions.

The Government will implement most the Harper Review's recommendations. Many of the recommendations are in areas of state and territory responsibility and the Government will work closely with the states and territories to advance reform. The package of reforms outlined in the Government's response will strengthen Australia's long-term economic performance by promoting more dynamic, competitive and well-functioning markets for the benefit of all Australians.

The Government commented in its response:

- Technological change has brought new opportunities and challenges. One of the most innovative is the 'sharing economy', facilitating new entrepreneurial activity and creativity in service delivery.
- At the same time the population is ageing, requiring innovative approaches to the delivery of high quality human services.
- To respond to these challenges, we need a competition framework that is fit for purpose.

http://www.treasury.gov.au/PublicationsAndMedia/Publications/2015/CPR-response

Defence Industry Policy Statement, 2016

This Defence Industry Policy Statement sets out a greater role for defence in industry and innovation policy. It is structured in four parts:

1. Delivering Defence capability. A more focused, coordinated and transparent relationship between Defence and industry is required to maximise delivery of Defence capability.
2. A new approach to Defence innovation. Defence will transform the way it approaches innovation, streamlining its engagement with industry and academia, simplifying access to Defence research funding, and creating a seamless link between capability needs, smart ideas and innovation in Australian industry.
3. Driving competitiveness and export potential. The Government will maximise opportunities for competitive Australian businesses, building export potential, depth of skills and diversification for the Australian defence industry.
4. Cutting red tape. The Government will streamline tendering and contracting procedures, and rationalise the industry programs to cut red tape and make it simpler and less costly for Australian industry to support Defence, aligned with implementation of the *First Principles Review: Creating One Defence*.

http://www.defence.gov.au/whitepaper/Docs/2016-Defence-Industry-Policy-Statement.pdf

8.3 Knowledge and innovation

Senate Innovation System Inquiry, 2015

Innocuous Report

Significant Attachment Report, *The Structure and Performance of Australia's National Innovation System*. (Green and Howard, 2015a) and Issues paper (Green and Howard, 2015b)

http://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Economics/Innovation_System/~/media/Committees/economics_ctte/Innovation_System/Final_Report/e05.pdf

National Innovation and Science Agenda, NISA, 2015

From the website:

> Extraordinary technological change is transforming how we live, work, communicate and pursue good ideas. We need to embrace new ideas in innovation and science, and harness new sources of growth to deliver the next age of economic prosperity in Australia. The National Innovation and Science Agenda is an important step in the right direction,

The National Innovation and Science Agenda will focus on four key pillars:

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

Together these pillars provide a framework for Australian innovation policy. The initiatives are worth $1.1 billion over four years.

http://www.innovation.gov.au/

Boosting High-Impact Entrepreneurship In Australia, 2015

On 30 October 2015, the report Boosting High-Impact Entrepreneurship in Australia was released by the Office of the Chief Scientist.

http://www.chiefscientist.gov.au/2015/10/new-report-boosting-high-impact-entrepreneurship-in-australia/

Work Integrated Learning in STEM In Australian Universities, 2015

In June 2015, the report Work Integrated Learning in STEM in Australian Universities, produced by the Australian Council for Educational Research (ACER), was released.

http://www.chiefscientist.gov.au/2015/08/report-work-integrated-learning-in-stem-in-australian-universities/

Work Integrated Learning In STEM Disciplines: Employer Perspectives, 2015

On 27 August 2015 the report Work integrated learning in STEM disciplines: employer perspectives, produced by the National Centre for Vocational Education Research (NCVER) , was released.

http://www.chiefscientist.gov.au/2015/08/report-work-integrated-learning-in-stem-disciplines-employer-perspectives/

Productivity Commission Review of Intellectual Property Laws, 2016

Key points

- Australia's intellectual property (IP) arrangements fall short in many ways and improvement is needed across the spectrum of IP rights.
- IP arrangements need to ensure that creators and inventors are rewarded for their efforts, but in doing so they must:
    - foster creative endeavour and investment in IP that would not otherwise occur
    - only provide the incentive needed to induce that additional investment or endeavour
    - resist impeding follow–on innovation, competition and access to goods and services.
- Australia's patent system grants exclusivity too readily, allowing a proliferation of low quality patents, frustrating follow–on innovators and stymieing competition.

How Regional Universities Drive Regional Innovation, 2016

The Report (Australia. Office of the Chief Economist, 2016) examines how regional universities drive regional innovation. It presents an investigation of world best practices, strategies and structures that underpin successful examples of regional innovation sponsored by regional universities.

The study takes an approach that circumvents the challenges faced by impact assessments using sub-optimal metrics. It also provides a level of insight that cannot be gained from a listing of successful regional impact case studies. This study seeks to understand the prerequisite university structures, strategies and processes that are necessary to underpin university driven regional innovation. It also seeks to understand the factors that are inhibiting effectiveness in this area, leading to a road map that can further build the capacity of regional universities to drive regional innovation.

The work demonstrates how successful examples of regional innovation driven by regional universities have been achieved. It is argued that with this understanding it will be possible to design future policies within organisations and nationally, to better enable universities to drive regional innovation.

Through organisational policy development individual regional universities can improve the mechanisms they use to create industry impact. Through national level policy development, the successful strategies of individual universities can be scaled up, for dissemination across a broader range of regional universities.

Review of the R&D Tax Incentive, Ferris, Finkel, Fraser, 2016

The Review recommended:

1. Retain the current definition of eligible activities and expenses under the law, but develop new guidance, including plain English summaries, case studies and public rulings, to give greater clarity to the scope of eligible activities and expenses
2. Introduce a collaboration premium of up to 20 percent for the non-refundable tax offset to provide additional support for the collaborative element of R&D expenditures undertaken with publicly-funded research organisations. The premium would also apply to the cost of employing new STEM PhD or equivalent graduates in their first three years of employment. If an R&D intensity threshold is introduced (see Recommendation 4), companies falling below the threshold should still be able to access both elements of the collaboration premium
3. Introduce a cap in the order of $2 million on the annual cash refund payable under the R&D Tax Incentive, with remaining offsets to be treated as a non-refundable tax offset carried forward for use against future taxable income Introduce an intensity threshold in the order of 1 to 2 per cent for recipients of the non-refundable component of the R&D Tax Incentive, such that only R&D expenditure more than the threshold attracts a benefit
4. If an R&D intensity threshold is introduced, increase the expenditure threshold to $200 million so that large R&D-intensive companies retain an incentive to increase R&D in Australia That the Government investigate options for improving the administration of the R&D Tax Incentive (e.g. adopting a single application process; developing a single programme database; reviewing the two-agency delivery model; and streamlining compliance review and findings processes) and additional resourcing that may be required to implement such enhancements. To improve transparency, the Government should also publish the names of companies claiming the R&D Tax Incentive and the amounts of R&D expenditure claimed

Performance Review of the Australian Innovation Science and Research System, Innovation and Science Australia, 2016)

(Innovation and Science Australia, 2016)

https://industry.gov.au/Innovation-and-Science-Australia/Documents/ISA-system-review/Performance-Review-of-the-Australian-Innovation-Science-and-Research-System-ISA.pdf

Australia 2030: prosperity through innovation, a plan for Australia to thrive in the global innovation race, Innovation and Science Australia (2017).

Released in 2017, Australia 2030: Prosperity through Innovation (Innovation and Science Australia, 2017b) plans for society and economy that all Australians can aspire to by 2030. The Plan makes 30 recommendations that underpin five strategic policy imperatives:

- Education: respond to the changing nature of work by equipping all Australians with skills relevant to 2030
- Industry: ensure Australia's ongoing prosperity by stimulating high-growth firms and raising productivity
- Government: become a catalyst for innovation and be recognised as a global leader in innovative service delivery
- Research and development (R&D): improve R&D effectiveness by increasing translation and commercialisation of research
- Culture and ambition: enhance the national culture of innovation by launching ambitious National Missions

ISA consulted with stakeholders across the Australian innovation, science and research system throughout 2017 and received 130 public submissions. The consultation and submissions helped inform and shape the plan.

Prosperity Through Innovation - Report of the Analysis of Stakeholder Consultation

The Consultation Program (Innovation and Science Australia, 2017a) sought to obtain the opinions of businesses, research and teaching organisations, government agencies and intermediaries about the current position, opportunities, and directions for Australia's Innovation Strategy. These meetings provided very valuable insights and context about what is currently being achieved, the constraints (and brakes), and actions and priorities to enhance innovation system performance over the short, medium, and longer-term horizons.

There consultations revealed a high level of awareness of the intensity of innovation policy development regarding innovation over the last 25 years, reflected in numerous policy statements, initiatives, inquiries, reviews and evaluations. The Consultations also drew attention to the following:

- All regions and cities are different: innovation ecosystems are at different stages of development and have different enablers from which to work from.
- Connectivity, particularly national digital connectivity, was an overarching theme in all consultations
- A perceived absence of long term policies to assist in developing innovation.
- The concept of innovation itself, where people particularly in the creative fields, are actually 'being innovative' but not seeing it that way. Innovation is the business.
- The importance of international knowledge sharing and mobility of talent.
- The role of regional innovation systems and the contribution of universities to driving economic development and renewal in depressed regions.

An Expert Opinion Survey was undertaken following completion of the consultation program. A total of 361 survey responses were received.

The Survey asked respondents to indicate their level of agreement of disagreement with a number of propositions put forward in the Survey Instrument. The key messages from the Survey are summarised below.

- There is strong support for innovation being addressed through a national strategy across all sectors surveyed. However, responses to questions about the balance between using a strategy to build on existing and emerging strengths in innovation versus addressing existing and anticipated future weaknesses suggests a tendency to treat strategy as the affirmation of strengths rather than problem-fixing.
- Innovation is not viewed as primarily a concern for business. Business sector respondents expressed a range of views on this proposition (from strongly agreeing to strongly disagreeing). However, university and public research sector and government respondents tended to disagree with this proposition.
- Whilst opinion in the business sector tended to favour a 'laissez faire' stance for supporting innovation via de-regulation and market efficiency measures, opinion in government itself together with the university and public research sector is far less in favour of such a policy stance. Intermediaries tended to align with the business sector on this issue.
- Opinion across all sectors is strongly supportive of public policy seeking to enhance participation in Global Value Chains and also developing a better understanding of how trade agreements can impact on innovation performance.
- This support for enhanced international connectivity also extended to academic research, with respondents in all sectors (including business) being in favour of a national innovation strategy enhancing international research collaboration. This consensus across sectors also applied to the proposition that the effectiveness of the interactions between academic research and business-driven innovation is a legitimate focus for public policy.

- There was also consensus across sectors over the importance of balancing a recognition of place-based dimensions of innovation with international connectivity between these places. Similarly, there is consensus (including in the business sector) that academic research generates useful outcomes independent of innovation per se – and that care should be taken to ensure that a national innovation strategy does not restrict useful non-innovation outcomes.
- Business and government respondents were supportive of the notion that the breadth of competitive considerations associated with successful national innovation performance means that industrial strategy is a more appropriate framework for supporting innovation.

Performance Review of the Rural Innovation System, National Rural Research and Innovation Committee, 1918

This Review of the Rural Innovation System responds to Terms of Reference issued by the National Research and Innovation Committee[25] to:

> … describe the performance and impact of Australia's rural innovation system. The project will collate and analyse evidence across a range of metrics in order to present a comprehensive review of the overall performance of the system, highlighting areas of strength, opportunities for improvement and gaps in our knowledge base.

Key points regarding performance and impact included the following -

General

- The effective performance of the rural innovation system, as an essential component of Australia's rural sector, is vital to Australia's economic future. Contrary to what some assume, the rural sector is very much part of the "new economy", particularly in the development, application and use of advanced technologies.
- There are, however, many challenges remaining. These can be met with a vision and strategy for the sector involving national, industry, business and the community commitment to future value creation.

Context, challenges and opportunities

- The rural innovation system has evolved through a number of "waves" beginning with mechanisation in the agrarian revolution of the 1700s, the emergence of agricultural sciences followed by the impact of the biological sciences, and more recently the impact if digital applications, data and analytics, and more recently in a "disruption" of the industry and business models with support for AgTech and GeneTech start-ups through greater availability of risk capital.
- There are many challenges and opportunities being articulated for the rural sector, including a $100 billion farm production output by 2030 and a national AgTech initiative.
- The rural innovation and production system is being strongly impacted by the growing importance of Global Value Chains (GVCs) which makes a "connected" innovation approach even more essential.
- There is a growing appreciation of the economic significance of the "biologically derived" economy.

Issues to consider

- The contribution of agriculture to GDP has been falling, but when put in a value chain context to include manufacturing and services, the contribution is much greater. A diversified Food and AgTech sector, operating across the value chain is emerging, and attracting interest from innovators and investors.
- Farm profitability has been increasing, particularly for larger farm businesses – but the scope for increasing further returns is contingent on reducing *input* costs; anticipating trends in demand, and niche marketing will be a major driver of profitability for many rural businesses.
- Addressing demand side issues, including finding new customers, is fundamental for the future of the rural sector.
- Agility, flexibility, responsiveness, and maintaining the flow of ideas are critical issues for rural innovation and rural production system performance. The two aspects are mutually reinforcing.
- There is a broad understanding that collaboration across the innovation system and the value chain is essential.
- Many opportunities have been identified for a robust rural sector future, including a focus on health and wellness and prospects in food service around platform technologies.

8.4 Science and research

The Importance of Advanced Physical and Mathematical Sciences to The Australian Economy, 2015

On 25 March 2015, the report The Importance of Advanced Physical and Mathematical Sciences to the Australian Economy was released.

[25] The R&I Committee is an Advisory Committee to the Agriculture Senior Officials Committee (AGSOC) and is responsible for the oversight of the development and implementation of the National Primary Industries Research Development and Extension Framework (the Framework) and also provides advice on the overall performance of the primary industries research innovation system.

Growth Through Innovation and Collaboration: A Review of the CRC Program, David Miles, 2015

In his letter of transmittal of the Report to the Minister, David Miles advised that "extensive consultation with stakeholders demonstrated that the CRC Programme valuable and effective, but that there is scope for improvement" (Miles, 2015). Miles made a number of recommendations to sharpen the programme and set it on a path to better meet the government's objectives. He advised that the CRC Programme should remain as a stand-alone programme serves to put science at the centre of industry policy.

The recommendations covered:

1. As an integral part of the Australian Government efforts to put science at the centre of industry policy the Cooperative Research Centres (CRC) Programme should continue. It is imperative however that it is refocused and targeted to achieve the Australian Government's priorities for applied science and research.
2. The programme objectives should be revised to put industry front and centre.
3. The CRC Programme should be structured into two streams of activity: traditional CRCs to support medium- to long term industry-led collaborations; and CRC projects (CRC Ps) to support short term, industry-led research.
4. CRCs and CRC-Ps should work with Growth Centres to share knowledge, experience and resources and achieve common goals.
5. Future CRC and CRC-P funding should be prioritised to support research that delivers outcomes in growth sectors. While the programme should prioritise these sectors it should not do so exclusively to ensure it can respond to emerging priorities and meritorious proposals from other sectors.
6. Applicants for CRC funding should demonstrate that the proposed research and related activities are in line with the revised programme objectives, and that they will stimulate growth and lead to outcomes including, but not limited to: increased jobs, exports, productivity, integration into global supply chains, new technologies, products or services, increased revenues and intellectual property outputs such as patents.
7. Industry should be actively involved in the development of CRC and CRC-P proposals and the subsequent administration, governance and management of any partnership funded through the programme.

Miles felt sure that "If the suite of recommendations is implemented, I believe the CRC Programme will be well placed to complement and support the government's competitiveness agenda and help the Australian economy to grow and remain internationally competitive into the future".

Review of research funding and policy, Ian Watt 2015

The Review Report (Watt, 2015) developed recommendations which in broad terms aim to:

- ensure the quality and excellence of Australian university research and research training
- allocate funding through Research Block Grants (RBG) in a simpler and more transparent manner
- provide incentives to universities to increase and improve engagement and collaboration with business and other end-users
- encourage universities to engage in research commercialisation and knowledge transfer with business and the broader community, including through funding incentives and a focus on more effective management of intellectual property (IP)
- ensure that competitive grant criteria recognise the quality of the proposal and support the opportunities for commercialisation and collaboration with business.

Australia's STEM Workforce, 2016

A new report by the Office of the Chief Scientist provides the first detailed analysis of Australia's Science, Technology, Engineering and Mathematics (STEM) trained workforce was released on 31 March 2016

Economic Contribution of Advances in Science, 2016

On 22 January 2016, the Chief Scientist launched two reports that look into the economic contribution of science. More than a quarter of Australia's economy can be attributed to advances in science over the past 20 to 30 years. That's an annual contribution of $330 billion to our national prosperity. And it's just one measure of the phenomenal impact of the sciences on the way we live and work.

Research infrastructure Review, Final Report, Phillip Marcus Clark, 2016

The Review recommended that Australia needs a new, disciplined and better coordinated approach to Government investment in National Research Infrastructure.

> The Review Panel's objectives were to achieve stability, predictability and dependability through coordinated long term planning and long term funding. Accordingly, the Review Panel recommended that the Government should:
>
> - consolidate its National Research Infrastructure outlays;
> - align those outlays with the National Science and Research Priorities;

- distribute those outlays more efficiently and effectively;
- eliminate waste, duplication and marginal investments; and
- establish a long term funding program with appropriately independent governance.

Based on its consultations with stakeholders and other experts, including from international government agencies, the Review Panel recommended the establishment of a set of fundamental principles to guide the Government's investment in National Research Infrastructure.

The Review Panel recommended a new National Research Infrastructure investment model for Australia based on the Principles. A key recommendation is the establishment of the Australian National Research Infrastructure Fund (ANRIF) to plan and support long term investment in National Research Infrastructure. The investment required over the next decade would be approximately $6.6 billion

The Australian Government's Science and Research Priorities, Chief Scientist, 2016

The Government has developed a set of Science and Research Priorities, and corresponding Practical Research Challenges, designed to increase investment in areas of immediate and critical importance to Australia and its place in the world.

The Science and Research Priorities and associated Practical Challenges are intended to ensure that appropriate levels of public funding are allocated to research that addresses the most immediate problems facing the nation. They are neither exclusive; nor are they exhaustive.

> The implementation of priorities is expected, over time, to result in an increased proportion of Australian Government research investment allocated on a strategic basis to areas of critical need and national importance. This does not mean that funding should be directed to applied, mission-based research to the exclusion of other forms of research. Even in the priority areas, a significant amount of the research will need to be early-stage, basic research.

It is expected that addressing the Priorities and Challenges will require effort from across the full spectrum of research disciplines, including the physical and life sciences, engineering, information and communications technology and the humanities and social sciences. It will also require a coordinated approach from all Government departments and agencies.

> Cross-cutting issues related to the priorities present challenges in their own right and will be addressed through a whole-of-government strategic approach. These include big data, research infrastructure, workforce and international collaboration.

The Science and Research Priorities and Practical Research Challenges will be reviewed every two years to allow for new initiatives to take effect and to ensure that issues being addressed are still the most pressing for the nation.

The priorities are in the areas of:

- Food
- Soil and water
- Transport
- Cybersecurity
- Energy
- Resources
- Advanced manufacturing
- Environmental change
- Health

http://www.science.gov.au/scienceGov/ScienceAndResearchPriorities/Pages/default.aspx

The National Research Infrastructure Roadmap, Chief Scientist, 2016

The 2016 National Research Infrastructure Roadmap outlines national research infrastructure required over the coming decade so that Australia's world class research system continued to improve productivity, create jobs, lift economic growth and support a healthy environment.

The 2016 Roadmap has identified the following nine focus areas that require ongoing support to ensure that Australia will be able to maintain its position as an emerging or established global leader

- Digital Data and eResearch Platforms
- Platforms for Humanities, Arts and Social Sciences
- Characterisation
- Advanced Fabrication and Manufacturing

- Advanced Physics and Astronomy
- Earth and Environmental Systems
- Biosecurity
- Complex Biology
- Therapeutic Development

The 2016 Roadmap was provided to Government in February 2017.

Australia's National Science Statement, 2017

The National Science Statement sets a long-term approach to science, providing guidance for government investment and decision making and clarity on strategic aims. (Australian Government, 2017)

The Statement sets out the government's vision is for an Australian society engaged in and enriched by science. This means achieving four objectives:

- engaging all Australians with science
- building our scientific capability and skills
- producing new research, knowledge and technologies
- improving and enriching Australians' lives through science and research

To realise its vision, Statement says that the government will act in three leadership roles:

- supporting science by providing funding and other resources for the spectrum of basic to applied scientific research, critical scientific infrastructure and equipment, and science and mathematics education, directly investing in Australia's future
- participating in science by producing, using and sharing research, data and information, operating scientific research infrastructure and engaging with science internationally
- enabling science by setting institutional arrangements that shape the science system and its interactions with business and the community, including the translation of research into economic and other benefits.

The Statement also says that "In supporting science, developing science policies and carrying out science-related activities and decisions", the government will:

- recognise that science is fundamental to the economy and social wellbeing, and core to the mission of the government, as part of a multidisciplinary research ecosystem
- ensure that scientific research investment is focused on high-quality research, Australia's scientific strengths and agreed science and research priorities
- ensure that support across the spectrum of basic to applied research is stable and predictable
- encourage and support collaboration across disciplines, across sectors and across international borders
- ensure that opportunities for all Australians to engage with all aspects of the science process are maximised
- show and promote leadership in actively addressing inequality in science education, participation and employment
- measure and report performance of the science system as a whole and government agencies individually
- seek advice from experts in their respective fields in assessing priorities and research quality and in making policy.

The Statement does not address how the vision and actions will be implemented, and how it will be known whether success has been achieved and over what time frame.

Securing Australia's Future: Harnessing Interdisciplinary Research for Innovation and Prosperity, 2017

Recognising rapid changes in the global economy, environment and policy, the Australian Government engaged the Australian Council of Learned Academies (ACOLA) to undertake detailed interdisciplinary research to help guide Australian thinking and policy decisions. The report (Torok and Holper, 2017) suggested that "the future will bring change for Australia. But whether that change is for the better or worse largely depends on the decisions we make today as individuals and as a nation" -

> Dozens of Australia's finest minds assessed the opportunities available to the nation globally and domestically, charting a course for the future. The resulting findings can prepare Australia to address the challenges ahead and make the most of the opportunities. Securing Australia's Future synthesises the major themes that emerge from ACOLA's reports. Each chapter includes key findings designed to optimise Australia's prosperity and place in the region.
>
> The future is a long game but its base must be built now. This book provides a vision for the nation, for its politicians, public servants and industry leaders – a sound footing for securing Australia's future. It is a vital resource for Members of Federal and State parliaments, senior public servants, industry leaders, universities and the interested public.

9 TOWARDS 2030 – BRAIDING INNOVATION POLICY AND INDUSTRY POLICY

The narrative will provide signals about “where to next”. Observations about the integration of innovation policy with a broader industrial strategy for the ACT, as is occurring in the UK (UK. Prime Minister, 2017a, UK. Prime Minister, 2017b).

ATTACHMENT: EVOLUTION OF THE MACHINERY OF GOVERNMENT

The administrative arrangements for industry, research, science and innovation policy have developed over a complex pathway. It reflects:

- The important role of trade and industry development in the development of the Australian economy.
- Frequent changes in Ministerial and department functions and structures to reflect changes in emphasis and priority.
- Separate and disconnected decision and resource allocation processes between many government departments and research funding agencies.
- Differential strengths in policy lobbying and advocacy by sector based industry organisations and professional associations.

The Department of Trade and Customs was one of the first Commonwealth Departments established in 1901. In 1956, it became the Department of Trade, and until 1972 Ministerial responsibility was held by the Country Party and Deputy Prime Minister. Until 1964, when the UK entered the European Common Market, trade and industry was heavily oriented towards UK demand.

The Tariff Board, established in 1921, had a role to advise the Government on questions of assistance to Australian industries and reporting on 'the necessity for new, increased, or reduced duties' and on 'the necessity for granting bounties for the encouragement of any primary or secondary industry in Australia'. For many years the tariff was the key instrument of ‘industry policy’.

The Tariff Board evolved into the Productivity Commission, which holds an influential position in Australian industry and innovation policy/

1 INDUSTRY

9.1 Department of Trade and Industry 1963-1972

Department overview

Formed 17 December 1963

Preceding Department

- Department of Trade

Dissolved 19 December 1972

Superseding agency

- Department of Tourism and Recreation - for tourism
- Department of Overseas Trade
- Department of Secondary Industry - for the Office of Secondary Industry
- Department of Transport
- Department of the Prime Minister and Cabinet - for the Tariff Board

Ministers responsible

- John McEwen, Minister (1963-71)
- Doug Anthony, Minister (1971-72)
- Gough Whitlam, Minister (December 1972)

Department executives

- Alan Westerman, Secretary (1963-71)
- Doug McKay, Secretary (1971-72)

9.2 Department of Secondary Industry 1972-1974

Formed 19 December 1972

Preceding Department

- Department of Shipping and Transport
- Department of Trade and Industry

Dissolved 12 June 1974

Superseding agency

- Department of Overseas Trade
- Department of Manufacturing Industry

Ministers responsible

- Jim Cairns, Minister (1972-73)
- Kep Enderby, Minister (1973-74)

Department executives

- Doug McKay, Acting Secretary (1972-73)
- Frank Pryor, Secretary (1973-74)

9.3 Department of Manufacturing Industry 1974-1975

Formed 12 June 1974

Preceding Department

- Department of Secondary Industry

Dissolved 22 December 1975

Superseding agency

- Department of Administrative Services

Ministers responsible

- Kep Enderby, Minister (1974-75)
- Jim McClelland, Minister (1975)
- Lionel Bowen, Minister (1975)
- Bob Cotton, Minister (1975)

Department executive

- Neil Currie, Secretary

9.4 Department of Industry and Commerce 1975-1982

Formed 22 December 1975

Preceding Department

- Department of Tourism and Recreation - for tourism
- Department of Transport - for shipbuilding
- Department of Manufacturing Industry

Dissolved 7 May 1982

Superseding agency

- Department of Defence Support
- Department of Industry and Commerce

Ministers responsible

- Bob Cotton, Minister (1975-77)
- Phillip Lynch, Minister (1977-82)

Department executive

- Neil Currie, Secretary

9.5 Department of Industry and Commerce 1982-1984

Formed 7 May 1982

Preceding Department

- Department of Industry and Commerce
- Department of Business and Consumer Affairs
- Department of Housing and Construction

Dissolved 13 December 1984

Superseding agency

- Department of Industry, Technology and Commerce
- Department of Local Government and Administrative Services

Ministers responsible

- Phillip Lynch, Minister (1982)
- Andrew Peacock, Minister (1982-83)
- John Button, Minister (1983-84)

Department executive

- Tom Hayes, Secretary and Comptroller-General

9.6 Department of Industry, Technology and Commerce 1984-1993

Formed 13 December 1984

Preceding Department

- Department of Science and Technology - for technology and industrial research and development
- Department of Defence Support - for offsets
- Department of Industry and Commerce - for all functions except regional development

Dissolved 24 March 1993

Superseding agency

- Department of Industry, Technology and Regional Development

Minister responsible

- John Button, Minister

Department executives

- Tom Hayes, Secretary (1984-85)
- David Charles, Secretary (1985-90)
- Malcolm McIntosh, Secretary (1990)
- Neville Stevens, Secretary (1990-93)

9.7 Department of Industry, Technology and Regional Development 1993-1994

Formed 24 March 1993

Preceding Department

- Department of Industry, Technology and Commerce - for all functions
- Department of Immigration, Local Government and Ethnic Affairs - for regional development function

Dissolved 25 March 1994

Superseding agency

- Department of Housing and Regional Development - for regional development function
- Department of Industry, Science and Technology - for all other functions

Ministers responsible

- Alan Griffiths, Minister (1993-94)
- Peter Cook, Minister (1994)
- Ted Lindsay, Parliamentary Secretary (1993-94)

Department executives

- Neville Stevens, Secretary (1993)
- Sandy Hollway, Secretary (1993-94)

9.8 Department of Industry, Science and Technology 1994-1996

Formed 25 March 1994

Preceding Department

- Department of Industry, Technology and Regional Development

Dissolved 11 March 1996

Superseding agency

- Department of Industry, Science and Tourism

Minister responsible

- Peter Cook, Minister for Industry, Science and Technology

Department executive

- Sandy Hollway, Secretary

9.9 Department of Industry, Science and Tourism 1996-1998

Formed 11 March 1996

Preceding Department

- Department of the Prime Minister and Cabinet - for certain science functions
- Department of Tourism
- Department of Housing and Regional Development - for industry aspects of the housing function
- Department of Industry, Science and Technology

Dissolved 21 October 1998

Superseding agency

- Department of Workplace Relations and Small Business
- Department of Communications, Information Technology and the Arts
- Department of Industry, Science and Resources

Minister responsible

- John Moore, Minister for Industry, Science and Tourism

Department executives

Greg Taylor, Secretary (1996)

Russell Higgins, Secretary (1997-98)

9.10 Department of Industry, Science and Resources 1998-2001

Formed 21 October 1998

Preceding Department

- Department of Primary Industries and Energy
- Department of Industry, Science and Tourism

Dissolved 26 November 2001

Superseding agency

- Department of Industry, Tourism and Resources
- Department of Education, Science and Training

Minister responsible

- Nick Minchin, Minister

Department executive

- Russell Higgins, Secretary

9.11 Department of Industry, Tourism and Resources 2001-2007

Formed 26 November 2001

Preceding Department

- Department of Industry, Science and Resources
- Department of Employment, Workplace Relations and Small Business

Dissolved 3 December 2007

Superseding agency

- Department of Resources, Energy and Tourism
- Department of the Environment, Water, Heritage and the Arts
- Department of Innovation, Industry, Science and Research

Minister responsible

- Ian Macfarlane, Minister

Department executive

- Mark Paterson, Secretary

9.12 Department of Innovation, Industry, Science and Research 2007-2011

Formed 3 December 2007

Preceding Department

- Department of Industry, Tourism and Resources
- Department of Employment, Workplace Relations and Small Business - for matters relating to small business

Dissolved 14 December 2011

Superseding agency

- Department of Industry, Innovation, Science, Research and Tertiary Education

Department executives

- Mark Paterson, Secretary (2007-11)
- Don Russell, Secretary (2011)

9.13 Department of Industry, Innovation, Science, Research and Tertiary Education 2011-2013

Formed 14 December 2011

Preceding Department

- Department of Innovation, Industry, Science and Research

Dissolved 25 March 2013

Superseding agency

- Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education

Department executive

- Don Russell, Secretary

9.14 Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education 2013

Formed 25 March 2013

Preceding Department

- Department of Industry, Innovation, Science, Research and Tertiary Education

- Department of Climate Change and Energy Efficiency

Dissolved 18 September 2013

Superseding agency

- Department of Industry

Department executive

Don Russell, Secretary

Child agencies

- Australian Institute of Marine Science
- ANSTO
- Australian Qualifications Framework
- ARC
- CSIRO
- IP Australia
- Office of the Chief Scientist
- TEQSA

9.15 Department of Industry 2013-2014

Formed 18 September 2013

Preceding Department

- Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education

Dissolved 23 December 2014

Superseding agency

- Department of Industry and Science

Ministers responsible

- Ian Macfarlane, Minister for Industry
- Bob Baldwin, Parliamentary Secretary to the Minister for Industry

Department executive

- Glenys Beauchamp, Secretary

Child agencies

- Australian Institute of Marine Science
- ANSTO
- Australian Qualifications Framework
- ARC
- CSIRO
- IP Australia
- Office of the Chief Scientist
- TEQSA

9.16 Department of Industry and Science 2014-2015

Formed 23 December 2014

Preceding Department

- Department of Industry

Dissolved 21 September 2015

Superseding agency

- Department of Industry, Innovation and Science

Ministers responsible

- Ian Macfarlane, Minister for Industry and Science

- Karen Andrews, Parliamentary Secretary to the Minister for Industry and Science

Department executive

- Glenys Beauchamp, Secretary

9.17 Department of Industry, Innovation and Science 2015-2017

Formed 21 September 2015

Preceding Department

- Department of Industry and Science

Dissolved 20 December 2017

Superseding agency

- Department of Jobs and Small Business

Department executive

- Heather Smith, Former Secretary

9.18 Department of Jobs and Small Business 2017 -

Formed 20 December 2017

Preceding Department

- Department of Employment

Minister responsible

- Michaelia Cash, Minister for Jobs and Innovation

Department executive

- Kerri Hartland, Secretary

9.19 Department of Industry Science and Technology

Formed 26 August 2018

Minister responsible: Karen Andrews

9.20 Department of Small and Family Business, Skills and Vocational Education

Formed 26 August 2018

Minister responsible: Michaelia Cash –

10 SCIENCE AND TECHNOLOGY

10.1 Department of Education and Science 1966-1972

Formed 13 December 1966

Preceding Department

- Department of Territories - for education in the NT
- Department of the Interior - for education in the ACT and Jervis Bay
- Prime Minister's Department - for the Education Division and the Office of Education

Dissolved 19 December 1972

Superseding agency

- Department of Education Department of Science

Department executives

- John Bunting, Secretary (1966-67)
- Hugh Ennor, Secretary (1967-72)

10.2 Department of Science 1972-1975

Formed 19 December 1972

Preceding Department

- Department of Education and Science - for scientific research and support of research; weights and measures and national standards

Dissolved 6 June 1975

Superseding agency

- Department of Minerals and Energy - for Minerals and solar energy research
- Department of Science and Consumer Affairs - for all other functions

Minister responsible

- Bill Morrison, Minister for Science

Department executive

- Hugh Ennor, Secretary

10.3 Department of Science and Consumer Affairs 1975

Formed 6 June 1975

Preceding Department

- Department of Science

Dissolved 22 December 1975

Superseding agency

- Department of Science
- Department of Business and Consumer Affairs

Ministers responsible

- Bill Morrison, Minister (6 June 1975)
- Clyde Cameron, Minister (Jun-Nov 1975)
- Bob Cotton, Minister (Nov-Dec 1975)

Department executive

Hugh Ennor, Secretary

10.4 Department of Science 1975

Formed 22 December 1975

Preceding Department

- Department of Minerals and Energy - mineral and solar energy research
- Department of Science and Consumer Affairs - for science

Dissolved 5 December 1978

Superseding agency

- Department of Science and the Environment

Minister responsible

- James Webster, Minister

Department executives

- Hugh Ennor, Secretary (1975-77)
- John Farrands, Secretary (1977-78)

10.5 Department of Science 1975-1978

Formed 22 December 1975

Preceding Department

- Department of Minerals and Energy - mineral and solar energy research
- Department of Science and Consumer Affairs - for science

Dissolved 5 December 1978

Superseding agency

- Department of Science and the Environment

Minister responsible

- James Webster, Minister

Department executives

- Hugh Ennor, Secretary (1975-77)
- John Farrands, Secretary (1977-78)

10.6 Department of Science and the Environment 1978-1980

Formed 5 December 1978

Preceding Department

- Department of Environment, Housing and Community Development - for environment and conservation
- Department of Science - for science and technology, including research, support of research, and support of civil space programs; meteorology; ionospheric prediction service; analytical laboratory service; weights and measures

Dissolved 3 November 1980

Superseding agency

- Department of Home Affairs and Environment - for environment and conservation
- Department of Science and Technology - for science and technology, meteorology, ionspheric production service, analytical laboratory service, weights and measures

Ministers responsible

- James Webster, Minister (1978-79)
- David Thomson, Minister (1979-80)

Department executive

- John Farrands, Secretary

10.7 Department of Science and Technology 1980-1984

Formed 3 November 1980

Preceding Department

- Department of Science and the Environment
- Department of Productivity

Dissolved 13 December 1984

Superseding agency

- Department of Home Affairs and Environment
- Department of Industry, Technology and Commerce
- Department of Science

Department executives

- John Farrands, Secretary (1980-81)
- Greg Tegart, Secretary (1981-84)

10.8 Department of Science 1984-1987

Formed 13 December 1984

Preceding Department

Department of Science and Technology

Dissolved 24 July 1987

Superseding agency

- Department of the Arts, Sport, the Environment, Tourism and Territories - for the Antarctic territories and related legislation
- Department of Primary Industries and Energy - for the Australian Institute of Marine Science Act 1972
- Department of Employment, Education and Training - for coordination of research policy, research grants and fellowships; Anglo-Australian Telescope Agreement Act 1970 and associated agencies
- Department of Administrative Services - for meteorology, ionospheric prediction and analytical laboratory services
- Department of Industry, Technology and Commerce - for patents, science and research policy, the civil space program, weights and measures and the Commission for the Future

Minister responsible

- Barry Jones, Minister

Department executive

- Greg Tegart, Secretary

11 TRADE

11.1 Department of Trade and Customs 2001-1956

Formed 1 January 1901

Dissolved 11 January 1956

Superseding agency

- Department of Customs and Excise
- Department of Primary Industry
- Department of Trade

Department executives

The head of the Department was the Comptroller-General, initially Harry Wollaston, and later:

- Nicholas Lockyer (1911–13);
- Stephen Mills (1913–22);
- Percy Whitton (1922–23);
- Robert McKeeman Oakley (1923–27);
- Ernest Thomas Hall (1927–33);
- Edwin Abbott (1933–44);
- John Kennedy (1944–49);
- Bill Turner (1949–52); and
- Sir Frank Meere (1952–56).

11.2 Department of Trade 1956-63

Formed 11 January 1956

Preceding Department

- Department of National Development - for industrial development
- Department of Commerce and Agriculture - for trade promotion, policy treaties, investigations
- Department of Trade and Customs - for tariff policy, trade agreements, import licensing policy

Dissolved 17 December 1963

Superseding agency

- Department of Trade and Industry

Minister responsible

- John McEwen, Minister

Department executives

- John Crawford, Secretary (1956-60)
- Alan Westerman, Secretary (1960-63)

11.3 Department of Trade and Industry 1963-1972

Formed 17 December 1963

Preceding Department

- Department of Trade
- Dissolved 19 December 1972

Superseding agency

- Department of Tourism and Recreation - for tourism
- Department of Overseas Trade
- Department of Secondary Industry - for the Office of Secondary Industry
- Department of Transport
- Department of the Prime Minister and Cabinet - for the Tariff Board

Ministers responsible

- John McEwen, Minister (1963-71)
- Doug Anthony, Minister (1971-72)
- Gough Whitlam, Minister (December 1972)

Department executives

- Alan Westerman, Secretary (1963-71)
- Doug McKay, Secretary (1971-72)

11.4 Department of Overseas Trade 1972-1977

Formed 19 December 1972

Preceding Department

- Department of Trade and Industry
- Dissolved 20 December 1977

Superseding agency

- Department of Trade and Resources

Ministers responsible

- Jim Cairns, Minister (1972-74)
- Frank Crean, Minister (1974-75)
- Doug Anthony, Minister (1975-77)

Department executive

Doug McKay, Secretary

11.5 Department of Trade and Resources 1977-1983

Department overview

Formed 20 December 1977

Preceding Department

- Department of Overseas Trade - for trade and commerce with other countries
- Department of National Resources - for commercial development and marketing of minerals

Dissolved 11 March 1983

Superseding agency

- Department of Resources and Energy - for commercial development, marketing and export of minerals, including uranium and hydro-carbon fuels
- Department of Trade

Minister responsible

- Doug Anthony, Minister for Trade and Resources

Department executive

Jim Scully, Secretary

11.6 Department of Trade 1983-87

Department overview

Formed 11 March 1983

Preceding Department

- Department of Trade and Resources

Dissolved 24 July 1987

Superseding agency

- Department of Primary Industries and Energy - for sugar legislation and commodity marketing/administration functions
- Department of Foreign Affairs and Trade - for functions of trade agreements, bilateral and multilateral trade policy and international trade and commodity negotiations along with the New Zealand Preferential Customs Tariff Act and the Trade Representatives Act 1933
- Department of Industry, Technology and Commerce - for export services/promotion function; export expansion and market development

Ministers responsible

- Lionel Bowen, Minister (1983-84)
- John Dawkins, Minister (1984-87)

Department executives

- Jim Scully, Secretary (1983-84)
- John Menadue, Secretary (1983-86)
- Vince FitzGerald, Secretary (1986-87)

11.7 Department of Foreign Affairs and Trade 1987 -

Department overview

Formed 24 July 1987

Preceding agencies

- Department of Foreign Affairs
- Department of Trade

Ministers responsible

- Julie Bishop, Minister for Foreign Affairs
- Steven Ciobo, Minister for Trade and Investment
- Concetta Fierravanti-Wells, Minister for International Development and the Pacific
- Luke Hartsuyker, Assistant Minister for Trade, Tourism and Investment

Department executive

- Frances Adamson, Secretary

Child agencies

- Australian Trade and Investment Commission
- Australian Secret Intelligence Service
- Export Finance and Insurance Corporation
- Australian Centre for International Agricultural Research
- Export Finance and Insurance Corporation

12 PRIMARY INDUSTRIES

12.1 Department of Trade and Customs 1901-1956

Formed 1 January 1901

Dissolved 11 January 1956

Superseding agency

- Department of Customs and Excise
- Department of Primary Industry
- Department of Trade

12.2 Department of Markets 1925-1928

Formed 16 January 1925

Preceding Department

- Department of Trade and Customs - for the Commerce Branch
- Prime Minister's Department - for the Immigration Office

Dissolved 19 January 1928

Superseding agency

- Department of Markets

Ministers responsible

- Victor Wilson, Minister (1925-26)
- Thomas Paterson, Minister (1926-28)

Department executive

- Edward Joseph Mulvaney, Secretary

12.3 Department of Markets 1928

Formed 19 January 1928

Preceding Department

- Department of Markets and Migration

Dissolved 10 December 1928

Superseding agency

- Department of Markets and Transport

Minister responsible

- Thomas Paterson, Minister

Department executives

- Edward Joseph Mulvany, Secretary (Jan-Apr 1928)
- Hayburn Thomson, Acting Secretary (Apr-Aug 1928)
- Herbert Charles Brown, Secretary (Aug-Dec 1928)

12.4 Department of Markets and Transport 1928-1930

Formed 10 December 1928

Preceding Department

- Department of Works and Railways - for Commonwealth railways and war service homes
- Department of Markets

Dissolved 21 April 1930

Superseding agency

- Department of Markets
- Department of Transport

Ministers responsible

- Thomas Paterson, Minister (1928-29)
- Parker Moloney, Minister (1929-30)

Department executive

- Herbert Charles Brown, Secretary

12.5 Department of Markets 1930-1932

Formed 21 April 1930

Preceding Department

- Department of Markets and Transport

Dissolved 13 April 1932

Superseding agency

- Department of Commerce

Ministers responsible

- Parker Moloney, Minister (1930-32)
- Charles Hawker, Minister (1932)

Department executive

- Edward Joseph Mulvany, Secretary

12.6 Department of Commerce 1932-1942

Formed 13 April 1932

Preceding Department

- Department of Markets - for trade and agriculture
- Department of Transport - for navigation, shipping and lighthouses

Dissolved 22 December 1942

Superseding agency

- Department of Commerce and Agriculture

Ministers responsible

- Charles Hawker, Minister of Commerce
- William Scully, Minister of Commerce

Department executives

- Edward Joseph Mulvany, Secretary (1932-34)
- Frank Murphy, Secretary (1934-42)

12.7 Department of Post-War Reconstruction 1942-1950

Formed 22 December 1942

Preceding Department

- Department of Labour and National Service

Dissolved 16 March 1950

Superseding agency

- Repatriation Department – for re-establishment of ex-servicemen and the Commonwealth reconstruction scheme
- Prime Minister's Department – for economic policy, education, regional and industrial development
- Department of the Interior – for War Service Land Settlement and Rural Loans Schemes

Ministers responsible

- Ben Chifley, Minister (1942-45)
- John Dedman, Minister (1945-49)
- Eric Harrison, Minister (1949-50)

Department executives

- H. C. Coombs, Secretary (1943-48)
- Allen Brown, Secretary (1949)
- Finlay Crisp, Secretary (1949-50)

12.8 Department of Commerce and Agriculture 1942-1956

Formed 22 December 1942

Preceding Department

- Department of Post-War Reconstruction - for Bureau of Agricultural Economics, Fisheries Division
- Department of Supply and Shipping - for jute and flax production
- Department of Commerce - for trade and agriculture

Dissolved 11 January 1956

Superseding agency

- Department of Primary Industry - for agricultural and pastoral industries and fisheries
- Department of Trade - for trade promotion, policy treaties, investigations

Ministers responsible

- William Scully, Minister (1942-46)
- Reg Pollard, Minister (1946-49)
- John McEwen, Minister (1949-56)

Department executives

- Frank Murphy, Secretary (1942-45)
- Edwin McCarthy, Secretary (1945-50)
- John Crawford, Secretary (1950-56)

12.9 Department of Primary Industry 1956-1974

Formed 11 January 1956

Preceding Department

- Department of Trade and Customs - for sugar agreements, cotton, sulphuric acid, and policy in relation to bounties
- Department of Commerce and Agriculture - for agricultural and pastoral industries and fisheries
- Department of the Interior - for War service land settlement

Dissolved 12 June 1974

Superseding agency

Department of Agriculture

Ministers responsible

- William McMahon, Minister (1956-58)
- Charles Adermann, Minister (1958-67)
- Doug Anthony, Minister (1967-71)
- Ian Sinclair, Minister (1971-72)
- Ken Wriedt, Minister (1972-74)

Department executives

- John Crawford, Secretary (1956)
- Jim Moroney, Secretary (1956-62)
- Alf Maiden, Secretary (1962-68)
- Walter Ives, Secretary (1968-74)

12.10 Department of Agriculture 1974-75

Formed 12 June 1974

Preceding Department

- Department of Primary Industry

Dissolved 22 December 1975

Superseding agency

- Department of Primary Industry

Ministers responsible

- Ken Wriedt, Minister (1974-75)
- Rex Patterson, Minister (1975)
- Ian Sinclair, Minister (1975)

Department executive

- Walter Ives, Secretary

12.11 Department of Primary Industry 1975-87

Formed 22 December 1975

Preceding Department

- Department of Agriculture
- Department of Northern Australia

Dissolved 24 July 1987

Superseding agency

- Department of Primary Industries and Energy

Ministers responsible

- Ian Sinclair, Minister (1975-79)
- Peter Nixon, Minister (1979-83)
- John Kerin, Minister (1983-87)

Department executives

- Walter Ives, Secretary (1975-78)
- Doug McKay, Secretary (1978-80)
- Lindsay Duthie, Secretary (1980-86)
- Geoff Miller, Secretary (1986-87)

12.12 Department of Primary Industries and Energy 1987-1998

Formed 24 July 1987

Preceding Department

- Department of Resources and Energy
- Department of Primary Industry

Dissolved 21 October 1998

Superseding agency

- Department of Agriculture, Fisheries and Forestry
- Department of Industry, Science and Resources

Ministers responsible

- John Kerin, Minister (1987-91)
- Simon Crean, Minister (1991-93)
- Bob Collins, Minister (1993-96)
- John Anderson, Minister (1996-98)

Department executives

- Graham Evans, Secretary (1987-88)
- Geoff Miller, Secretary (1988-93)
- Greg Taylor, Secretary (1993-96)
- Paul Barratt, Secretary (1996-98)
- Ken Matthews, Secretary (1998)

12.13 Department of Agriculture, Fisheries and Forestry (DAFF) 1998-2013

Formed 21 October 1998

Preceding agency

- Department of Primary Industries and Energy

Dissolved 18 September 2013

Superseding agency

- Department of Agriculture

Agency executive

- Andrew Metcalfe, Secretary (2013)
- Conall O'Connell, Secretary (2007-2013)
- Joanna Hewitt, Secretary (2004-2007)
- Mike Taylor, Secretary (2000-2004)
- Ken Matthews, Secretary (1998-1999)

Child agencies

- AQIS - Australian Quarantine and Inspection Service
- ABARE - Australian Bureau of Agricultural and Resource Economics
- BRS - Bureau of Rural Sciences
- Biosecurity Australia
- AFMA - Australian Fisheries Management Authority
- Wheat Exports Australia
- Australian Pesticides and Veterinary Medicines Authority
- Cotton Research and Development Corporation
- Fisheries Research and Development Corporation
- Grains Research and Development Corporation
- Grape and Wine Research and Development Corporation
- Rural Industries Research and Development Corporation
- Sugar Research and Development Corporation
- Wine Australia Corporation

12.14 Department of Agriculture 2013 - 2015

Formed 18 September 2013

Preceding Department

- Department of Agriculture, Fisheries and Forestry

Dissolved 21 September 2015

Superseding agency

- Department of Agriculture and Water Resources

Ministers responsible

- Barnaby Joyce, Minister for Agriculture
- Richard Colbeck, Parliamentary Secretary to the Minister for Agriculture

Department executives

- Daryl Quinlivan, Secretary (2015)
- Paul Grimes, Secretary (2013-15)

12.15 Department of Agriculture and Water Resources 2015 -

Formed 21 September 2015

Preceding Department

- Department of Agriculture

Ministers responsible

- Barnaby Joyce, Minister for Agriculture and Water Resources
- Anne Ruston, Assistant Minister for Agriculture and Water Resources
- Luke Hartsuyker, Assistant Minister to the Deputy Prime Minister

Department executive

- Daryl Quinlivan, Secretary (2015-)

Child agencies

- Australian Bureau of Agricultural and Resources Economics and Sciences
- Australian Fisheries Management Authority
- Agricultural Minister's Forum
- Agricultural Industry Advisory Council
- Agricultural Senior Officials Committee
- Australian Grape and Wine Authority
- Australian Pesticides and Veterinary Medicines Authority
- Cotton Research and Development Corporation
- Fisheries Research and Development Corporation
- Forest and Wood Products Council
- Grains Research and Development Corporation
- Indonesia-Australian Partnership on Food Security in the Red Meat and Cattle Sector
- Murray-Darling Basin Authority
- National Landcare Advisory Committee
- National Rural Advisory Council
- Rural Industries Research and Development Corporation

13 EDUCATION

13.1 Department of Education and Science 1966-1972

Formed 13 December 1966

Preceding Department

- Department of Territories - for education in the NT
- Department of the Interior - for education in the ACT and Jervis Bay
- Prime Minister's Department - for the Education Division and the Office of Education

Dissolved 19 December 1972

Superseding agency

- Department of Education Department of Science

Department executives

- John Bunting, Secretary (1966-67)
- Hugh Ennor, Secretary (1967-72)

13.2 Department of Education 1972-1983

Formed 19 December 1972

Preceding Department

- Department of Education and Science - for education
- Department of External Territories - for Norfolk Island education
- Department of the Interior - for Aboriginal education, Northern Territory, function passed via Department of Aboriginal Affairs
- Department of Labour and National Service - for child care

Dissolved 11 March 1983

Superseding agency

- Department of Education and Youth Affairs

Ministers responsible

- Kim Edward Beazley, Minister (1972-75)
- Margaret Guilfoyle, Minister (1975)
- John Carrick, Minister (1975-79)
- Wal Fife, Minister (1979-82)
- Peter Baume, Minister (1982-83)

Department executives

- Hugh Ennor, Acting Secretary (1972-73)
- Kenneth Norman Jones, Secretary (1973-83)

13.3 Department of Education and Youth Affairs 1983-1984

Formed 11 March 1983

Preceding Department

- Department of Education

Dissolved 13 December 1984

Superseding agency

- Department of Education - for education other than migrant adult education
- Department of the Prime Minister and Cabinet - for youth affairs

Minister responsible

- Susan Ryan, Minister

Department executives

- Kenneth Norman Jones, Secretary (1983)
- Peter Wilenski, Secretary (1983)
- Helen Williams, Acting Secretary (1983-84)
- Dick Johnson, Secretary (1984)

13.4 Department of Education 1984-1987

Formed 13 December 1984

Preceding Department

- Department of Immigration and Ethnic Affairs - for matters relating to overseas students
- Department of Education and Youth Affairs - for education other than migrant adult education

Dissolved 24 July 1987

Superseding agency

- Department of the Arts, Sport, the Environment, Tourism and Territories - for the Canberra College of Advanced Education Act 1967 and the remainder of the Commonwealth Teaching Service Act 1972
- Department of Employment, Education and Training - for education other than migrant adult education; ACT local education

Minister responsible

- Susan Ryan, Minister

Department executives

- Dick Johnson, Secretary (1984-85)
- Helen Williams, Secretary (1985-87)

13.5 Department of Employment, Education and Training 1987-1996

Formed 24 July 1987

Preceding Department

- Department of Employment and Industrial Relations - for employment, training, labour market programs and the Commonwealth Employment Service
- Department of Education - for education other than migrant adult education
- Department of Science - for research functions

Dissolved 11 March 1996

Superseding agency

- Department of Employment, Education, Training and Youth Affairs

Ministers responsible

- John Dawkins, Minister (1987-91)
- Kim Beazley, Minister (1991-93)
- Simon Crean, Minister (1993-96)

Department executives

- Vince FitzGerald, Secretary (1987-89)
- Greg Taylor, Secretary (1989-93)
- Derek Volker, Secretary (1993-96)

13.6 Department of Employment, Education, Training and Youth Affairs 1996-1998

Formed 11 March 1996

Preceding Department

- Department of Employment, Education and Training

Dissolved 21 October 1998

Superseding agency

- Department of Education, Training and Youth Affairs
- Department of Employment, Workplace Relations and Small Business

Ministers responsible

- Amanda Vanstone, Minister (1996-97)
- David Kemp, Minister (1997-98)

Department executives

- Sandy Hollway, Secretary (1996)
- Steve Sedgwick, Secretary (1997-98)

13.7 Department of Education, Training and Youth Affairs 1998-2001

Formed 21 October 1998

Preceding Department

- Department of Employment, Education, Training and Youth Affairs

Dissolved 26 November 2001

Superseding agency

- Department of Education, Science and Training - for most matters

Minister responsible

- David Kemp, Minister for Education, Training and Youth Affairs

Department executive

- Steve Sedgwick, Secretary

13.8 Department of Education, Science and Training 2001-2007

Formed 26 November 2001

Preceding Department

- Department of Education, Training and Youth Affairs

Dissolved 3 December 2007

Superseding agency

- Department of Education, Employment and Workplace Relations
- Department of Innovation, Industry, Science and Research

Minister responsible

- Brendan Nelson, Minister for Education, Science and Training

Department executives

- Steve Sedgwick, Secretary (2001-02)
- Peter Shergold, Secretary (2002-03)
- Wendy Jarvie, Acting Secretary (2003)
- Jeff Harmer, Secretary (2003-04)
- Lisa Paul, Secretary (2004-07)

13.9 Department of Education, Employment and Workplace Relations 2007-2013

Formed 3 December 2007

Preceding Department

- Department of Education, Science and Training
- Department of Employment and Workplace Relations

Dissolved 18 September 2013

Superseding agency

- Department of Education,
- Department of Employment

Department executive

- Lisa Paul, Secretary

13.10 Department of Education 2013-2014

Formed 18 September 2013

Preceding Department

- Department of Education, Employment and Workplace Relations

Dissolved 23 December 2014

Superseding agency

- Department of Education and Training (Australia)

Ministers responsible

- Christopher Pyne, Minister for Education
- Simon Birmingham, Assistant Minister for Education
- Scott Ryan, Parliamentary Secretary to the Minister for Education

Department executive

- Lisa Paul, Secretary

Child Department

- Shared Services Centre

13.11 Department of Education and Training 2014 -

Formed 23 December 2014

Preceding Department

- Department of Education

Minister responsible

- Simon Birmingham, Minister for Education and Training

Department executive

- Michele Bruniges, Secretary (since 4 April 2016)

Child Department

- Shared Services Centre

14 EMPLOYMENT AND INDUSTRIAL RELATIONS

Department of Labor and Immigration (12 June 1974 – 22 December 1975)

Department of Employment and Industrial Relations (22 December 1975 – 5 December 1978)

Department of Employment and Youth Affairs (5 December 1978 – 7 May 1982)

Department of Employment and Industrial Relations (7 May 1982 – 24 July 1987)

Department of Employment, Workplace Relations and Small Business (21 October 1998 – 26 November 2001)

Department of Employment and Workplace Relations (26 November 2001 – 3 December 2007)

Department of Employment (18 September 2013 - 20 December 2017)

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