FAILING TO PREPARE IS PREPARING TO FAIL: HOW INDUSTRIAL POLICY CAN PREPARE REGIONAL QUEENSLAND FOR A GLOBAL ENERGY TRANSITION

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ABSTRACT: The economy of Queensland, Australia is dependent on coal exports for economic growth, the buoyancy of the state budget and employment in regional areas with limited alternative economic opportunities. Queensland policy-makers need to address the risks associated with dependence on a commodity which has an uncertain future. This article considers the history of Australia's vulnerability to global transitions, current trends associated with a global energy transition, and suggests a strategy to mitigate against the multiple risks associated with a reliance on the export of coal by Regional Queensland.

KEY WORDS: Climate policy; energy policy; industrial policy.

1. INTRODUCTION

There has been much controversy about the proposed investment by Adani in a new coal mine in Australia's Galilee Basin, in Central Queensland. This development has been welcomed in Queensland's regional centres which have an above average unemployment rate (ABS, 2016) and, at the same time, opposed strongly by people, mainly elsewhere, concerned with climate change (Wordsworth, 2019; Goodell, 2019). This situation seems to pose a difficult choice for politicians: should the quest to deal with climate change be preferred to protecting the jobs of people in a disadvantaged region? In many ways, this is not a policy dilemma but, an opportunity to promote and support new industries, with new jobs, in regions that have been left behind economically. Taking such an opportunity is not new in Australia. In the early post-war period, manufacturing industries were deliberately fostered to provide employment to immigrants and political or economic refugees (Boehm,

1993). Regional Queensland is facing just another structural transition that must be managed.

While evidence of meaningful emission reductions by Queensland's largest customers for coal exports—India, China and Japan—remains elusive, representatives of the global community at the Conference of Parties in Paris in December 2015 indicated that there is a will to reduce carbon dioxide emissions to avert the worst of projected climate change (UNFCCC, 2016). There is also nascent evidence that a transition to renewable energy, as the primary supply for power systems, is underway (IEA, 2019d). Notwithstanding these trends, there is ongoing investment in mining coal in Central Queensland (Queensland Department of State Development, 2019). This has implications for investors, but more specifically workers in Central Queensland who are dependent on coal exports for their livelihoods (Queensland Resources Council, 2019; Capricorn Enterprise, 2019).

Queensland policy-makers should consider the path that Europe has taken to address regional development and regional income disparity through carefully targeted industrial policy (see, for example, (Iammarino *et al*., 2017; Alves Dias *et al*., 2018; Barzotto *et al*., 2019)). From the 1980s, industrial policy has been accused of creating mechanisms to pick winners or support inefficient domestic industries (Emmery, 2000; Neely, 1993; The Economist, 2010). However, after the economic downturn following the Global Financial Crisis (GFC), European policy-makers have been seeking ways to provide new opportunities in regionally disadvantaged areas of Europe through the support of new manufacturing capacity (Aiginger, 2014; Bianchi and Labory, 2019). In particular, manufacturing product that adheres to sustainable development principles has been emphasised (Aiginger, 2014). With exceptional resources to support low-cost manufacturing (Garnaut, 2019; Lynham, 2019), industrial policy should be considered for Queensland's regions, with the goal of reducing reliance on coal for economic development.

A policy framework that can accommodate the scope and scale of the cause and effects of climate change, while attempting to meet societal goals which are framed by ideologies to meet political objectives unrelated to climate change, is inherently complex. For this reason our method is to consider the attributes of the problem that Queensland faces in section 2, if there is any evidence that Australia has developed policy in the past to respond to problems of this nature in section 3, experience from other regions when facing similar problems in section 4, and then the policy

framework which might best help Queensland to respond to this complex problem in section 5. Section 6 concludes.

2. QUEENSLAND'S RESILIENCE TO DECLINING COAL DEMAND

Export Income, State Revenues and Employment

Mining has played a significant role in export led growth in Queensland (Shafiullah *et al*., 2017). Exports of coal are a major source of export income for Queensland raising $43 billion in 2018 (up from $15 billion in 2007) (QDNRME, 2018). Royalties returned to the Queensland government for coal sales totalled $3.7 billion in 2018 (up from $1 billion in 2007) (Queensland Office of State Revenue, 2019) which is 6 per cent of state revenues in 2018 (up from 3% in 2007). In 2007, mining contributed 8 per cent to the economy and manufacturing 9 per cent. After a large investment in mining in 2011-15, the mining sector in 2017 equates to 10 per cent of the Queensland economy, the largest contributor. By 2017 the manufacturing sector's contribution had slipped to 6 per cent. Since 2007, employment in mining has increased by 20 400 jobs whilst employment in manufacturing has slipped by 15 700 jobs (ABS, 2019c).

The 2016 Census Working Population Profile data show that 31 per cent of mining employment in the Bowen Basin is for trades persons and 51 per cent drivers/machine operators (ABS, 2019b). A transition to autonomous vehicles is predicted by Wood Mackenzie (International Mining, 2018) and has already been initiated by BHP (International Mining, 2019), Rio Tinto (Rio Tinto, 2019) and Glencore (Glencore, 2019). The stated intention to shift to automation poses a significant threat for the driver/machine operator jobs in coal mining.

Census Working Population Profile data for Biloela, Bowen Basin North and Central Highlands also show that coal mining sector employment makes up 40 per cent of employment in the Bowen Basin, based on Place of Usual Residence (ABS, 2019b). As a result, research has found that the communities in Queensland's Bowen Basin are highly vulnerable to global emissions reductions measures due to this heavy reliance on coal mining for employment (Fleming-Munoz *et al*., 2019).

A consequence of the mining investment boom is that alternative sectors like manufacturing and tourism have been side-lined in a state policy framework increasingly dictated to, and reliant on, mining (Ellem and Tonts, 2018). Political economy suggests that large multinational commodity companies have wielded undue influence on state governance

systems in Australia to support mining over other opportunities (Sheppard, 2011).

If, as Aiginga (2014) finds, a healthy manufacturing sector is an indicator of economic resilience, then Queensland's resilience has declined since 2007 and is at a level which indicates little room for manoeuvre as Asian demand for coal declines.

Global Trends in Coal Consumption that will Impact Queensland

Coal consumption reduction is only evident in the European Union (EU) and the USA (IEA, 2019c). Asian markets for coal are still either slightly increasing or stable (IEA, 2019c). In consideration of Queensland's vulnerability to a decline in coal exports to Asia, it is meaningful to consider coal consumption trends in Asian markets.

Japan:

Since the tsunami in 2011-12, Japan has become more reliant on coal for electricity generation as nuclear plants were shut down in the aftermath of the Fukushima nuclear failure. By 2017 Japan needed coal to generate 33 per cent of its electricity. Despite greater reliance on coal for electricity, coal consumption has declined since 2013: 2 per cent for electricity generation, 10 per cent for other industry and 8 per cent for steel manufacturing, as shown in Figure 1.

In policy terms, Japan has indicated its desire to shift to low-carbon energy sources. For instance, in 2019, Japan's Minister for Economy, Trade and Industry, Isshu Sugawara, stated:

> "*Japan wants to stay as a front runner by accelerating the development of hydrogen, a key future technology, and taking an initiative to promote global energy transition.*" (Sugawara, 2019 cited in Obayashi, 2019).

This underpins a strategic plan to develop and commercialise new hydrogen-based power-to-gas, power generation, mobility and industrial process technologies and invest in new supply infrastructure for power and mobility in Japan (Japan Ministry of Economy Trade and Industry, 2019a; Japan Ministry of Economy Trade and Industry, 2019b). This strategy will lead to decreased coal imports from Queensland.

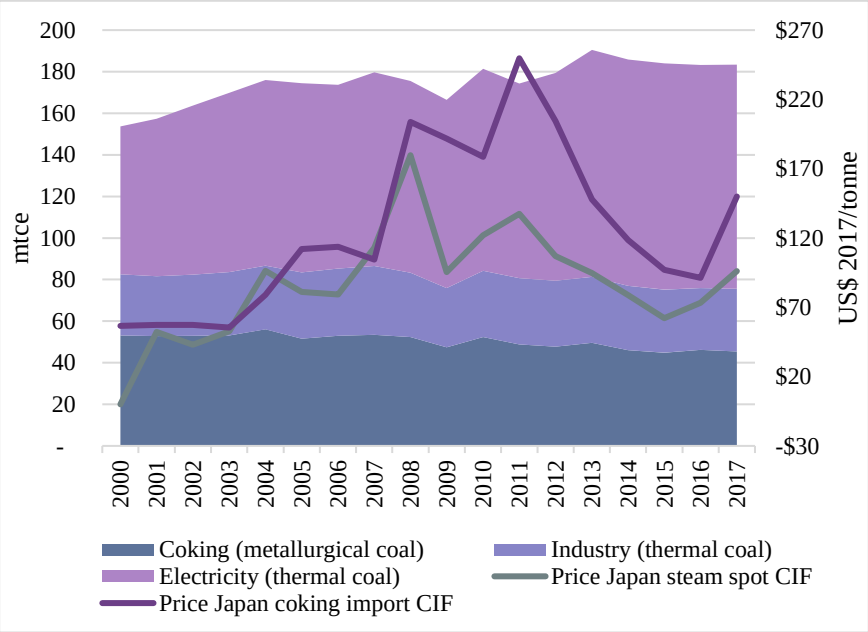

Figure 1. Coal Demand and Prices in Japan. Source: (IEA, 2019a; 2019c).

China:

Coal consumption peaked around 2012-13 and at 2017 remained 6 per cent lower than the peak, as shown in Figure 2. In response to the GFC, China announced a stimulus program designed to counteract reduced global demand. A consequence of the stimulus program was domestic coal supply constraints leading to increased imports (Tu and Johnson-Reiser, 2012). China's unexpected demand for imports played an important part in elevated global thermal and coking coal prices in 2011 which declined as global supply investment responded to the higher global demand, and the stimulus program wound back (Roberts *et al*., 2016).

The long term trend for coal consumption in China is unclear but research elsewhere finds that clean tech markets will drive investment towards renewable energy (Linnenluecke *et al*., 2019), and China is already investing heavily in both production and deployment of clean energy (International Renewable Energy Agency, 2019). Recent reports indicate that China seeks to improve air quality (Smith, 2019b), increase renewable energy investment (Moore, 2019), cease investment in coal power (Smith,

2019c), and address demand-supply imbalances (Smith, 2019a), all of which could lead to a decline in demand for coal from Queensland.

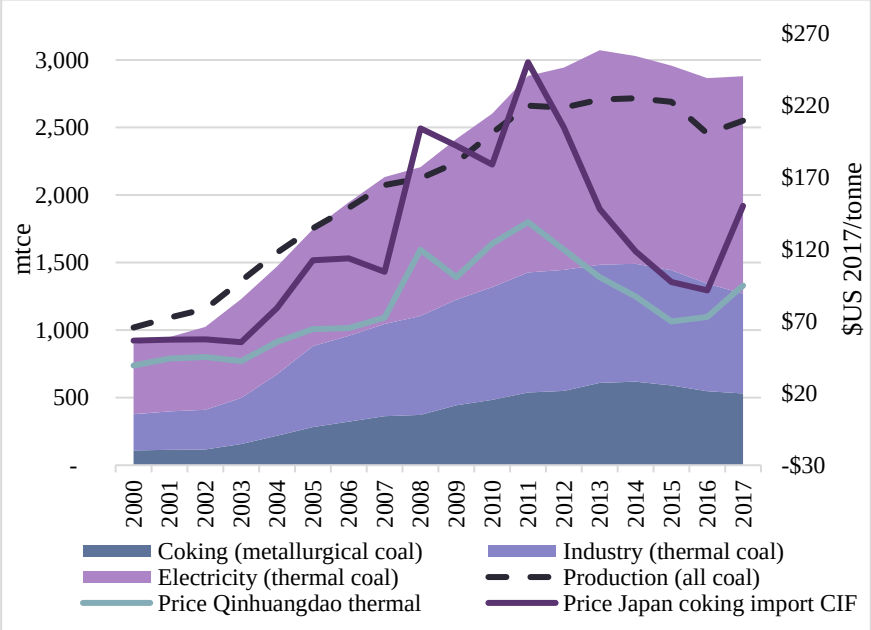

Figure 2. Coal Demand and Prices in China. Source: IEA (2019a; 2019c).

India:

India is the only major economy projected to increase coal consumption to 2025 in the IEA's New Policy Scenario (IEA, 2019e). As can be seen in Figure 3, India currently imports around 30 per cent of coal consumed. What is subject to debate is the quantity of coal that India is going to be able to source domestically.

Whilst India has a stated policy to reduce imports of thermal coal, expectations are that thermal imports of 50-100 (Vishwanathan *et al*., 2018) to as much as 300 million tonnes per annum (mtpa) (IEA, 2018) will continue for the foreseeable future. Indonesia is the dominant supplier of thermal coal to India, although South Africa has made increasing contributions since 2008. Queensland is a small contributor (2% or less) to India's thermal coal imports.

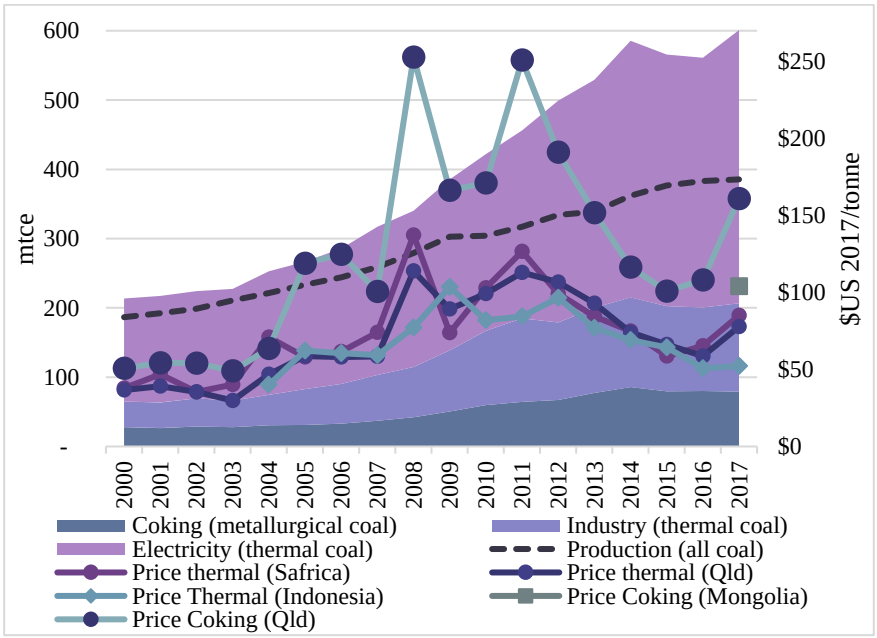

Figure 3. Coal Demand and Prices in India. Source: IEA (2019a; 2019c).

Domestic thermal coal prices in India tend to be considerably lower than imported coal, due largely to the poor quality of domestic coal. Deposits are not always located close to coal power stations leading to long-distance rail haulage which increases costs. In addition, rail haulage capacity is limited, reducing the opportunity to transport coal to power stations across the country.

Some analysts predict problems for coal imports to India. Electricity distribution companies in India can only supply power at prices that consumers can afford, which limits what they can pay to electricity generators which, in turn, limits what electricity generators can pay for coal, and imported coal is relatively expensive. A parliamentary report in 2018 noted that 65GW of a total 90GW of private generation capacity is in financial stress requiring assistance from the Reserve Bank of India to restructure debt to reduce lenders' exposure (Standing committee on energy, 2018). There is also evidence that private investment in energy is primarily directed at renewable energy rather than coal (Fickling, 2019). India is considered to be on-track to meet its Paris emissions commitments (Climate Action Tracker, 2020) and the Secretary of the Ministry of New and Renewable Energy has stated that India plans to have installed 500GW

of renewable energy by 2030 (Kumar, 2019). In summary, no clear evidence exists for even a medium-term market opportunity for exports of thermal coal from Queensland to India.

Due to a lack of metallurgical coal deposits, India imports the majority of its coking coal. In 2007-08, Queensland supplied more than 90 per cent of India's coking coal imports which had slipped to approximately 67 per cent by 2018. Canada, the USA and Mozambique have increased contributions to India's coking imports (Export Import Data Bank, 2019). India is expected to continue to import metallurgical coal of 40-90 mtpa (Vishwanathan *et al*., 2018) to 2030. There is therefore prospect for ongoing metallurgical coal export opportunity to India for Queensland.

Geopolitics and Investment in Coal in the Indo-Pacific

Geopolitical shifts in the Indo-Pacific are a further risk for Queensland future coal exports. Mongolia is already supplying 28 mtpa of metallurgical coal to China (equal to Australian supply, but at half the price) (Peoples Republic of China, 2019). There are plans for investment in the Ovoot Basin (Aspire Mining, 2016; Aspire Mining, 2019) to double supply from Mongolia (SteelGuru, 2018). In September 2019, Russia promised investment in Mongolia including rail corridors (Sino Daily, 2019) and multiple Memoranda of Understanding were signed between India and Russia including investment in coal mines in Russia (Business Standard, 2019). These announcements indicate a strategic relationship developing between India and Russia to secure India's access to metallurgical coal.

The Impact of Climate Negotiations on Demand for Coal

The International Energy Agency (IEA) models global energy consumption and emissions based on nations' announced energy policies, known as the New Policies Scenario (NPS). It also models consumption required to limit global temperature rise, known as the Sustainable Development Scenario (SDS). Whilst the IEA proposes the NPS as the most likely scenario, Parties to the Paris Agreement committed (loosely) to the SDS. Scientists warn that adherence to the NPS will lead to significant environmental and social dislocation. For this reason, this discussion considers the risks and opportunities of the SDS.

Figure 4 shows Asia Pacific coal supply in 2017 and projected demand to reach global climate goals in 2030. The SDS forecasts imply that, at

current production levels, countries that supply to the Asia Pacific will experience significant supply surpluses by 2030. This level of surplus capacity will lead to very low prices and financial consequences for miners in higher production cost regions like Queensland.

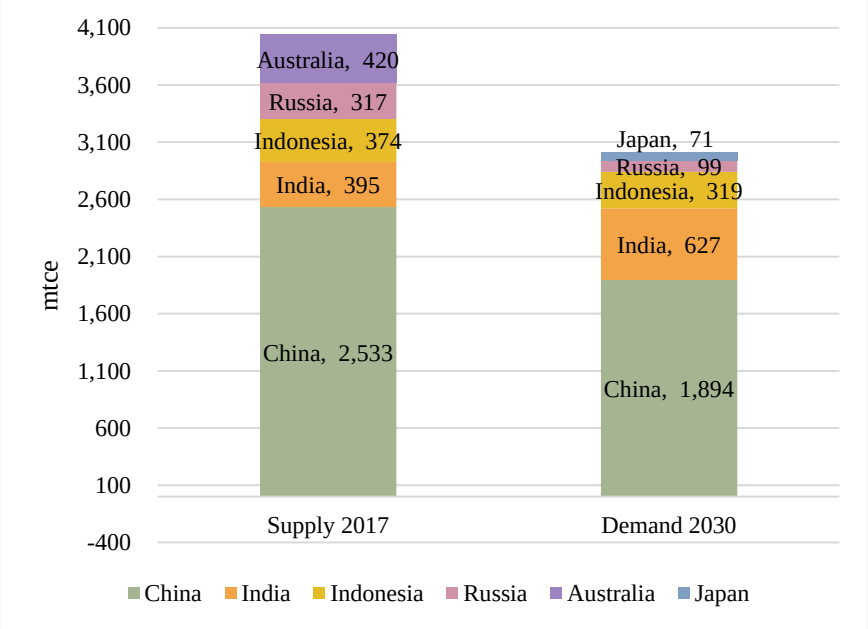

Figure 4. Asia Pacific Coal Balance to Meet Climate Targets. Source: IEA (2019e).

Does the Ownership of Queensland Coal Mines Show any Strategic National Interest in Ongoing Trade with Queensland?

From the 1980s, Japanese companies have invested heavily in Queensland's coal resource (Austrade, 2017; Queensland Coal Board, 1980-2000). Japan's relationship with Queensland has secured coal supply for Japanese manufacturing and the development of an export industry for Queensland. We consider here whether ownership of Queensland's coal mines indicates a strategic national interest in access to coal exports. Strategic national interest has been estimated by attaching a perceived nation status to coal mine ownership and apportioning exports from each mine to the nation status of the owners. As detailed in Table 1, Japan is shown to have a strategic interest in 37 per cent of hard coking and 25 per

cent of thermal coal exports in 2018. Japan's share of thermal coal exports has decreased in recent years (QDNRME, 2018) as a result of Japanese commitments to reduced carbon dioxide emissions. Figure 1 highlights that Glencore, a global commodities company, is loosely attributed to Europe's national interest and has become the dominant investor in thermal coal. Anglo American, another global commodities company, is attributed to the USA's national interest and has become the dominant investor after Australia and Japan in hard coking coal. Australia is shown to be the dominant investor in soft coking coal. China, Korea and India show little commitment to long-term strategic investment in Queensland.

Despite imports of metallurgical coal from Queensland, Indian companies have, as yet, no investment in currently exporting coal mines. The Adani Carmichael coal mine is not represented in Table 1 because it is still under construction and therefore had no exports in 2018. It could be argued that Adani's struggles to obtain approval for its Carmichael coal mine in the Galilee Basin has been a disincentive to Indian companies investing in Queensland coal mines but the Carmichael mine requires opening up a new coal basin with all the challenges associated with infrastructure investment and environmental approvals. Activity in coal mine ownership since 2013 shows plenty of opportunity for Indian companies (or Korean or Chinese) to pursue strategic relationships for the delivery of coal to India (and Korea and China) into the future. It is thus questionable whether, India, the country with reputedly the most pressing requirement for Queensland coal, has any long-term interest in ongoing imports of coal from Queensland. This is supported by the recent reports of relationship building between India and Russia, as detailed in section 3.

Summary

While Europe and the USA already show significant downward coal consumption trends, decreasing consumption of coal in Asia is less evident. There are, however, signs that a downward trend could soon become evident, including: Japan's stated objective to support a global energy transition; China's heavy investment in renewable energy manufacturing capacity as well as deployment, and its stated objectives to improve air quality; India's stated objectives to eliminate coal imports and invest heavily in renewable energy; India's developing relationships with Russia and Mongolia for access to low-cost coal in Mongolia; the commitment to reduced emissions made by most countries in the Paris Agreement; and conflicting evidence of Indian national strategic interest

in coal mines in Queensland. All of these factors point to a significant risk for Queensland of a fall in demand for thermal and metallurgical coal from Queensland.

3. THE EFFECTS OF PREVIOUS GLOBAL TRANSITIONS ON MANUFACTURING IN AUSTRALIA

Since before Federation, Australia has been heavily engaged in international trade and economically reliant on exports. Wool was the largest export commodity after Federation, with wool exports contributing 30 per cent to gross domestic product (GDP) in 1950 following the outbreak of the Korean War. The history of Australian wool exports is characterised by booms when wool was in demand (like at the outbreak of wars) and busts when demand fell away. Agricultural products like wheat, dairy, sugar and later iron ore and coal have played significant roles in Australia's interaction with the global economy and supporting its economic development (Australian Department of Foreign Affairs and Trade, 2020; Boehm, 1993).

Not all countries have derived benefit from development of natural resources. Initially raised in *The Economist* (1977), the Netherlands' experience following the exploitation of natural gas, referred to as 'Dutch Disease', highlighted the unexpected consequences of heavy investment in natural resources; i.e. real appreciation of the local currency, increasing wages, the decline of manufacturing, and unemployment. At approximately the same time, evidence was presented that Australian import-competing industries were being disadvantaged through the development of the minerals sector (Gregory, 1976). Booming sector models followed to illustrate the logic of manufacturing decline in resource rich economies (Corden, 1984) Indeed, as a mining boom kicked off in Australia in 2011, Treasury discussed the potential for 'Dutch Disease' in Australia, but downplayed it as a real concern due to the benefits that could accrue to Australia from the potential growth of the Chinese and Indian economies (Gruen, 2011).

Claims have been made that Australia has avoided the pitfalls suffered by many resource rich, exporting nations, that have fallen prey to what is also referred to as the 'resource curse' (van der Ploeg, 2011). The leading counter-case to the 'resource curse' is the USA, with its superior geological endowment, where mineral extraction led to expanding domestic and international industry which in turn triggered links to universities and geological expertise to improve extraction, engineering and technology for increasing profitable extraction of minerals (David and Wright, 1997).

Ville and Wicken (2012) widened this discussion to propose that natural resource extraction in Australia and Norway has led to the creation of knowledge-and technology-intensive sectors, driving wider economic benefit for the national economies. Asian demand for iron ore and coal drove high levels of investment in extraction but also transport infrastructure, knowledge institutions like CSIRO and GeoScience Australia, Austrade, the Export Finance and Insurance Corporation (Ville and Wicken, 2012; Boehm, 1993), electricity generation for primary metal manufacturing and a world class Mining Equipment, Technology and Services (METS) sector (CSIRO, 2020), all contributing to the success of Australian commodities in international markets.

Since the findings of van der Ploeg (2011) and Ville and Wicken (2012), that Australia had avoided 'Dutch Disease' or the 'Resource Curse' and, notwithstanding the success of the extraction and primary metals manufacturing industries, Australian manufacturing has been in decline. For example, the Australian motor vehicle industry, established after World War II, lost all of its main players in 2017 after a quarter of a century of decline, which intensified after 2008 (Australian Department of Industry Innovation and Science, 2020). Although it was obvious for some that Australian car manufacturers were unable to compete, a flow of government subsidies was maintained just to keep the industry alive (Nieuwenhuis and Wells, 2015). Unlike the mining sector, which is focussed mainly on global opportunities, the vehicle manufacturing sector focussed only on the local market because it could not compete with well-resourced international manufacturers. Operations in Australia were relatively expensive due to a small domestic market, with a preference for large vehicles not in demand globally, limiting the potential for economies of scale and exports, exacerbated by the relatively high value of the Australian dollar (Beer, 2018).

Lessons from the Australian motor vehicle manufacturing sector indicate that attempts to defend or promote an industry that faces long-term declines in demand, whatever the reason, will have severe consequences. Research conducted on the outcomes for employment from the closure of car factories was that, three years after closure, one-third of workers had left the workforce, one-third found full-time work and one-third were either unemployed or underemployed (Beer, 2018; Beer and Thomas, 2007). Thus, the insensitivity of both manufacturers and policy makers to clear global trends in motor vehicle manufacturing in both Victoria and South Australia resulted in a structural adjustment after 2008 and the loss of 28 737 jobs in just over a decade (ABS, 2019d). There was little in the way

of an industry transition strategy prior to the exit of the automotive industry. Some government assistance was provided to assist workers to retrain (Australian Department of Employment, 2017), and investment funds were made available periodically as structural adjustment programs after closures were announced (Rafi, 2017). Examination of the efficacy of the South Australian Innovation and Investment Funds found that there is statistical evidence that there were employment and turnover benefits but only weak evidence for capital benefits (Rafi, 2017). This was because investment funds were not structured within a coherent industrial policy or regional development strategy to attract new industry for workers (with their new skills) to transition to. This reflects the predisposition by Australian policy-makers to eschew regional development in favour of tactical structural adjustment programs to respond, after the fact, to industry shocks (Beer, 2015). The Productivity Commission has noted that structural adjustment programmes are often a mechanism to 'buy off' opposition to policy change (Productivity Commission, 2001). Consequently, in many cases, retrained workers exited the region as opportunities failed to materialise and the regional economy declined (Beer, 2015).

Prior to electricity restructure in the 1990s, electricity utilities in Australia had often been used as tools of economic development by state governments, to provide employment in regional areas (Booth, 2003). Following trends in the United Kingdom, New Zealand and the United States of America (USA) to deregulate publicly-owned, vertically-integrated electricity utilities, and shift electricity supply to corporations or private companies run on commercial principles (Molyneaux and Head, 2019); New South Wales, Queensland, South Australia and Victoria deregulated and corporatised electricity supply in the 1990s and early 2000s (Weller, 2018). The focus on efficiency and productivity crowded out debate about the social and political consequences for the 26 700 persons who lost work in electricity supply between 1990 and 1998 (Sharma, 2003). Economies and employment in regional areas like the Latrobe Valley were particularly devastated. Lukewarm attempts to attract investment for new business ventures failed and the region remained heavily dependent on coal generators for employment. Proposed funding to enable an orderly transition away from coal generation was scuttled when the Victorian Labor government lost power (Weller *et al*., 2011, Weller, 2017). Even the structural adjustment component of Australia's climate change policy in 2011 did not help much because it resulted in redistributive funding being allocated mainly to areas that were not affected by coal plant closure (Weller, 2019).

The Latrobe Valley case, like that now faced by regional Queensland, was affected by decisions made outside Australia. Engie, a French multinational electric utility company and the owner of Victoria's second largest and Australia's oldest coal-fired power station, shut down Hazelwood with only 5 months' notice in 2017.

> "*The closure of Hazelwood is in line with ENGIE's strategy to gradually end its coal activities. This is laid out in the Group's transformation plan that aims at concentrating solely on low-carbon projects for power generation, renewable energy and natural gas*". (Engie, 2016).

Engie's stated intention to end coal activities was made after the Paris Agreement to limit carbon dioxide emissions and was the first meaningful indicator for Australia of the consequences of global investment trends associated with domestic economic activities reliant on coal. However, state and federal governments were largely unprepared for the closure when it occurred with severe consequences for workers.

Australia has a large fleet of coal-fired power stations and is a signatory to the UNFCCC's carbon dioxide emission reduction agreements, so policy-makers should be prepared for coal plant shutdown—and yet there was little industrial strategy to counteract the consequences of closure of Hazelwood. The job loss associated with coal plant closure has not been limited to the Latrobe Valley. Research finds that after multiple coal plant closures in Australia between 2012 and 2017, the local communities where the plants were located experienced persistently higher unemployment than the rest of the state after the closures (Burke *et al*., 2019). Other research in Australia points to outmigration as employment declines after the construction phase for coal seam gas extraction (Measham *et al*., 2016). The levels of unemployment are possibly even understated in these studies, since in locations like Collinsville in Queensland, which saw the closure of its coal-power station in 2012, there is now a much lower population in all age-groups between 15 and 60 (ABS, 2019a).

Overall, the tendency for policy-makers to frame problems and policies in a political ideological context (Weller, 2019) has led to tactical structural adjustment programs that have not proactively sought to attract large new industries nor resulted in new employment opportunities for affected workers. Thus, communities have been damaged when plants were closed, through reduced incomes, and a greater reliance on employment in lower paid industries (Beer, 2015).

4. GLOBAL EXPERIENCE WHEN DEMAND FOR COAL DECLINES

Lessons Highlighted by the World Bank

World Bank research on the experiences of countries in Asia, Europe, and the USA shows that

> "*job losses in the coal industry are indeed inevitable as the industry contracts. Those that bear most of the burden are coal miners, their families, and communities, particularly the mono-industry communities*". (Stanley *et al*., 2018, P9).

The World Bank finds that large scale coal worker job losses have been driven by mine mechanisation, government policies and competition from other fuels. It recommends transition strategies which pursue: (i) meaningful consultation with stakeholders with respect to requirement for, scale of, and time of, closures; (ii) rigorous planning from the start informed by discussion and monitoring during the stages of closure; (iii) temporary income support for workers and their families that complement existing social protection programs; and (iv) deployment of pro-active labour market policies to encourage and enable re-employment (Stanley *et al*., 2018)

> "*Given the energy transition, planning and preparing for coal mine closure are essential to lessen the shock to coal-dependent communities and facilitate new employment possibilities for redundant workers. A sustained commitment will be required from several stakeholders—governments, international financial institutions, the private sector, and civil society—to ensure this is achieved*". (Stanley *et al*., 2018, p10).

The EU is Focussing on Industrial Policy for Regional Development as Coal Demand Declines

There is some evidence that high fiscal deficits and adverse current account balances together with a small manufacturing base led countries in southern Europe into sustained economic decline after the GFC (Aiginger, 2014). By comparison, Ireland, with a large manufacturing base, bounced back from the GFC remarkably quickly (Aiginger, 2014). In particular. Irish manufacturing of pharmaceutical products has enjoyed significant success since the GFC, increasing employment by 11 000 since 2008

(RICSO, 2020b) leading to a growth in manufacturing contribution to GDP from Euro 11 billion in Q1 2008 (24% of GDP) to Euro 32 billion in Q1 2020 (36% of GDP) (RICSO, 2020a). Thus, manufacturing is under consideration for its ability to promote economic development with place-sensitive policies considered necessary to maximise the development potential of regions (Iammarino *et al*., 2017). The EU is pursuing tactical gestures to foster growth from sectors, industries and clusters as 'industrial strategy' for regions by addressing systemic and market failures through engaging in strategic co-ordination (Kitson, 2019). Policy frameworks utilise the state—through its agencies—to facilitate network connections between firms, research agencies and innovators to develop sector ecosystems which strengthen the manufacturing base (Bailey *et al*., 2019).

This new industrial policy seeks to develop new technologies at the same time as supporting society's long term goals (Aiginger, 2014) as portrayed in the European Green Deal (European Commission, 2019) which seeks to pursue innovation whilst ensuring sustainable development and a 'Just Transition' for coal miners.

The US Has Also Been Conducting Place Based Industrial Policy

The US has been practising place-based industrial policy for decades to support coal in Appalachia, oil in Texas and Louisiana, agriculture and ethanol in the Midwest, and defence in the South and West (Bailey *et al*., 2019). Enterprise Zones have been established to relax regulation and encourage economic development in rural locations (Hooton and Tyler, 2019). Federal intervention in the form of the National Network of Manufacturing Institutes (NNMI) seeks to connect new technology to the manufacturing sector, underscoring the need for place-based opportunities to foster regional economic development (Clark and Doussard, 2019).

Ongoing support for coal mining in Appalachia as demand for coal generation has declined has had consequences for Kentucky and West Virginia. Associated job loss between 2007 and 2017 was 10 484 for Kentucky and 6 000 for West Virginia. Kentucky, with a larger manufacturing sector which employs 13 per cent of the workforce, has grown employment and GDP since 2007 but West Virginia, with a manufacturing sector which employs only 6 per cent of the workforce, has declining employment and low GDP growth (Bureau of Economic Analysis, 2019; Bureau of Labor Statistics, 2019). These outcomes provide further evidence of the stabilising nature of manufacturing on economic performance in line with the findings of Aiginger (2014).

5. HOW MIGHT QUEENSLAND PREPARE FOR A FUTURE WITHOUT COAL EXPORTS?

As discussed in section 4, Europe and the USA are actively pursuing industrial policy for economic development in their regions. Asia too has successfully pursued industrial policy for economic development that has seen China, India, Japan and Taiwan develop successful manufacturing sectors. Aiginger (2014) has found that a strong manufacturing sector is an indicator of economic resilience, so Queensland policy-makers should look to developing manufacturing capacity in regional Queensland to build resilience to an uncertain future for coal exports. In doing so, careful consideration should be given to global trends and local strengths.

Global Investment Trends

Current investment decisions point to a global transition away from coal to renewable energy—$304 billion in renewable energy against $127 billion in coal and gas power generation combined (IEA, 2019d). There is also a forecast transition away from internal combustion engine vehicles (ICEV) to electric vehicles (EV), with estimates varying but the IEA predicts 23-43 million annual sales of EVs by 2030 (IEA, 2019b) as the price of EV's reaches parity with ICEVs (Graham *et al*., 2019). Sales of EVs at scale serve broader objectives of reducing carbon emissions from oil consumption by ICEVs (IEA, 2019b) but also bring down the cost of li-ion batteries (BloombergNEF, 2019), the major cost component of EVs. Significant investment in EV's and li-ion technology from 2009 by the USA and China (Rodrik, 2014; Masiero *et al*., 2016) and more recently in li-ion battery manufacturing by South Korean and Chinese manufacturers seeking a foothold in both the US and European EV markets (Yonhap News Agency, 2020; Rathi, 2019; Reiserer, 2019; Heon-chul and Kim, 2020) provide evidence of the global opportunity. The positive spill-over from a transition to EVs for a transition to electricity supplied predominantly from variable renewable energy (VRE), is the very steep decline in the cost of batteries to stabilise energy supply from variable and intermittent renewable sources.

So, there is global investment in VRE because it is cheaper than coal generation when the sun shines and the wind blows. Add to that a global transition to EVs and deployment of batteries to meet the new global trends, and energy storage becomes the facilitator to investment in schedulable renewable energy (SRE) and the wholescale replacement of coal for electricity. Willingness to invest in energy storage by China, South

Korea, Europe and the USA is evidence of this very large global opportunity.

Queensland Strengths

Queenslanders should not accept that the spoils of this global transition only fall to Europe, the USA and Asia because Queensland has become reliant primarily on resource extraction and industrial policy inaction. First, with some of the best solar resources in the world, and low-cost land available for the deployment of photovoltaic panels, the cost of energy as an input to manufacturing, including the future production of hydrogen for domestic use and export, will be cheaper than most other locations (Garnaut, 2019). Second, having developed the infrastructure to transport commodities from inland to regional centres and port infrastructure for seaborne transport of goods, Queensland is well-positioned to supply new product to Asian and European markets. Third, Queensland has large deposits of bauxite and copper, which if manufactured using cheap renewable energy, would give competitive advantage to primary metals manufacturing (Garnaut, 2019). This is pertinent as nations seek to reduce greenhouse gas emissions—product manufactured in Queensland using renewable energy will have a lower carbon footprint than transition products (i.e., solar panels, wind turbines, energy storage and EVs) manufactured in China, India or Europe. Fourth, Queensland has deposits of cobalt, nickel, vanadium (QDNRME, 2020) and West Australia has deposits of lithium (Geoscience Australia, 2020) which can be processed and consumed locally for energy storage manufacturing. Fifth, although Australian labour is more expensive than labour in Asia, automation in manufacturing significantly reduces the contribution of labour cost to manufacturing product cost (Venkatasamy, 2019). Sixth, Queensland is a state in a stable developed country with access to low-cost capital. All of the above support the principle proposed by Garnaut (2019), that industrial policy which supports manufacturing of primary metals and all forms of energy storage to meet the demand that will result from a global transition to electric vehicles and electricity generated from renewable energy in Regional Queensland, will deliver economic development and regional employment to build resilience to unpredictable Asian demand for coal.

Good Industrial Policy Design

Industrial policy which helps develop 'infant industries' like energy storage and renewable hydrogen to respond to the emerging global opportunity for electric vehicles and renewable energy is required because there is already strong support within other nations for this emerging opportunity. As Barack Obama said in 2011,

> "*if we want to compete with China, which is pouring hundreds of billions of dollars into this space, if we want to compete with other countries that are heavily subsidising the industries of the future, we've got to make sure that our guys here in the United States of America at least have a shot.*" (cited in Rodrik, 2014, p. 481).

It should be noted that this comment was made after the Obama Administration was accused of wasting tax payer money by attempting to 'pick winners' through a $535 million Department of Energy (DOE) loan guarantee to Solyndra, a solar cell manufacturer, which filed for bankruptcy a year after receiving support as part of the American Reinvestment and Recovery Act of 2009 (Public Law 111-5, 2009). Under the same program, Tesla received a $465 million DOE loan guarantee in 2009 as it haemorrhaged money and was laying off staff. In contrast, by 2013 the Obama Administration was accused of losing taxpayer money by not taking equity in Tesla (Woolley, 2013) because the electric car manufacturer had turned its fortunes around. As Rodrik (2014) argues, the cases of Solyndra and Tesla indicate that failure is always part of a successful industrial policy. What is important in policy design is the limitation of risk of failure: by understanding the wider societal benefits; by reducing potential for investors to seek advantage through political power and information asymmetry; and by understanding the existence and potential for spill-overs and market failures (Rodrik, 2014).

Some have claimed that Australia is not particularly adept at sustaining a manufacturing sector (Murphy, 2017; Gittins, 2018). However, this view related to a past that is very different to the future that is now faced. In the words of Andrew Dzurak, Professor in Nanoelectronics at the University of New South Wales,

> "*Australia is perfectly positioned to use our high levels of knowledge and scientific capabilities to drive new manufacturing in Australia—high value added manufacturing. We're very well positioned, and it just takes the will and the self-belief to make it happen.*" (Dzurak, 2020).

Policy-makers should not avoid industrial policy because of ideological accusations of attempting to pick winners, but design industrial policy to be transparent, well-informed and non-ideological. Government support can take many forms: facilitating partnerships with European vehicle and South Korean li-ion battery manufacturers for manufacturing in Queensland; attractive investment and tax frameworks; support for research and innovation networks and institutions to link research to technological superiority; and the provision of infrastructure to facilitate efficient delivery to global locations. A good starting position for policy ideas for Queensland regional development can be found at the Australia New Zealand Regional Science Association International (ANZRSAI, 2020).

6. CONCLUSION

As found by the World Bank, job loss in coal mining is inevitable as a result of automation in mines, competition with alternative fuel sources and national aspirations of climate mitigation (Stanley *et al*., 2018). If the global energy transition imperatives do not alter global coal demand, low-cost coal producers, like Russia and Mongolia, are in process to seek to control price sensitive markets like India and China. A further risk to coal mining employment is the stated intentions by mining companies to move to autonomous vehicles, as discussed in Section 2. Disruption will be forced on Central Queensland's coal mines and employment.

Queensland's existing manufacturing industry is small and comprised mainly of agricultural product and primary metal manufacturing. It needs to be diversified and expanded to benefit from the global opportunity unfolding. Queensland's adoption of a National Hydrogen Strategy (Finkel, 2019) is a first step in this direction. The development of a Queensland energy storage manufacturing strategy should be the next step.

Queensland policy-makers should heed the lessons of past job loss in Australia as a result of global transitions. Defending jobs in a declining industry ultimately damages the very people who hold the jobs. Ex-car workers understand this well. As observed in rapidly developing Asian

countries such as South Korea, the explicit support of manufacturing 'infant industries' can yield significant benefits provided that they are nurtured where appropriate natural and human resources are plentiful. The people of Central Queensland need their governments to implement a well-funded program of industrial transition that involves careful attention to the welfare and prospects of workers affected, following the recommendations of the World Bank and the goals of the European Green Deal. Only then, will there be widespread acceptance of change in the regions affected.

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