

AUSTRALIA'S INDUSTRIAL DEVELOPMENT AGENDA: CONTEMPORARY TRENDS IN AUSTRALIAN SCIENCE, TECHNOLOGY AND INNOVATION POLICY

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INTRODUCTION

In 2015, Malcolm Turnbull signalled a change in direction in Australia's economic strategy. This change represented a movement away from a strong economic reliance on minerals as the major source of national income to a high value-added economy. Half a century after Donald Horne's scathing indictment in "The Lucky Country" of Australia's reliance on the resource sector, Prime Minister Turnbull pointed towards a considerable reform of industry policy in Australia with a view to creating "a modern, dynamic, 21st century economy for Australia" (Turnbull, 2015). The main components of the transformation of the Australian economy from a resource-based economy to a "21st century economy" have been identified as science, technology, innovation, new ideas, entrepreneurship and competition.

In science and technology policy terms, the Turnbull government is attempting to “redefine, enhance and improve Australia’s National System of Innovation”. This “transformation” of the national economy was largely a bipartisan approach to economic and industry policy at the last election, and has been an integral part of the Labor Party’s industrial development platform for a few decades. Indeed, the broader theme of Australia in transition to a digital economy could also be found in the policy platforms of the Australian Greens (2016) and the Nick Xenophon Team (2016). This election represented the first time that Australia has had such a common policy platform focusing on the need to transition from a resource-based economy to one in which harnessing knowledge and innovation is at the forefront.

In the light of these statements of intent, this paper attempts to contribute to public policy debates in Australia relating to science, technology and innovation by examining the failure of policy in this arena for more than three decades – for the notion of a shifting emphasis from a resource-based economy to a knowledge-based one is hardly new. The approach taken in this paper is to examine the policy responses to science, technology and innovation over the past few decades and then consider the more recent innovation agenda, which was evident at the last Federal election, but really began with Terry Cutler’s (2008) “Review of the National System of Innovation”.

It is at this point that we wish to contribute to the national innovation debate. We aim to do this by examining three possible explanations of why government attempts to transition Australia into a 21st modern, knowledge-based economy, as the Prime Minister suggested in 2015, have failed and continue to fail. Past and more recent responses to an “Australian economy” in transition have tended to focus on weaknesses in Australia’s system of innovation such as the absence of true venture capital markets, poor linkages between research and industry, retention and development of a highly skilled workforce, poor technology transfer and the focus of government industry policy on industry protection or declining industries – more recently evident with respect to resource development. This paper attempts to explore broader, more systemic issues affecting the ongoing appearance, then disappearance of science, technology and innovation from Australia’s industrial development agenda.

This paper is deliberate in avoiding introducing proposals that simply cost government more

money. Although it is inevitable that facilitating a major transition in the national economy will likely cost more money in the short run, we have chosen to examine some possible underlying influence on decisions affecting our industry base. In particular, we favour a re-prioritisation of public expenditure on industrial and, even economic policy in favour of building what might be termed ‘new economy’ infrastructure such R&D, telecommunications infrastructure, skills development and building firmer and more genuinely collaborative research–industry linkages. However, this debate is the subject of another paper. Here, we are arguing for changes to the political, economic and cultural factors affecting the totality of industry and economic development.

PREVIOUS APPROACHES TO AUSTRALIAN SCIENCE AND TECHNOLOGY

Among the developed nations of the world, Australia has been somewhat late in engaging in an analysis of the role of science and technology in public policy. Science and technology begins to emerge as an important input into policy processes around the early 1970s. Until this point, Australian science focused on supporting the national industrial base, particularly in relation to agriculture and mining, or contributing to the formation of new knowledge, mostly through research conducted within universities. A concomitant of this was that the national system of science and technology, up until the early 1970s, remained largely protected from close public scrutiny. This system supported industry through organisations such as CSIRO (and its predecessors) and state-government-funded research laboratories, again mostly in agriculture but also in mining related sectors, including energy. However, an important feature of the total system of science and technology has been the domination of fundamental science over genuinely applied science.

Despite the connection of some of Australia’s science to the national industrial base in agriculture and mining, an important feature of the whole system has been its disconnection from industry, and the inability to commercialise very high quality science, by international standards, with agriculture being the notable exception. Indeed, debates over the utility of Australian science in many areas of public policy began to emerge.

A new role for science in resolving public policy issues was somewhat symbolised by the emergence of new universities that would focus greater attention on applying scientific knowledge to the problems of society. Griffith, Murdoch, Flinders, James Cook, La Trobe, Macquarie Universities were established in this era. These universities emerged as an extension of Australian science into contemporary problems of society such as the environment, health, economic internationalisation, industrial productivity and economic diversification. However, the specific issue we are addressing in this paper is the emergence of science and technology (S&T) in the debates relating to the diversification of the Australian economy. The role of science and technology in the national economy became a more common part of Australia's policy debates in the early 1980s, particularly with the election of the Hawke Labor government in 1983. Economics, industry and S&T policy began to focus on the ongoing issue relating to the inability of Australia to translate its excellence in science into economic activity. Indeed, in 2017, Australia is still trying to resolve this ongoing issue. By international standards, the connection between Australia's efforts in science and technology remain poorly connected to Australian industry, particularly with respect to investment in new high-value-added industry sectors.

Policy initiatives relating to the development of new, innovative industry sectors in Australia have commonly correlated with the decline in national export revenues in agriculture and mining. Indeed, science, technology and innovation have recently been promoted as an important driver of future economic activity, as a response to sharp declines in national mining revenues. However, Australia has pursued this 'innovation' agenda several times over recent decades in response to declining international mineral prices. The main difference between current approaches to an economy in transition and past responses is that the necessity of this transition is now generally accepted across the political spectrum. Past policy initiatives have usually been the ambit of Labor governments, but the 2016 election provided evidence that the conservative parties also have developed a commitment to developing a more advanced economic base in Australia. These policy responses have included attempts to address underlying assumptions regarding weaknesses in Australia's industrial structure, which have constrained the emergence of new clusters of economic activity. A couple of examples include the following.

As a response to low levels of investment in new, innovative enterprise in Australia several

attempts have been made to provide incentives for investment in these new industries. The Management Investment Companies program of late 1980s and early 1990s is an example of the use of tax incentives to provide venture capital for these industry sectors. In addition, many state governments used their own investment vehicles, usually state banks, to provide capital for these emerging industry sectors. In general, these programs were small or failed and had little impact on the flow of capital into new, high value-added industries.

Another issue for the emergence of new high value-added industries has been the disconnection between Australian industry and research and development (R&D) efforts (for example, see Australian Bureau of Statistics, 2004). There have been many approaches to strengthening the linkages between Australian R&D and the national industry base. Possibly the most successful federal government program has been the Collaborative Research Centre's (CRC) program. Here, federal funding was used to assist in the formation of large research enterprises incorporating industry, research organisations and universities in particular, government agencies at all tiers of government, and not-for-profit organisations. In general, this program has been largely successful, developing research entities that were capitalised at tens of millions of dollars, and sometimes hundreds of millions of dollars, although, in some cases, government funding merely served to overarch the transaction costs inherent in collaborative research, and many research partnerships have not continued post CRC on account of the real transaction costs being perceived as too high (Sinnewe, Charles and Keast 2016).

In addition, the premier university funding body, the Australian Research Council, re-orientated a major portion of its funding to collaborative projects between universities and 'industry partners', which include private and public sector agencies, not-for-profit organisations and government departments. Australia's premier industry research organisation, CSIRO, has undergone many restructures, many name changes, and many new funding models, which sometimes had the objective of driving the organisation to securing more industry funding, in order to maintain its financial viability.

These policy initiatives and programs are examples of government actions taken to address particular problems in Australia's system of innovation, and the capacity of the nation to move towards a high value-added, science, technology and innovation economy. Further examples of

government programs and policy initiatives could also be provided with respect to technology transfer, foreign multinational ownership of Australia's technology inputs, high-value skills development, linkages into international science and technology networks, and the performance of capital markets.

However, the recent economic shock to the Australian economy, through the decline in mineral prices, there is strong evidence that Australia has not made the transition to a high value-added industrialised nation despite these policy interventions. Although most of these policy initiatives are able to demonstrate success within the ambit of their specific objectives, the totality of these programs has been largely ineffective at achieving large scale economic reform. In 2016 and 2017, the economic and industry narrative is still mostly concerned with Australia still needing to make a transition. Australia is still a highly resource-dependent economy, although other service sectors have emerged as also being important contributors to national wealth.

RECENT POLICY RESPONSES TO AN ECONOMY IN TRANSITION

Terry Culter's (2008) review of Australia's system of innovation presented a new approach to the policy debates in Australia on science, technology and innovation. It is reasonable to characterise the role of science, technology and innovation debate as being piecemeal, inconsistent and marginal to mainstream industry and economic policy. It lacked bipartisan support, and resource allocations were unreliable. It was particularly destructive to have resources being routinely allocated and then withdrawn from R&D in Australia, at the level of both national and state governments. The unpredictability of research funding provided research institutions with very few opportunities for building long-term research capabilities in areas of excellence. The recent movement of climate scientists out and back into CSIRO was symptomatic of the absence of science, technology and innovation having a core, consistent, central role in Australian industry policy.

Cutler's report provided an opportunity of to examine Australian science and technology holistically as a core input into future industry development in Australia. It examined the whole system, which was an important movement away from devising policies, usually with inadequate

resources, which attempted to redress pieces of the system. The report identified four reasons why the system was broken, and why the attempts to make minor repairs to the system was failing. These reasons were as follows (Cutler, 2008, chapter 1).

First, “The architecture of Australia’s system” (p. 1) had been neglected and lagged behind international standards of systems of innovation. Second, the notions of innovation had changed considerably over recent decades and Australia had not understood the expansive nature of innovation in a modern economy. An example of this issue is the extent to which Australia has tended to perceive innovation as the output of science and technology. There are now many examples of innovation going beyond a technological output. It may be the product of changes in processes such as ride sharing or a change in relationships, manifested so clearly in the modern use of social media. Cutler (2008, p. 1) refers to these phenomena as “transforming ideas into clever goods and services”.

Third, Cutler (2008, p. 2) also highlights the inconsistency of Australia’s public and private commitment to R&D over several decades. As noted in several places throughout this paper, when Australia is prospering from high commodity prices or suffering from high budget deficits, R&D expenditure is usually regarded as an optional expenditure item. This approach to R&D is particularly detrimental to Australia building long-term competitive “knowledge-based” advantage in high-value industry sectors. Indeed, renewable energy is an area usually regarded as a sector in which Australia should be a world leader, but we have, for the most part, simply ignored this opportunity in favour of non-renewable energy. Four, Cutler (2008) notes that Australia has failed to compete with even developing nations such as India and China in making innovation a core component of its industrial development agenda. Cutler (2008, p. 2) also observes that innovation is also central to the modernisation of many developed countries such as Singapore, Finland and South Korea.

The Cutler report (2008) made an important contribution to progressing the policy debate, in Australia, from dealing with fragments of the national system of innovation to examining the whole system. However, the politics changed and the Cutler report did not have much influence on the way in which science, technology and innovation was considered in economic and industry policy. The 2016 election appeared to provide a signal that the economic shock of a

sharp decline in commodity prices had forced both major parties into offering innovation, and an economy in transition, as the solution to Australia's declining economic position.

The newly formed Turnbull government introduced innovation into the federal government's economic discourse with the release of its report, entitled "National Innovation and Science Agenda" (Commonwealth of Australia, 2015). This "Agenda" was central to the conservative party's economic and industry policy at the July, 2016 election. This document is still an operational document, presumably providing guidance as to the future direction of the federal government with respect to the way in which innovation, science and technology will provide direction for future government economic policy. This agenda identifies four areas of key concern to be addressed if science and innovation is to be addressed. These areas are culture and capital, collaboration, skills and development and government as an exemplar. The package of initiatives associated with this agenda was \$1.1 billion when the document was release in December of 2015 (Commonwealth of Australia, 2015, 1).

It appeared that the "National Innovation and Science Agenda" represented a distinct new role for science, technology and innovation in Australian industry and economy debate. However, there are a few important issues to note with respect to this document and the subsequent 2016 election campaign. It would be disingenuous to presume that the "National Innovation and Science Agenda" (Commonwealth of Australia, 2015) represented a new approach to innovation in Australian policy debates. These type of policies and initiatives have been part of the policy approach of other political parties, in some cases for decades. The important change was that the conservative parties were now incorporating science, technology and innovation into policy as a central component of their approach to the economy and industry.

Although science, technology and innovation was central to the platforms of both major and minor political parties, these issues received little attention in the mainstream policy coverage of the election. With respect to the broader political narrative tax cuts to business, Medicare and refugee policy assumed a far more dominant role in the political coverage and advertising than did the core, now mainstream policy initiatives relating to science, technology and innovation. In addition, the initiatives relating to the "National Innovation and Science Agenda" strengthened Australia's national system of innovation by around \$1.1 billion, which suggested that the impact

of this agenda would be marginal to the totality of government expenditure on economic, industry and education policy. Whilst the change in rhetoric at the 2016 election was encouraging, there was very little to suggest that Australia's economic and industrial culture would be influenced by changes in government policy that would result in a transition of the current Australian economy towards a modern 21st century economy. In this paper, we are proposing a cultural change is necessary before a transition of this nature can be achieved. This cultural change needs to embrace much more than "removing the bias against businesses that take risks and innovate", and supporting "greater private sector investment by co-investing to commercialise promising ideas" (Commonwealth of Australia, 2015, p. 4). The "National Innovation and Science Agenda" identified these issues as the main changes required to change business culture in Australia, and appear much less than the magnitude of change required to transition an economy. Overall, our view is that, despite recent and past programs and initiatives attempting to address failures in Australia's national system of innovation, Australia has made very little progress towards transitioning towards a modern 21st century economy, the implication being that the initiatives identified in the "National Innovation and Science Agenda" are unlikely to make any significant change to Australia's position.

THE RESTRUCTURING OF THE AUSTRALIAN ECONOMY

Indeed, the data suggests that, despite over three decades of some state and federal elections promising a shift in the Australian economy, very little has actually been achieved. In 2015, the rhetoric reflected an economy moving into the 21st century led by science and innovation. In 2017, the reality has been an industrial development agenda, which has included providing massive subsidies for coal mining in Central Queensland (one of many examples is provided by Denniss, 2017).

Table 1 provides one measure of Australia's international standing with respect to innovation. In 2016, it ranked 19th out of the 128 countries ranked according to this set of data. This ranking is unflattering to Australia as it is a G20 nation, and one of 35 OECD nations. Furthermore, Australia's ranking on the Global Innovation Index declined from 17th position in 2014 and 2015 to return to its ranking to its 19th ranking in 2013 (Cornell University, INSEAD, World

Intellectual Property Organisation, 2015). Indeed, this measure of innovation suggests that Australia has been largely unsuccessful in changing its capacity to re-industrialize, and move away from its dependence on commodities, regardless of the transitory federal policy interventions into the science, technology and innovation space.

TABLE 1: GLOBAL INNOVATION INDEX 2016 RANKINGS		
Country	Score	Rank
Switzerland	66.28	1
Sweden	63.57	2
United Kingdom	61.93	3
United States of America	61.40	4
Finland	59.90	5
Singapore	59.16	6
Ireland	59.03	7
Denmark	58.45	8
Netherlands	58.29	9
Germany	57.94	10
Korean Republic	57.15	11
Luxembourg	57.11	12
Iceland	55.99	13
Hong Kong (China)	55.69	14
Canada	54.71	15
Japan	54.52	16
New Zealand	54.52	17
France	54.23	18
Australia	54.04	19
Austria	53.07	20

Source: Cornell University, INSEAD and World Intellectual Property Organisation (2016), *The Global Innovation Index 2016: Winning with Global Innovation*, Ithaca, Fontainebleau Geneva, p. xviii.

Table 2 provides further insight into those factors that might be regarded as the current weakness in Australia's national system of innovation. Some of these factors have previously been identified by governments over the past three decades with policy responses, but most of the negative issues identified have remained as problems limiting Australia's capacity to emerge as the type of economy characteristic of a modern knowledge economy.

TABLE 2: METRICS DETERMINING INNOVATION INDEX AUSTRALIA 2016			
Positive Factors < 19th	Ranking	Negative Factors >19th	Ranking
Political environment	16	Education	37
Regulatory environment	12	Economic sustainability	33
Business environment	14	Investment	26
Tertiary education	8	Innovation linkages	37
Research and development	13	Knowledge absorption	49
Information & communication technology (ICT)	7	Knowledge creation	28
General infrastructure	10	Knowledge diffusion	100
Credit	6	Intangible assets	37
Trade, competition and market scale	11	Creative goods and Services	37
Knowledge workers	9		
Knowledge impact	18		
Online creativity	9		

Source: Cornell University, INSEAD and World Intellectual Property Organisation (2016), *The Global Innovation Index 2016: Winning with Global Innovation*, Ithaca, Fontainebleau Geneva, p. 179.

If these negative factors are dissected even further, it is noted that Australia's expenditure on non-tertiary education as a percentage of GDP ranks 54th of the 128 countries included in these metrics, while Australia is also 73rd in expenditure per secondary school pupil as a percentage of GDP and 79th in the percentage of graduate science and engineering from tertiary institutions. As might be expected, energy consumption used in generating GDP is also high in comparison with other countries (68th), but the profile Australian business with respect to its capacity to engage in the 21st economy is particularly alarming (Cornell University, INSEAD and World Intellectual Property Organisation, 2016, p. 179). For example, Australia ranks 62nd with respect to its protection of minority shareholders, 83rd with respect to gross expenditure on R&D being financed overseas, and 66th in the import of ICT services as a percentage of total trade. Australia's knowledge, technology and creative outputs are also poor by world standards. Australia also ranks 51st in terms of Australian patents as a proportion of purchasing power GDP, 90th in terms of the export of ICT services as a percentage of total trade ranks and 107th in terms of foreign direct investment as a percentage of GDP ranks, while, in order areas, Australia ranks

61st in industries such as national feature films and 53rd in creative goods as a percentage of total trade (Cornell University, INSEAD and World Intellectual Property Organisation, 2016, p. 179).

Total R&D is another indicator of national innovation and provides an example of the nature of the problems confronting Australia with respect to the transition of its economy. Australia is below the OECD average for expenditure on R&D as a percentage of GDP, being one of the ‘middle-level’ OECD countries with respect to R&D expenditure as a percentage of GDP. However, the resources being devoted to R&D as a percentage of GDP has been declining since 2008. Indeed, it is likely that the decline in national expenditure on R&D as a percentage of GDP has continued to decline since 2013, in accordance with the major funding cuts to CSIRO, universities and climate science that occurred under the conservative governments between 2013 and 2016. Of equal concern is the decline in business expenditure on R&D as a percentage of GDP from 1.23% in 2011-12 to 1.19% in 2013-14 (Australian Bureau of Statistics, 2016, Catalogue number 8104.0).

EXPLORING THE FAILURE IN AUSTRALIA’S TRANSITION

The preceding analysis indicates that Australia has been aware of the long-term economic problems associated with its dependence on agriculture and mining revenues. Policy makers and participants in the economic and industry policy debates have routinely attempted to devise ways of shifting the national focus from mining, agriculture and tourism towards higher value-added activities. There have been some successes particularly with respect to service industries, such as information media and telecommunications, financial and insurance services, health care and social assistance and education (Office of the Chief Economist, 2015, p. 37). There have also been some successful government programs which have had some impact on addressing some of the structural weaknesses of Australia’s industry infrastructure. However, the magnitude of an economy in transition requires much more than these interventions.

We would like to canvass four different perspectives on why government action on science, technology and innovation has achieved such little success. We believe our approach to national identity and culture is somewhat novel in the Australian literature dealing with this subject, but

our analysis of crony capitalism and leadership also brings a different perspective to the problem. Underlying our analysis are some assumption about the objectives of the broader industrial development and economic agenda.

First, we are assuming there is general agreement that the ‘new economy’ is a high value-added economy, which implies that Australia needs to move into new industry sectors. The contentious component of this assumption is that extent to which Australia should focus on proven industries, which cohere with the nation’s historical competitive advantage. So, the issue to be addressed is whether Australia builds its new industrial capabilities on the sectors that are already important to the economy such as mining, agriculture, tourism, financial services and education. Our starting point is that Australia needs to transition into areas beyond these existing areas of strength. For example, the nation has recently experienced a sharp decline in the high value-added components of the mining industry, in tandem with the decline of the mining sector in general. Our assumption is that diversification is required.

Second, we assume that, as a first-world developed nation, it is desirable to develop high-wage and high-skill industries. We have not added the prospect of competing with other nations on the basis of low wages. Here, the paper considers an economic transition to high-value industries as being the objective of this transition. We do not consider the issue of transitioning the Australian workforce to high skilled jobs. However, in presenting our analysis, we are aware that transitioning the workforce is much more complex than simply moving the labour force from existing jobs into the new jobs created in the ‘new economy’. Regardless of the new industries that are created in Australia’s ‘new economy’, international development in technological change and the rate of technological change dictates that Australia must reposition its workforce, regardless.

Finally, and most importantly, the previous analysis of past and current science, technology and innovation policy underlies our assumption that past and current policy initiatives will not achieve the economy promoted in our recent policy debates. Although some of these policy initiatives have been successful, and have addressed specific weaknesses in the national system of innovation, they do not address the more fundamental problem of the business environment that exists in Australia. Policies relating to poor linkages between research institutions and

business, the absence of venture capital, low levels of investment in R&D, inconsistent funding of research, deficiencies in Australia's education and skills base, inadequate numbers of students undertaking studies in science, technology, engineering and mathematics, deficiencies in technology transfer into Australian industry and the client state nature of Australia's high value-added industries are all very important in building Australia's national system of innovation. However, we suggest that previous attempts at addressing these problems have been insufficient, and have lacked commitment and support because Australia's still lacks a business and industry culture conducive to the high value-added, innovative economy.

As stated previously, the last election was the first election that the major political parties agreed on the need to change the fundamental business culture in Australia, yet, despite its centrality in the economic discourse of the election, the 'innovative' economy was relegated to some new commitments to R&D, company tax cuts and some funding to restructure Australia's manufacturing sector. In comparison to other issues dominating the election campaign, there appeared to be a distinct lack of understanding of the fundamental shift that is required to reposition and 'transition' Australia to a new industrial base. As a starting point, the following three proposals are used as explanations for the failure of science, technology and innovation policy as a serious policy agenda in Australia.

The Jobs Agenda, National Identity and Depictions of Work

Job creation is probably the most consistent, dominant policy undertaking of the two main political parties at every election and while in government over the past three decades. As a starting point for understanding the failure of governments to make any significant progress towards a high value-added, innovation-based industrial development agenda in the past three decades, we examine depictions of work in Australia, and way in which employment is constructed in political discourse. Here, we use cultural artefacts and political debate as a way of demonstrating that knowledge-based work has not yet been inculcated into our national culture.

We start with the emergence of the Heidelberg School in the years leading up to Federation, a movement with which artists such as Tom Roberts, Arthur Streeton, Charles Conder, Walter

Withers and Frederick McCubbin are often identified. This school, whose artists often painted *en plein air*, sought to escape from the previously overly mannered and overtly Euro-centric portrayals of the Australian bush, and aimed to present human characters in a more thoroughly naturalistic setting characterised, in many cases, by the harsh Australian sun. For example, McCubbin's works speak to the discourse of the pioneering white settler, who must use physical toil to overcome the forbidding, alien nature of the Australian bush (Dixson 2000, p. 102). Examples include *On the Wallaby Track* (1896), *Down on His Luck* (1889) and *Bush Idyll* (1893) and, perhaps most famously, *The Pioneer* (1904).

Possibly the most instantly recognisable of all Australian paintings is Tom Robert's *Shearing the Rams* (1890). This famous work, held in the National Gallery of Victoria, and another representative of the output of the Heidelberg School, depicts vigorous men depicted with rolled-up sleeves, hard at work shearing in what is presumably a hot, uncomfortable environment, while a golden sunny glow penetrates the shed, it nevertheless underscores the heat of the Australian bush. A man in the background can be seen drinking lustily from a blackened billy, a small but satisfying reward for all his hard, sweaty and competitive work. Overall, the image points to a pervading national identity based on sweat and toil, or 'hard yakka' as it became known amongst working man and woman. Artwork such as these point clearly to Australia's national identity being built on the privileging of physical toil rather than the application of intelligence to solve problems of pressing concern to society, with the artwork in question providing a visual mnemonic to the oft-cited statement that Australia has, at many points of its comparatively short history, 'been riding on the sheep's back'.

Such attitudes with respect to Australia's national identity are also inherent in much of the literature typically viewed as being a core part of national folklore. Poetry such as *The Man From Snowy River* (1890) by A.B. 'Banjo' Paterson speak clearly to an obsession with the rugged outdoors, and the steadfast folk who made their living from this torrid environment. Such folk not only engage in hard physical work, they positively revel in it. Perhaps even more telling is the same bush poet's *Clancy of the Overflow* (1889), where the town-bound author, seemingly an accountant with "cashbook and the journal", reminisces on meeting a drover named Clancy along the Lachlan River. He wistfully laments the "foetid air and gritty of the dusty, dirty city"

and fantasises about exchanging claustrophobic urban life for the freedom of the bush. Instead of having to mingle with townsfolk, their eyes “eager and greedy, and their stunted forms and weedy”, he yearns to see “the vision splendid of the sunlit plains extended”, and meet with the bush folk and the “kindly voices” that will greet him on arrival. The clear implication is that city-life is polluting to the soul, and results in bodies that cannot be compared with the rugged form of the true worker. In effect, the one who uses his or her mind for a living is denigrated, and the toiler is celebrated as the true Australian.

It is well known that Australian national identity, from its incipient beginnings in the late 1800s, was forged, to use a time-honoured but nonetheless fitting cliché, in the crucible of war and Gallipoli and the First World War, in particular. Under supposedly incompetent British leadership, or so the legend goes, Australian soldiers, plucked from the farms and having ridden horses and wielded firearms since childhood, were sent into the mud and horror of a very European war. The Anzac, and indeed all Australian infantry soldiers thereafter, is thus characterised as ‘The Digger’. He thus uses the earth and his physical labour as a resource for his own protection and that of his comrades. He works towards victory through unrelenting toil, his shovel more useful than any Lee Enfield rifle.

In more recent times, popular culture has also continued to privilege the worker as the ‘true Australian’. Particularly emblematic of this is the popular music that emerged in Australia in the early 1980s, when Australian national identity, confused and somewhat downtrodden in the wake of the controversial Vietnam War, the Whitlam dismissal in 1975, and the economic pessimism and introspection of the Fraser era, started to revive and re-imagine itself as it surged with renewed vigour towards the bicentenary of white settlement in 1988. This was the era of a Prime Minister who held a record for beer-drinking prowess, an English-born entrepreneur who let us beat ‘the Yanks’ in the America’s Cup, and where resource-exploitative Australian companies started to swagger onto the world stage, despite Midnight Oil’s critique of Australia’s resource-based economy in *Beds are Burning* (1987) and *Blue Sky Mine* (1990). This was an era in which Australia, and being Australian, was celebrated, with songs such as Ice House’s *Great Southern Land* (1982) and Men at Work’s *Down Under* (1981) being understood by the populace as

manifesting Australian pride, even if the latter song does acknowledge the “plunder” associated with the nation’s resource dependency.¹

More important for our purposes is Scotland-born singer Jimmy Barnes’ *Working Class Man* (1985), which eventually came to be regarded a celebration of the sorts of Australian values discussed above. Barnes himself has said that “Most people thought [the song] ... was written about me, but it was actually written about my audience - staunch, honest people, who work and who care” (Jenkins 2007, p. 303). The eponymous hero, “a legend of his time”, has “blue denim in his vein” and is a “steel town disciple”. He’s the first to put his hand up for “overtime”, because he’s saving up for “a little woman” that he’ll “someday ... make his wife”. In the minds of most Australians who have heard the song, he’s not the heteronormatively-coded working class hero of the songs of Jersey-centred Bruce Springsteen or even Bon Jovi, even if “He did his time in Vietnam”. No, he’s the same bloke, the same “weary driver”, you could probably find cruising his tattered but faithful Holden Kingswood down a street lined with the Illawarra Flame Trees made famous in Cold Chisel’s *Flame Trees* (1984) – also sung by Jimmy Barnes. He’s the same bloke who ponders whether the “young factory auto worker” will leave the never-changing town, or stay with the “girl falling in love near where the pianola stands”. The video of *Working Class Man* further cements the worker as a legend, with ‘Barnsie’ hollering away in a sweat-soaked white singlet in front of steel-working scenes at Port Kembla, and burning cane fields in the far north of Queensland. There’s plenty of dust, sweat and heat here to remind you of just how heroic the working class man’s toil is. As one commenter on the You Tube video pithily stated, “Please rise for the National Anthem”.²

If *Working Class Man*, or *Waltzing Matilda*, is not Australia’s ‘other’ national anthem, it might very well be the television advertisement for Victoria Bitter, or VB as it is more commonly known. Various versions appeared over several decades, beginning in 1968, all set to sweeping orchestral music strongly reminiscent of Elmer Bernstein’s main theme from *The Magnificent Seven* (1960), all to augment the nuance of hard work as a kind of heroic activity, and depicting working-class men carrying out a range of typically sweaty working-class duties. The overall

¹ Released in the United States in 1982, and reached Billboard No. 1 in January 1983.

² <https://www.youtube.com/watch?v=erSJGrpfnOI>

message is that a “hard-earned thirst needs a big, cold beer” and that the “best cold beer is Vic – Victoria Bitter”. That thirst can be achieved via a number of means; for example, you can get it “riding [a horse]”, “fixing the trains”, “in a hole [while digging]”, “on a plank” (a labourer wheels a wheel barrow up a plank), “lifting”, “shifting [an entire house]”, “feeding a fire [on a cane farm]”. The images revolve, in particular, around the primary industries sector, such as farming, commercial fishing and livestock-rearing, the construction sector, and mining. Here, is Australian national identity writ large, propped up by one of its more enduring working-class institutions, beer.

A ‘real’ Australian worker is therefore traditionally seen as one who exchanges his (note the gender) hard, physical work for monetary gain, to “make a living”, as the saying goes. He is anti-authoritarian, sometimes cheekily ill disciplined, revels in the role of underdog, and dislikes the airs and graces of the well-educated, who think of themselves as his betters. This is a worker who builds, digs or grows things out of the natural resources provided by nature. His input is more about brawn than creativity or the application of knowledge. He might maintain or fix, he might integrate resources to some degree, but he does not generally strive to innovate, and when he does, it is generally in a field or sector regarded as sufficiently representative of the Australian ethos discussed above; agriculture, the mining sector, and construction, for example. In short, it is the mastery and exploitation of Australia’s natural environment and its manifold resources that underpins much of our present attitudes towards innovation, and science and technology policy by extension. So, the quintessential Australian worker is not a knowledge worker. He is more likely to be thought of as some sort of labourer or tradesman. The industry is not likely to be science or technology related, it is more likely to be a sector where he can be ‘on the tools’. In Australia, it might still well be said nothing’s as precious “as a hole in the ground”, and those who work in that mine are still accorded a status in popular culture over and over the city-bound and soft knowledge workers (Midnight Oil, *Blue Sky Mine*, 1990).

Although Australia’s political parties and Australian governments have turned towards the modernisation of the Australian economy as a solution to the economic decline usually associated with falling commodity prices, i.e., as a response to economic downturns, the political debate has also focused on jobs creation in a similar way described previously with respect to

national identity and cultural identity. The following quotes are used to conclude this analysis of the jobs agenda in Australia.

“Well, I certainly have an enormous amount of respect for the people [Tony’s tradies] who are out there having a go. They are the backbone of any society. They are certainly the backbone of any strong economy...” (Abbott, 2015, asked by David Speers on comment on Tony’s tradies).

“When Joyce talked about jobs and growth it was in the context of specific infrastructure projects. The construction of dams. Building a second airport in Sydney. The need to proceed quickly with a Melbourne-to-Brisbane inland railway. Trendy stuff about innovation, even defence projects, hardly got a look in, because it was not seen as connecting with the daily lives of people in the regions” (Oakes, 2016).

“We gotta [sic] think of the carpenters, the plumbers, the farmhands who won’t get a degree and they are paying taxes” (for students to go to university) (Tehan, 2017).

As can be seen, the notion of the ‘real’ Australian worker being involved in manual labour, or at least working in the resources or agricultural industries, is still manifest in contemporary political discourse.

The Nature of Crony Capitalism in Australia

It may seem an exaggeration to apply the term crony capitalism to Australia government business relations. It is more generally applied to corrupt relationships existing between government, the public service and business (for example, Montinolo, 1994; Hughes, 1999). In general, Australia is not regarded as a corrupt country. In 2016, it scored 79 from a possible score of 100 on Transparency International’s Index of accountability, giving it a world transparency ranking of 13th out of 176 countries (*Transparency International*, 2016, <https://www.transparency.org/country/AUS>). While Australia does not rate a mention in *The Economist*’s index of crony capitalism, it has several sectors replete with “[rent-seeking]

industries that have a lot of interaction with the state (and) are vulnerable to crony capitalism” (*The Economist*, 2016, <http://www.economist.com/blogs/graphicdetail/2016/05/daily-chart-2>). These rent-seeking sectors include coal, timber, deposit-taking banking and investment, infrastructure and pipelines, oil, gas, other extractive energy, real estate, construction, mining, commodities and utilities. This index is constructed on proportion of GDP accumulated by the wealth of billionaires in these rent-seeking industries, within 22 nations for which reliable data exists.

Crony capitalism was used, effectively, by Quentin Beresford, in his book, *The Rise and Fall of Guns Ltd* (2015), to explain the logging industry in Tasmania over many decades. We believe Beresford’s depiction of logging in Tasmania provides many parallels with Australia’s overall national dependence on resources. His variation of Tasmanian version of crony capitalism incorporated a lack of transparency in political and policy decision making, solidarity between the major political parties, federal and state governments, powerful state government agencies, major business interest groups, unions and media. Although environmental groups and community activist groups were successful in preventing the damming of rivers, the logging of forests and the construction of toxic paper mills, their successes mostly required national campaigns outside of Tasmania (Beresford, 2015). Similarly, the model of Australian federal crony capitalism that we are suggest promotes resource-based industrial development over a knowledge-based, high value-added economy does not imply a high level of personal corruption as originally suggested when describing crises in developing nations. However, there are many elements of crony capitalism that still exist in the determination of federal industrial development expenditure.

It is difficult to ascertain the level of government support provided to Australia’s resource-based industries. Table 3 provides a measure of Federal government policy affecting industry assistance by sector in Australia. This table suggests that, in comparison to manufacturing, resource based industries are not heavily subsidised. However, there are some important caveats to assets and subsidies that are not included in these Productivity Commission estimates. These factors add considerable value to the assistance provided to sectors such as the mining industry.

TABLE 3
COMBINED ASSISTANCE BY INDUSTRY GROUPING 2014-15 (\$m)

	Tariff output (gross tariff)	Budget outlays	Tax concessions	Net combined assistance *
Primary Production	\$208.9	\$746.9	\$450.8	\$1322.4
Mining	\$1.2	\$263.8	\$288.3	\$299.1
Manufacturing	\$7,617.3	\$1091.7	\$392.7	\$7040.2
Services	\$0	\$1,754.3	\$1677.1	\$1,693.6
Unallocated	\$0	\$399.1	\$271.0	\$670.2
Total	\$7,827.3	\$4,255.7	\$3,079.9	\$7,638.3

* Note: Net combined assistance is less input penalty from tariffs imposed on input products.

Source: Based on Productivity Commission (2015), *Trade and Assistance Review 2014-15*, Annual Report Series, Canberra, p. 25

For example, the Commission (2015) provides examples of industry assistance not included in their estimates as follows.

- “Concessional debt and equity finance
- State and territory government support to industry
- Access and pricing of resources (mining, forestry, fisheries and water), if on favourable terms” (p. 19).

In addition, the Commission (2015) also notes that the flowing benefits to industry are not classified as industry assistance.

- “Employment incentives to business
- Remote housing concessions in mining regions

- Differential tax rates in relation to excises, GST and FBT (and State payroll tax)
- Improved transport infrastructure ...” (p. 19).

A key feature of crony capitalism is a lack of transparency, and it appears that there is little transparency surrounding subsidies to industries such as mining. If the current public debate surrounding subsidies that appear to be being offered to Adani Australia, with its interest in expanding carbon-based and environmentally deleterious energy extraction, they would not appear in Productivity Commission data relating to industry assistance. Indeed, the mining industry more broadly does not appear in these metrics for two important reasons. Negotiations with state governments, together with the pricing of resources, are exempt from these data. It appears that Adani Australia is being offered free water in perpetuity for its coal operations, deferred royalty payments and concessional debt financing. There is no transparency surrounding the cost of this assistance.

A key aspect of Beresford’s analysis of crony capitalism in Tasmania is characterization of the logging industry being unchallenged as being crucial to the economic survival of the state, by all the major institutions, political parties and interest groups. His book demonstrates that this popular conviction was unfounded, and challenged only by the brave. There are national parallels with local depiction of crony capitalism. Australia’s export revenue is highly dependent on its extractive industries. In 2015-2016,

“Australia’s top 5 goods and services exports were: *Iron ore and concentrates* (\$47.8 billion); *Coal* (\$34.5 billion); *Education-related travel services* – which includes foreign student expenditure on tuition fees and living expenses in Australia – (\$19.9 billion); *Gold* (\$16.6 billion) and *Natural gas* (\$16.5 billion)” (Department of Foreign Affairs and Trade, 2017, p. 5).

However, the ability of commodity-focussed economics to dominate the economic agenda, and capture widespread collective support, becomes less clear when other economic data is introduced into the industrial development policy debate. For example, Table 4 ranks employment by industry in Australia in 2017. This table should suggest that the jobs in knowledge-based industries, found at the top of this table, would take much higher priority in government policy than has been the experience over the past three decades.

TABLE 4: EMPLOYMENT BY INDUSTRY RANKED Feb. 2017	
Industry	Persons Employed
Health Care and Social Assistance	1,525,900
Retail Trade	1,228,000
Construction	1,074,300
Professional, Scientific and Technical Services	1,009,200
Education and Training	957,300
Manufacturing	900,400
Accommodation and Food Services	849,900
Public Administration and Safety	789,500
Transport, Postal and Warehousing	611,000
Other Services	482,700
Administrative and Support Services	435,000
Financial and Insurance Services	431,900
Wholesale Trade	372,000
Agriculture, Forestry and Fishing	309,800
Mining	228,500
Arts and Recreation Services	219,900
Rental, Hiring and Real Estate Services	209,100
Information Media and Telecommunications	204,500
Electricity, Gas, Water and Waste Services	136,200

Source: Department of Employment (2017), *Employment by Industry – Ranked February 2017*, Labour Market Information Portal, http://lmip.gov.au/default.aspx?LMIP/LFR_SAFOUR/LFR_Industry_Ranked.

The decline in the importance of the resource based sectors to the Australian economy is also reflected on the Australian Stock Exchange. As of the 1st June, 2017, “Materials” stocks represented 15.8% of the capitalization of the S&P/ASX 200 Index while “Energy” stocks accounted for 4.4% of the capitalization of this segment of Australia’s largest companies. The “Financial” (36.3%) companies dominate the S&P/ASX 200 Index, while new knowledge-based industries emerging in this sector include “Health Care” (7.5%), “Telecommunications” (4.2%) and “Information Technology” (1.3%) (ASX, 2017, <http://www.asx200list.com>).

The comprehensive support to an industrial development agenda that eventually reverts to exploiting natural resources of some form is inconsistent with the changing nature of its contribution political agendas such as ‘jobs and growth’, which is common to the campaigns of the major political parties for over three decades, both state and federal. However, a phenomenon

associated with crony capitalism is that the political powerbase of these industries is maintained. The current support for the Carmichael coal project in Galilee Basin is a current example of the strength of this powerbase across the groups. Beresford (2015) associates this with a particularly Australian form of crony capitalism, which is characterised by the interactions of political parties, three tiers of government, strong business lobby groups and most of the media. High levels of government subsidies and the problems securing finance are evidence that there is little commercial or economic logic to this coal-mining project.

Finally, the existence of this conflation of interests stifling the emergence of the ‘new economy’ envisaged as far back as 1983 was most evident when the mining industry was challenged with super profit, “mining tax”, later to become the Minerals Resource Rent Tax Act, 2012 (MRRT) (Federal Register of Legislation, 2013). The initial provisions of this super profits tax proposed by Prime Minister Kevin Rudd, and presented by Treasurer Wayne Swan, initiated a public media campaign by the mining industry (see McKnight and Hobbs, 2013 for an analysis of the ethics of this campaign), which was instrumental in having the subsequent diluted to the extent of being ineffectual in extracting any meaningful rents from the mining industry. The withdrawal of the “superprofits tax” in favour of the MRRT was a demonstration of the resilience of entrenched economic interests in Australia to resist any reshaping of the economic agenda. Indeed, business interests convinced government that the public supported the notion that they were essential to Australia’s economic prosperity (Bell and Hindmoor, 2014), despite most Australians being largely disconnected from the mining industry with respect to their own employment (refer to Table 4). Furthermore, Australia had failed to accumulate any meaningful public reserves from the profits of the mining booms over several decades (compare to the use of oil revenues in Norway; on which, see Cleary, 2016).

Leadership

The final impact on the science, technology and innovation agenda that we wish to consider is leadership. Tiffen’s (2017) book analysing the destabilization of government through increasing changes in government provides a starting point for examining the issue of leadership. We have previously noted that there are major structural impediments to changing the underlying structure

of Australia's industrial base, such as our cultural heritage manifested in our national identity, and power relations inherent in Australian capitalism. Tiffen's characterization of political leadership, which has become increasingly insecure or unstable, would suggest that any major policy changes to economic or industry policy need to be accompanied by firm leadership on such themes. We suggest that unstable leadership only partially explains the problem of leadership with respect to driving transition in an economy.

The success of the Hawke/Keating government in achieving major structural reforms to the Australian economy is often attributed to the ability of Hawke and Keating to win the support of major interest groups, achieve electoral support, articulate a vision and balance the cost and benefits of reform across the population (for example, Kelly, 1994, Megalogenis, 2012, O'Brien, 2015). Keating, in particular, was an adept, skilful leader in prosecuting an argument for change and campaigning for political support to gain acceptance for what are probably the last major structural changes to the Australian economy and industry policy. However, his agenda of liberalisation has had lasting impact on the Australian economy and its harnessing of competition:

“JPK: The Liberals were always interested in business bodies, cabals, monopolies, duopolies. I wasn't. I was interested in markets, not business. I had faith in markets, in competition” (Paul Keating cited in O'Brien, 2015, p. 48).

However, a second important reform that should also be recognised as conviction leadership was the introduction of the Goods and Services Tax (GST) by the Howard/Costello government. Indeed, Howard won the 1998 election with this new tax as the centrepiece of this economic agenda, despite John Hewson having lost the 1993 election to a not insignificant extent because of his promise to introduce a similar tax. (Warhurst, 2000). Howard's leadership on this issue, and the introduction of gun control laws in Australia (Federal Register of Legislation, 1996), were examples of leadership being both persuasive and capable of winning political support, sometimes contrary to the views of their natural constituency. Yet neither Howard nor Costello had any interest in transforming the Australian economy or its industrial base from its commodity dependence to a high value-added, knowledge base.

Apart from the leadership cited above with respect to Hawke/Keating and Howard/Costello,

there has been little evidence of political leadership capable of introducing any type of major reforms to Australia's industrial structure or economy. There has been ample evidence that major reforms under Gillard and Rudd were hampered by incompetent government, internal political tensions and deliberate sabotage (McKew, 2012; Kelly, 2014; Garrett, 2015). The Abbott government was weak and ineffectual (Savva, 2016; Patrick, 2016) and, moreover, had a very strong commitment to maintaining Australia's commodity-based economy. Indeed, Tony Abbott's view on the Turnbull innovation agenda is as follows:

“It's good that we're no longer talking about innovation and agility because that, frankly, loses people. We have to talk about the issues that they understand and we've got to put it in terms of their interests and how we're going to advance their interest” (Abbott, 2016).

In effect, Abbot's view is essentially more of the same, and speaks largely to the notion of promoting the view that political discourse should be structured around the tropes that voting Australia best understands, such as the nation's reliance on resource extraction, agriculture and infrastructure provision through the construction sector, more so given that these areas are closely tied to Australia's national identity.

CONCLUSIONS

Past attempts to build an Australian economy around science and technology have relied on programs that will usually have a marginal influence over the modernisation of the nation's industrial structure. The absence of a well-formed and mature venture capital market was noted earlier as an important weakness in the Australian system of innovation. The Management Investment Companies was implemented to attract funding into the venture capital market with the attraction of tax concessions, but, in terms of where capital markets invest their money, this program was marginal and its impact on the investment strategies of the financial markets was insignificant. The reasons for the failure of this program, and subsequent venture capital programs, to make any substantial contribution to the development of a venture capital market in Australia were later published (Ryan, 1991a, Ryan, 1992), but contained a common theme. The absence of a venture capital market in Australia was correctly identified as an important

constraint, as it continues to be, in building innovative, high value-added industry sectors in Australia. However, capital was one of many inputs into developing ‘venture capital-type’ industries.

These new sectors need to be supported by other types of infrastructure such as international business linkages, experienced and skilled entrepreneurs in the management of high-risk ventures, legal, accounting and technological support services meeting the requirement of new technology industries, and many political and social factors identified in the final section of this paper that support risky, untested and pioneer business opportunities. As was the case with the Management Investment Companies Program, our paper proposes that an innovative, creative business culture requires more than simply money to develop it.

During the 2016 election campaign, a core component of building core technological capability in this nation was the announcement that Australia’s next generation of submarines would be built in Adelaide (Department of Defence Ministers, 2016a). This decision received bipartisan support from Australia’s political parties. This project is likely to be beneficial in building Australia’s technological capabilities, creating employment in advanced manufacturing, and assisting other Australian industries such as steel survive through flow on effects, as claimed by the government (Department of Defence Ministers, 2016b). However, the project’s impact on the total national system of innovation, and the capacity of this project to transition the Australian economy, is exaggerated. It is extremely optimistic to claim that Australia will build an international industrial capability in defence industries by applying protectionist policy instruments to a single defence project. The first author’s own previous research has demonstrated that the extent to which foreign companies will transfer intellectual property and technological capability has been consistently overestimated. Indeed, previous attempts to build technological capability through industry offsets with foreign companies in Australia have generally failed (Ryan, 1991b).

In sum, this paper attempts to put an ‘economy in transition’ into perspective. The economic reforms of the 1980s in Australia positioned the nation to be able to compete in emergent international markets. These were major reforms. Transitioning to an internationally competitive, high value-added, modern secondary and tertiary economy is also a major reform, but one which

is still largely unrealised. To date, the inherent magnitude of such a change seems to be unrecognised in Australia's political debates. The OECD captured the magnitude of this change as follows:

“... it is increasingly recognized that innovation is influenced by certain social and cultural values, norms, attitudes and behaviors which may be described as an innovation culture. More and more governments therefore consider it important to foster and strengthen an innovation culture through policy measures based on the assumption that cultures and social behaviors are amendable” (OECD, 2012, Building an innovation culture).

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