



Fostering
international
raw materials
cooperation



Australia

Contextual analysis of the reference countries

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Abstract

The principal objectives of the INTRAW project (<http://intraw.eu>) are the mapping of best practices and boosting of cooperation opportunities related to raw materials between the EU and 5 technologically advanced non-EU countries (Australia, Canada, Japan, South Africa and the United States). Each of these five "Reference Countries" is subject to similar global challenges. This report presents the contextual analysis of Australia in order to explain the country's historical economic development during the 20th and 21st century in general, and in relation to development of primary raw materials in particular. Three reports focussing specifically on: raw materials research and innovation; education and outreach; and industry and trade in the Reference Countries will be the next outputs from the project to be published. These will underpin the development of a better understanding of the achievements made in these 5 countries in relation to raw materials research & innovation, educational and skills programmes, trade, exploration, exploitation, processing, recycling and substitution.

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1. Introduction

1.1 General

One objective of INTRAW is to characterise the contextual environment of the 5 Reference Countries for the project (Australia, Canada, Japan, South Africa and the United States) in relation to raw materials research & innovation, educational and skills programmes, trade, exploration, exploitation, processing, recycling and substitution. This, together with the mapping of corresponding policies and practices for each of these domains, will facilitate the comparative evaluation and cross impact analysis of the raw materials domains between the Reference countries and the EU.

1.2 Introduction to Contextual Analysis (WP1, Task 1.1)

The objective of Task 1.1 of the INTRAW project is to map the contextual environment of the reference countries (Australia, Canada, Japan, South Africa and the United States of America) against the contextual environment in the EU, leading to a better understanding of the achievements made in these countries in relation to *raw materials research & innovation, educational and skills programmes, trade, exploration, exploitation, processing, recycling and substitution*. This WP will also map the corresponding policies and practices of each of these domains. The data will be centrally processed, which will facilitate the comparative evaluation and cross impact analysis of the raw materials domains in each of the Reference countries and the EU.

1.3 Scope of this report

This report is the **Country Report for Australia, prepared as part of Task 1.1: "Contextual analysis of the Reference Countries"**. It is part of the deliverable for Work Package 1 of the INTRAW project (D1.2). This report on the contextual analysis for Australia is presented in 4 main sections after this introduction:

- **Chapter 2:** An Executive Summary

- **Chapter 3:** A historical overview on raw materials
- **Chapters 4 to 8:** Analysis of the contextual environment, covering 49 explanatory factors, grouped into five main categories:
 - Geo & Environmental (6 factors – Chapter 4);
 - Socio-Cultural (11 factors – Chapter 5);
 - Economic (14 factors – Chapter 6);
 - Political and Legal (14 factors – Chapter 7); and
 - Technological (4 factors – Chapter 8).
- **Chapter 9:** Conclusions.

The description of the analysis of the contextual environment in each of the main sections, Chapters 4 to 8, first describes general economic growth and change drivers associated with each of the explanatory factors, and then draws out findings that are specific to the non-energy raw materials sector. The conclusions section follows a similar pattern, with a general overview followed by conclusions specific to raw materials, arranged under the headings "*Industry and trade*", "*Education and outreach*", and "*Research and innovation*" thus integrating three sides of the 'knowledge triangle': higher education, research and business, that are reflected in the themes of the sector specific reports being prepared as deliverables from WPs 1.2¹, 1.3² and 1.4³.

The report is supported by three appendices:

- **Appendix A1:**
Presentation of the method employed to construct a multi-factor matrix and associated radar charts. The multi-factor matrix and radar charts were the tools used to carry out initial organisation and analysis of the information collected and to inform discussions within the work package team and with

1 Transactional analysis on Research and Innovation

2 Transactional analysis on Education and Outreach

3 Transactional analysis on Industry and Trade

members of the expert panel. They are considered as *work-in-progress input* and are included here for completeness.

- **Appendix A2:**

Presentation of summary findings via the “multi-factor matrix” and five- and 12- axis “radar charts”, and preliminary discussion of the

comparative importance of the explanatory factors based on the analysis.

- **Appendix A3:**

Presents the references quoted in this document.

2. Executive summary

In over 200 years of economic development Australia, founded as a small open settler economy, has become the world's 20th largest economy. It offers a high living standard for its population as indicated by it ranking second in the world in the Human Development Index (2013) after Norway. Australia has developed a service economy largely influenced and based on the export of commodities (mostly of non-renewable mineral resources), high real wages, and a well-educated and skilled labour force within a politically stable and mature representative democracy.

During its history, Australia's economic development can be explained by the shifting interactions between resource abundance and institutional arrangements, and between international economic conditions and policy responses to them (e.g. changing trade and immigration policies). Economic and technological factors were particularly important in this development; through shifting economic and trade policies (e.g. protectionism vs an open economy) Australia has explored, discovered and made efficient use of its mineral resources. This has provided long periods of sustained economic growth (GDP growth). The first "golden age" took place during the decades of 1850-1880 marked by the discovery of alluvial gold in the Victorian fields, massive immigration and continued economic and population growth. The second "golden age" (1945-1973) was also fuelled by a mining boom based on a more diversified portfolio of commodities, tied to Japan's rapid industrialisation and capitalising on previous discoveries of deposits of iron ore and coal. The third "golden age" (1991-present) is also marked by a sustained period of economic growth based on exports of commodities, very favourable terms of trade and a service economy with low unemployment and inflation.

Besides its economic output, foreign investment (mainly by capital from the

United States, United Kingdom, Japan, and more recently China) has played a key role in the development of the country (e.g. in the mining sector). Access to affordable oil and mining of domestic coal has been a key component of the energy matrix in Australia. Also important has been the development of reliable infrastructure for passengers and freight, with some of the world's largest bulk commodities ports (e.g. Port Hedland, world's largest bulk export port and Newcastle, the world's largest coal export port) being in Australia. Quality infrastructure and a generally well-educated workforce (similar or above OECD average levels) have also been essential in achieving productivity growth (e.g. in the 1970s and 1990s); another key factor explaining the sustained economic growth. The country has remained attractive for business by maintaining a stable and investor-friendly legal environment, and a relatively high spending power of households due to high wages. With regard to technological factors, although Australia is not placed among the leading innovation countries, it is placed in the top twenty, has a good scientific infrastructure and has achieved relatively good performances in R&D in some sectors notably in the mining sector (e.g. Australia pioneered flotation and heap leaching techniques for low grade gold ores, and is now pioneering automation in the Pilbara region).

Australia has evidenced flexibility and adaptability of its institutions and policies to changing international market conditions. With regard to the mining industry, this adaptation has been enabled by the country's rich and diverse **mineral endowment** (identified as mineral reserves and resources via prospecting and exploration investments) and by a dynamic and stable **political-institutional environment and flexible trade policies**. Especially after World War II and with the invention of bulk carrier vessels, Australia entered into the mining industry diversifying its portfolio of commodities alongside Japan

and other Asia Pacific countries as the new largest trade partners. Such vessels allowed lowering marine transportation costs of low-value bulky mineral and energy products, overcoming the problem of distance. The partnership with Japan has remained successful since the signature in 1957 of the Commerce Agreement, and more recently it has been boosted with the Japan-Australia Economic Partnership Agreement (JAEPA) entering into force in January 2015. Up until today Japan remains Australia's second largest trade partner (China has been first since 2012). Australia's willingness to adopt new institutional arrangements has been important in overcoming resource scarcity: for instance, in the case of water inequalities via the creation of efficient water management markets, the adoption of shifting immigration policies (White Australia policy vs a non-discriminatory policy after the 1950s) to address labour shortages, and through the promotion of foreign investments to address capital scarcity. Additionally the easing of restrictions for foreign banks to enter the domestic retail banking sector during the 1980s helped advanced the deregulation of the financial sector.

Australia's **mineral endowment** is identified through prospecting and exploration activities, which allow classification of mineral occurrences into discovered deposits and areas of mineral potential. Government-funded geoscience is a policy response aimed to promote:

- **Availability of public geoscience data** - the Australian (Commonwealth), State and Territory governments undertake various geoscience programmes to support mineral and petroleum exploration in Australia. These programmes acquire and make available pre-competitive geoscience information and datasets, particularly covering important areas, as a basis for exploration in both proven and greenfield mineral provinces. The geoscience archive includes regional surveys (airborne geophysical surveys, ground gravity, geochemical surveys), geological mapping, mineral occurrence mapping, core

photography and hyperspectral core scanning, geochronology, and rock property data. It is considered that collection and low-cost dissemination of geoscientific data by government agencies is critical for exploration success. It encourages exploration in high risk frontier regions, reduces risk and uncertainty across the exploration industry, and encourages participation of a larger number of small investors whilst also preventing exploration activities falling to ineffectively low levels, among other benefits;

- **Co-funding** - as part of the Exploration Incentive Scheme in Western Australia, a co-funded drilling programme is available for competitive companies.

The political-institutional environment fostering a successful mining industry has been enabled by and has in turn fostered the development of (in no order of priority):

- **Political and institutional stability** - the granting of security of tenure and a transparent taxation framework has been instrumental in attracting mining investments;
- **Access to land, energy and water** - access to land for exploration and development has been enabled by the ownership rights scheme (mineral rights are held by the state, making ownership and access negotiations easier). By engaging in negotiations with Indigenous Australians to secure land access agreements sufficient energy and water infrastructure is now widely available;
- **Innovation & Technology Development** - an important driver of productivity and efficiency increase and cost control. Australia has pioneered numerous technological innovations in history like flotation or heap leaching of low ore grades which have been become mainstream practice around the world. Currently, Australia-based companies are pioneering automation systems (e.g. automatic

haulage systems) in the Pilbara region;

- **Access to a well-developed mining equipment, technology and services sector (METS sector)** - The continuous expansion of the mining industry, particularly in the last three decades, has resulted in the development of the METS sector into a strong component of the Australian economy. METS companies are generally well positioned to withstand fluctuations in international markets, having the ability to export goods and services in down cycles of the mining business;
- **Efficient permitting procedures** - fast and low cost permitting has been a key driver of the mining industry; recent best practice examples are given by the Nova or the DeGrussa projects;
- **Granting of social licence** - on the one hand, Australia-based companies have seriously engaged in leading best available practices and mitigating the social and environmental impacts of the mining industry. On the other hand, Australia has also benefited from the location of most major mining centres in remote areas, away from major population centres and areas of intensive agriculture. This has been influential in reducing community objections to mining and instrumental for the granting of the social licence to operate;
- **Government support for the mining industry** - Australia's federal and state governments have consistently supported the mining industry by financing public geoscience data, financing infrastructure and public education, by partnering with the industry to develop technology and foster R&D and, by ensuring a competitive tax framework;
- **Access to a skilled workforce** - the lack of skilled workforce in the country has been traditionally resolved via employment-based immigration, and local shortages have been overcome using fly-in fly-out or drive-in drive-out schemes;
- **Access to transport infrastructure** - Australia's large size and the associated geographical challenges have not been a deterrent for mining companies. Many mineral deposits in Australia have been discovered and developed in isolated areas but companies have simply built the required infrastructure themselves (transport, energy, workforce).

All in all, Australian history depicts a clear account of an economy and an institutional context showing adaptability to international conditions and shifting its bases of prosperity through time by changing its economic and trade policies.

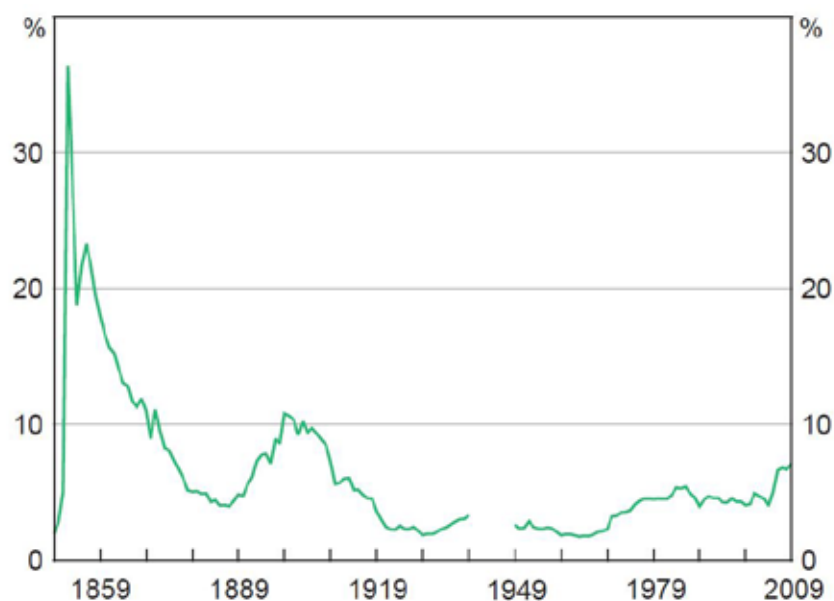
3. Historical overview on raw materials

Throughout its history Australia's economy has traditionally been specialised in the production, domestic use and export of raw materials (wool, fisheries, forests, energy and non-energy minerals). The importance of the raw materials sector in the Australian economy has shifted along the decades. During the first half of the 19th century, after British settlement and displacement of Indigenous Australians from good grazing and arable lands. For example, west of the Blue Mountains of New South Wales, the economies of the colonies were mainly driven by agriculture and pastoral activities with the wool export sector closely related to the demands of the British economy. Despite the long internal distances between the nearest ports in Australia and the large geographical distance between Australia and Great Britain, the wool export industry flourished due to the high value-to-bulk ratio and non-perishability of wool (McLean, 2003). The second half of the 19th century was driven by a surge in gold discoveries in Victoria around 1851 which is known as the first mining boom in Australian history. This boom triggered a gold rush and a process of economic growth,

a wave of mass immigration mainly led by Chinese workers (diggers), and multiculturalism. During the decade 1851-1861 the Victorian goldfields produced some 40% of the world's gold output and by 1861 gold was the source of 16% of Australia's Gross Domestic Product (GDP) (Power, 2002:17). The value-added to GDP at this time considerably exceeded that in all subsequent booms; the highest in all of Australia's history (**Figure 1**).

The gold rush lasted for about a decade and by the mid-1860s it had largely faded. The second mineral boom was also about gold and occurred in the late 19th century. This second boom was caused by the discovery and development of new gold and metal mines across the country, particularly in Western Australia, Queensland and New South Wales around 1890. The boom was possible thanks to the availability of capital in London to fund exploration activities (Battellino, 2010). The boom generated strong labour flows within the country to new mine sites (Mt. Morgan, Broken Hill, Kalgoorlie, Iron Knob and Iron Baron, etc.). At its peak the second gold boom contributed around 10% of GDP.

Figure 1: Australia, mining value-added (percent of nominal GDP, annual).

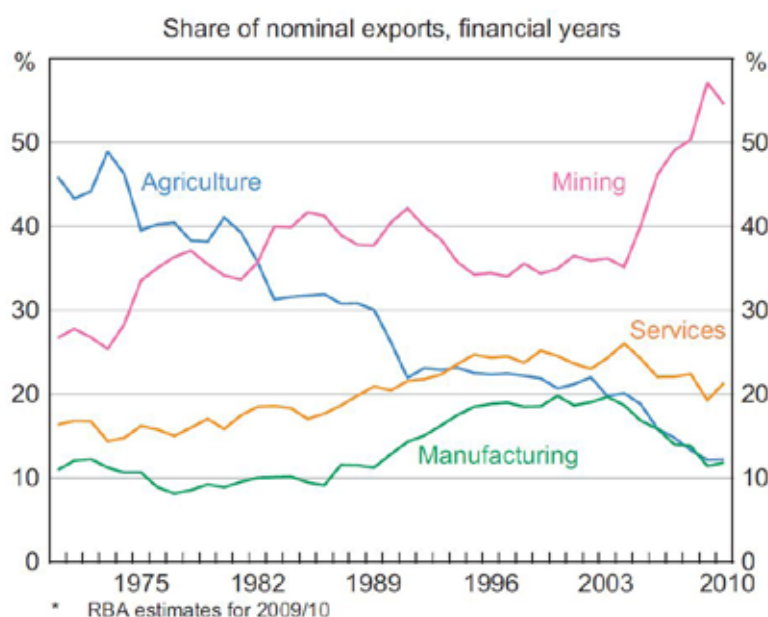


Source: Battellino (2010)

During the first half of the 20th century Australia's economy was marked by an inward-orientation, with a declining trade-to-GDP ratio and a surge of the manufacturing sectors protected by tariffs. During those years mining activity began to decline despite a continued rise in the value of mineral production. Mineral discoveries were low during the early decades of the 20th century and by 1930 gold was the source of less than 1% of GDP. The only major finds of the first half of the century were lead, zinc and copper deposits at Mt Isa but their full potential was not realised until the 1960s and early 1970s. The decades after World War II (WWII) saw the Australian economy commence a reorientation in its development strategy towards outside markets driven by a diversification of exports. During the 1960s the third Australian mining boom occurred amidst a very

positive international market driven by growing industrialised economies, especially Japan. Japan's post-war economic development was assisted by the Australian mining sector due to its close geographical proximity, the creation of bulk transport vessels lowering transportation costs and the Commerce Agreement signed between both countries in 1957. This agreement between Japan and Australia's established a long-term major trading partnership. The main drivers of the boom were coal and iron ore exports enabled by discoveries in the Pilbara region in Western Australia and by other metals such as bauxite, nickel, tungsten, uranium. The second half of the 20th century witnessed the continued growth of the services industry and the abrupt fall in the relative importance of agriculture (**Figure 2**).

Figure 2: Australian exports by industry (1970-2010)



Source: Connolly and Lewis (2010)

The boom of the 1960s came to an end at the beginning of the 1970s due to domestic and international changing conditions and policies. Then, in the late 1970s the fourth mining boom was led by the demands of the energy sector, in particular for thermal coal, oil and natural gas. On the supply side, larger, more efficient shipping lowered the costs of the transport of minerals, and new technology lowered mining extraction costs. The mining boom

led to rising inflation and the implementation of monetary and fiscal policies of little success. The fourth boom ended in 1981 due to the downturn in the global economy, high wages growth, inflation and tight policies leading to a recession of the economy by 1982-1983 (Battellino, 2010). During those decades the agricultural sector had been losing importance in relative terms against mineral resources and services. Following the recession of

1990-1991, the Australian economy experienced in another sustained period of growth and prosperity, in large part driven by the fifth mining boom taking place from 2005 onwards. This boom was characterised by a higher contribution of mining to GDP (5% in 2002-2003, 9.8% in 2008, 8.4% in 2009-2010 and around 8.9%

in 2013-2014) (ABS, 2014a), and the continued high cost of living partly brought on by the mining boom. In contrast, the agriculture sector accounted for around 3% of the GDP by 2002-2003 and has now declined to around 2.4% (Department of Agriculture, 2012).

4. Geo and environmental factors

4.1 Geographical situation

Australia's territory (land area) comprises almost 7.7 million square kilometres and includes the mainland continent, Tasmania and about 12,000 islands. This makes Australia the sixth largest country in the world. It is located in the southern hemisphere between the Indian and the South Pacific Ocean. Throughout its history, the geographic location of Australia in relation to the world economic centres has impacted both positively and negatively. Geographic isolation restricted the range of potential exports to non-perishable products with unusually high value-to-weight ratios. Conversely, Asian industrialisation, together with the invention of bulk-carrier shipping (intercontinental maritime transport, lowering of transportation costs tied to abundant oil during the 1950s), stimulated the production and need for a new range of export commodities (McLean, 2013). Australia has overcome its relative isolation problem by specialising in export products that overcame high transport costs, including wool and gold initially, to wheat, frozen meat, dairy products from the late 19th century, and a wide portfolio of minerals and energy products in the last 50 years (McLean, 2013). Its geo-political situation has been of high importance as it has enabled it to be closely linked to the growing Asia Pacific market demand throughout the second half of the 20th century and until the present day.

4.2 Natural & Mineral resources

During its history Australia's socio-economic development process has to a large extent been influenced and enabled by its natural and mineral resources wealth. The first six Australian colonies took advantage of the ample grazing lands available to develop an export-oriented wool industry, followed by successive mineral booms. Australia also developed a highly productive agricultural sector¹,

initially developed to serve the domestic market to now becoming more export-oriented, with a shift in emphasis from Europe to Asia in the last 20 years. A trend expected to continue with China and ASEAN countries (Department of Agriculture, 2012). Australia has the world's third largest exclusive economic zone and has strongly developed the fisheries sector. However despite the fish availability, over the past decade Australia has become a net importer of fish products in value terms (Department of Agriculture, 2012). The forestry sector contributes over (Australian dollars) \$ 22 billion of annual economic turnover and employs over 66,000 people.

Minerals have been a key sector during Australia's "golden age" periods (before the 1890s, 1945-1973 and 1991-present) (McLean, 2013) but also outside of these periods. Due to investments in exploration and a succession of major resource discovery over several decades, Australia is nowadays the world's leading producer of bauxite, iron ore, lithium, and zirconium; the second largest producer of alumina, gold, lead, and zinc; the third largest producer of manganese and uranium (mainly from three mines: Olympic Dam, Ranger Uranium Mine and Beverley Uranium Mine). Australia is the world's largest exporter of coal and it has the largest reserves of uranium, iron, lead, gold, nickel, rutile, zirconium and zinc (**Table 1**). Mineral exports contribute to around 35% of Australia's exports and Australia's mineral demand is now synchronised to the business cycles of China, India and Japan (Liew, 2012). For example, energy and minerals constitute two thirds of Australia's total exports to China, and more than half of Australia's iron ore exports are to China.

¹ Australian agricultural sector has traditionally been highly productive, with an average annual productivity growth of 1.2% during the past 33 years (broadacre

farmers reduced use of inputs annually by around 0.8% and increased output by 0.5%) (Department of Agriculture, 2012)

Table 1: Australia's world rank commodity mine production and reserves (2013).

Commodity	Production (2013)	Reserves (2013)	Observation
Alumina	2	-	China is the world's largest producer
Aluminium	6	-	Producers over Australia are China, Russia, Canada, USA, United Arab Emirates
Bauxite	1	2	2 nd largest reserves after Guinea
Brown coal (lignite)	7	2	Production larger in Germany, China, Russia, USA, Poland and Indonesia
Copper	5	2	Production larger in Chile, China, USA and Peru; copper reserves bigger only in Chile
Diamonds industrial	5	1	-
Gold	2	1	Gold mine production only larger in China
Hard coal	5	5	Production larger in China, USA, India and Indonesia and reserves larger in USA, China, India and Russia
Iron Ore	1	1	-
Lead	2	1	Lead production only larger in China
Lithium	1	3	Reserves larger in Chile and China
Manganese	3	3	Production larger in South Africa and China; reserves larger in South Africa and Ukraine
Nickel	4	1	Production larger in Philippines, Indonesia and Russia
Opal	1		Australia produces 95% of global production
Rare earths	5	3	Production larger in China, USA, India and Russia
Silver	4	2	Production larger in Mexico, Peru, and China
Tin	7	4	-
Uranium	3	1	Production is larger in Kazakhstan and Canada. Australia's uranium resources are world's largest (31%)
Vanadium	5	4	Reserves larger in China, Russia and South Africa
Zinc	2	1	Production larger in China
Zirconium	1	1	Australia produces a 57% of the world mine production

Source: commodities selection based on Giurco et al., (2009). Data collection for coal from BGR (2014, 2013), for uranium (Mining Technology, 2014; World Nuclear Association, 2015), for the remaining minerals USGS (2015)

4.3 Water resources

Australia has the lowest average rainfall of any inhabited continent and has an unequal regional distribution of rainfall and water availability. About 65% of runoff occurs in northern Australia and coastal Queensland. Only 6.8% of Australia's runoff is in the Murray-Darling Basin, although the region uses more than 50% of Australia's water, mostly for irrigated agriculture (Department of Agriculture,

2012). These characteristics have led the country to develop water management techniques throughout its history to cope with water scarcity, and more recently, the development of water markets (1980 onwards) to allocate water efficiently (Ceil, 2012) for the different uses of water across the country (irrigated agriculture being the primary user followed by water supply, sewerage and drainage services with 14%, manufacturing with a 5% and mining with a 4% in 2009-2010 (Pink, 2012).

Overall, water trading has delivered benefits valued in the hundreds of millions of dollars a year and has been a major success story in water policy reform (National Water Commission, 2011). The availability of water has had an important influence on the pattern of economic development in Australia. Throughout Australia's history, the link between water availability and agricultural production has been very important (McLean, 2013). Moreover, all of Australia's major cities and most of its towns are located where water can be extracted for human consumption, as well as for productive uses (Roberts et al., 2006). Given the crucial importance of the mining sector for Australia's development and the fact that water is essential during almost all stages of the mining business cycle, water availability and good water management have been key.

4.4 Climate

Australia is the lowest, flattest, and, apart from Antarctica, the driest of all continents. The country features a high variability in climatic zones, from the tropical regions of the north, through the arid expanses of the interior, to the temperate regions of the south. Temperatures in Australia were relatively stable from 1910 to 1950 and since then, both minimum and maximum temperatures have shown an increasing trend (Pink, 2012). Australia experiences many of nature's most extreme events (Pink, 2012). Evidence shows that the number of catastrophic and extreme weather events is getting larger (CEDA, 2014) and that they are likely to be more frequent and more severe than in the past (Mason et al., 2013). Recent events in Queensland, New South Wales and Western Australia have shown the impact of extreme weather on the economy. The 2010-2011 Queensland floods generated a loss of (Australian dollar) \$2.3 billion to the mining industry (coal exports) (Massola, 2011; Smith, 2011). Due to global warming, the chances of overheating in mines and spontaneous combustions have increased. Climate change-related risks are increasingly becoming of concern for the continuity of economic activities in the country; the mining sector is one of the most active in this respect

(Massola, 2011; Smith, 2011). Yet, in hindsight, Australia managed to pursue its long-term economic development process during the 20th century without being severely affected by recurring extreme weather events.

4.5 Geological Factors

The earthquake hazard risk is low in Australia compared to other more seismically active regions of the world. Yet, there is potential for such an event, particularly in Western Australia. Historically, the average annual economic cost of earthquakes in Australia has been low at (Australian dollar) \$144.5 million taken over the period from 1967 to 1999 (Middelmann, 2007). Earthquakes have not become a hindrance for economic development.

4.6 Ecologically sensitive areas

Australia's ecologically sensitive areas (ESAs) are established in each state and territory by the authorities. They normally include conservation reserves (nature reserves, national parks, conservation parks, State forests, timber reserves, also marine reserves and parks) and other areas defined by each state or territory. Currently Australia contains 14 biosphere reserves, one World Heritage site, the Great Barrier Reef and 65 Ramsar¹ wetlands sites covering more than 8.3 million hectares (Department of the Environment, 2013). An example of the ESAs in Western Australia is given in **Figure 3**.

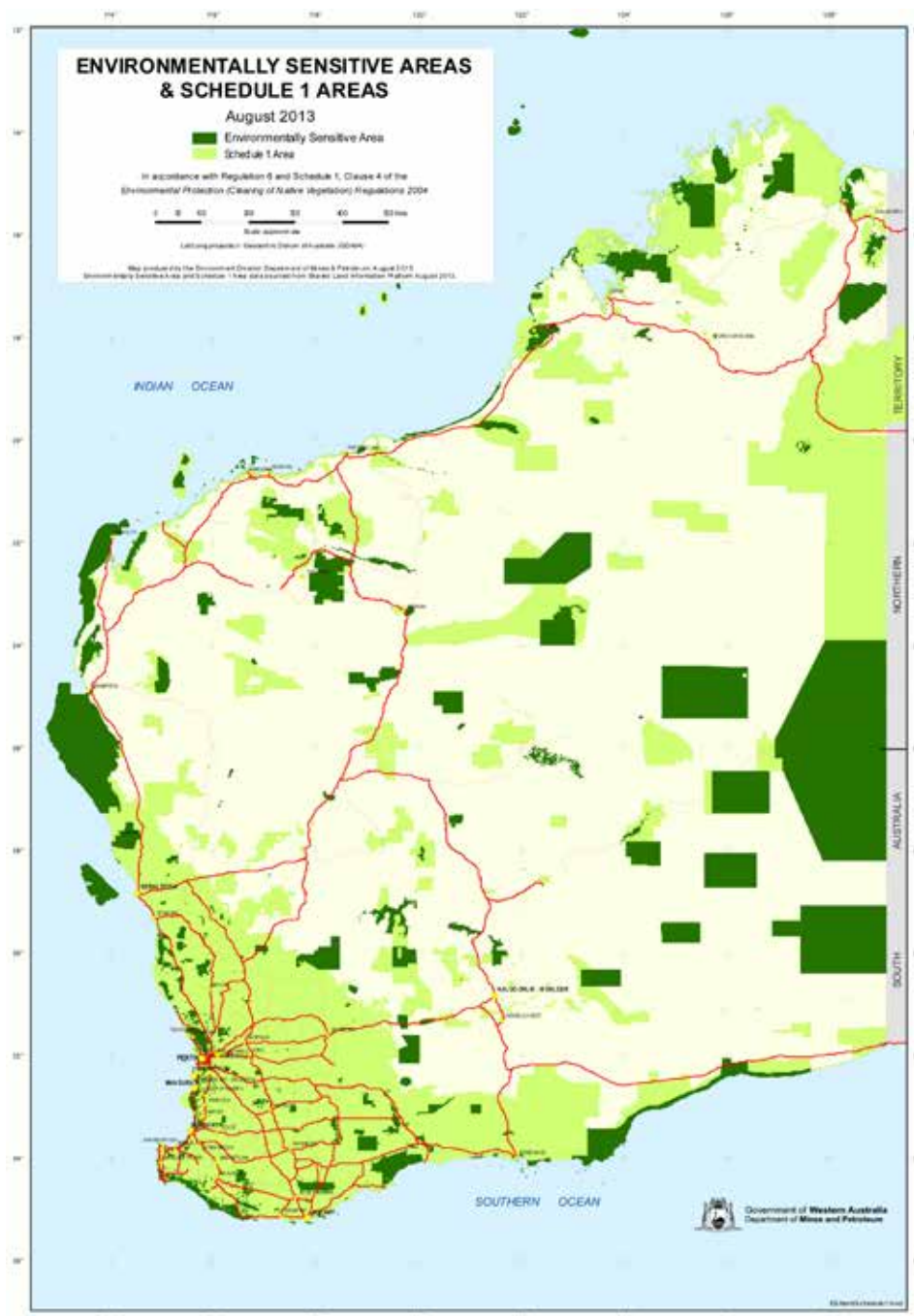
Australia's biodiversity is unique and globally significant. Australia houses many endemic species of plants and animals. It is estimated that between 7% and 10% of all species on earth occur in Australia (Steffen et al., 2009), and it is one of the world's "megadiverse" countries (Mittermeier et al., 1997). The Australian Government administers biodiversity conservation through the Environment Protection and Biodiversity Conservation Act 1999 (Pink, 2012). The words "ecosystem services" have been used increasingly and now appear in most environmental policy

¹ The Ramsar Convention (formally, the Convention on Wetlands of International Importance, especially as Waterfowl Habitat) is an international treaty for the conservation and sustainable utilization of wetlands, recognizing the fundamental ecological functions of wetlands.

documents (Pittock et al., 2012). Aquatic and maritime ecosystems are of great concern in Australia, particularly the biodiversity hotspot of the Great Barrier Reef. All projects which may inflict serious harm to the Reef, including port and navigation infrastructure, are subject to considerable scrutiny (Ward et al., 2015). Likewise, in continental Australia the environmental regulation offices (Commonwealth Department of the Environment and state Environmental Protection Agencies) put

strict controls on endangered species or new species which may be negatively impacted by economic activities. Although actually rare, there exist some records of mining projects stopped due to very negative potential impacts on animals. One such example involves the stoppage of a (Australian dollar) \$ 5 billion investment iron ore mine due to the discovery of troglobites (new species of tiny blind creatures) in 2007 (Sample, 2007).

Figure 3: Western Australia – environmentally sensitive areas (2013).



Source: Western Australia Department of Mines and Petroleum,
<http://www.dmp.wa.gov.au/documents/ESAandSchedule1.pdf>

5. Socio-cultural factors

5.1 Historical Background

During the last 215 years Australia's economic development process has been influenced by, at least, four inflection points very closely linked to the exports of commodities and the international economic conditions outside of Australia. The first watershed in Australia's history was the discovery of gold fields in 1851 and the ensuing gold rush. This event (and the years before) attracted much mass immigration (labour) from overseas and drew Australian workers from their jobs, it opened up "the Outback" and early multiculturalism, and economic and population growth shifted to a slower and sustained rate embedded in an open economic context (Butlin, 2014; Ville and Withers, 2014).

A second inflection point occurred at the beginning of the 20th century, after the 1890s depression, with Australia promoting an inward-oriented economic policy and growth strategy. Key policies were the instituting of the "White Australia Policy" in 1901 restricting non-European immigration, the increase in protectionism by effective rates of assistance to the manufacturing and agricultural sectors, especially after the World War I (WWI), reflected in relative low trade-to-GDP ratios (low in comparison to the 19th century).

A third inflection point took place after the World War II (WWII) when the country resumed an outward-oriented development strategy. Key policies included the gradual removal of the "White Australia Policy" accompanied by promotion of mass immigration (labour) resulting in the proportion of people born overseas again rising quickly, the re-emergence of a booming mining sector during the 1960s tied to the diversification of exports and Japan as the main trading partner (enabled by the bilateral Trade Agreement in 1957).

A fourth inflection point took place during the 1980s with further reductions in tariff protection to the manufacturing sec-

tor (even on the most highly protected industries such as autos, textiles, clothing, footwear), the floating of the Australian dollar in 1983, and deregulation or easing of restrictions on the entry of foreign banks into the domestic retail end of the capital market (banking sector). The strategy was designed to increase the openness of the economy and thus make manufacturing and traded services industries internationally competitive as mining and farming had been. Initial results of this policy shift involved a shrinking of employment in manufacturing and agriculture, emergence of regional economic disparities, high unemployment and a slow growth in average incomes. This was followed by the privatisation of numerous public enterprises in utilities (telecommunications and postal services), banking, and the transport sector (government-owned airlines). Reforms continued during the 1990s with the reform of the highly centralized labour market, the strengthening of the independence of the Reserve Bank and the introduction of a goods and services tax to replace a plethora of indirect taxes (McLean, 2013). During the 1990s, the impacts of the economic reform meant strong growth in incomes, productivity and employment, as well as low inflation and stabilized economic activity.

5.2 Human geography

5.2.1 Demographics

When European settlement began in New South Wales in 1788, the Australian continent was inhabited by around half a million hunter-gatherer Indigenous Australians with no villages or significant permanent structures. During early colonisation in the 19th century the pioneer European settler population comprised Anglo-Celtic convicts and ex-convicts. The immigrant population had reached only four hundred thousand by 1851 when the Victoria goldfields were discovered. In response to the discovery a first wave of mass migration of non-Anglo-Celtic immigrants

drove the gold rushes of the 19th century. In 1852 alone, 370,000 immigrants arrived in Australia. As the gold rushes ended, miners were absorbed into the Australian economy, resulting in increased availability of casual labour, much of which went into further developing the agricultural sector and other activities such as railroad building (Kay et al., 2012). After the gold rushes Australia's population had nearly reached 4 million by Federation in 1901.

For the first part of the 20th century natural increase was the main contributor to population growth which was low along with immigration. Following the end of World War II in 1945, the population had passed 7 million and planners projected that without migration Australia's population would peak in 1980, and then fall, which was unacceptable (this was known as the "populate or perish" imperative). Thus, in order to boost population growth Australia actively promoted employment-based migration policies to attract labour (ABS, 2014b) by gradually abolishing the "White Australia policy": a number of discriminatory laws that had been stopping non-European immigration since its enactment in 1901. Initiatives like the Colombo Plan to bring Asian students to Australian universities and the Migration Act (1966) which established legal equality between British, European and non-European migrants to Australia, are examples

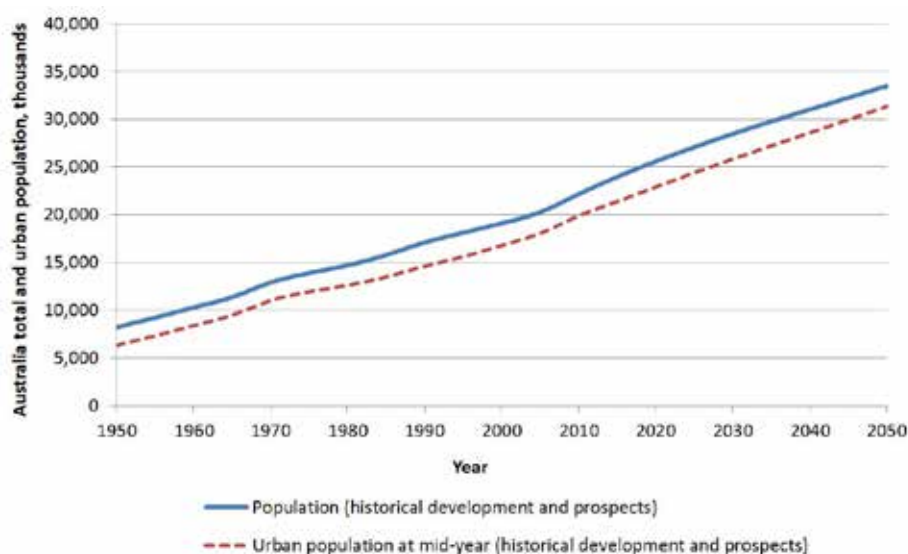
of the multiculturalism policy followed by Australia up until today.

From 1950 the population grew quickly, already doubling by 1986 reaching 16 million. The population has kept growing and is currently nearing 24 million, with a projection of passing 33 million by 2050 (United Nations, 2015a) (**Figure 4**).

Australia's population has had a high urbanisation ratio since the early days. Despite the importance of farming (for the domestic market, having grown in the second half the 20th century) and mining, Australia was a relatively urbanized society by the end of the 19th century, with much of its industrial and service sector activities concentrated in just a few large cities. Melbourne, with just over 500,000 people was the largest city. Between 1911 and 1945, Sydney's population grew by over 800,000 people, to almost 1.5 million, and it became Australia's most populated capital city. Currently, most of Australia's population is concentrated in two widely separated coastal regions – the south-east and east, and the south-west, a fact that has benefited the development of the mining industry: in Australia the location of most major mining centres in remote areas - away from major population centres and areas of intensive agriculture - has been influential in reducing community objections to mining.

The urban population rate is 89% and

Figure 4: Australia's total and urban population (thousands, 1950-2050).



Source: United Nations (2015a), medium variant for prospects and mid-year estimates for urban

nearly 70% live in the capital cities. All in all, Australia's population density has been low during its entire economic development process and this has had a high importance in keeping living standards high, e.g. by increasing labour productivity. The greatest population growth in Australia continues to occur in the outer suburbs of cities, the inner parts of capital cities, peri-urban areas adjacent to cities and urban centres, and a number of coastal regions. Australia's population today is much older and has a more balanced sex structure than a hundred years ago. By the late 20th century, low fertility, declining mortality, and the ageing of the large baby boom generation (born between 1946 and 1965) combined to see an increase in the numbers of older people, which is expected to grow as the Australian population ages (ABS, 2009).

External immigration has been integral to the development of Australia's demography. Net overseas migration is now the main driver of population growth, making up about 60% of it. Immigration played an important role during the second half of the 19th century (Butlin, 2014) and again after 1945, helping Australia to regain population and economic growth. Mass immigration (British, Italians, Greeks, other Europeans, and Asians) enabled high levels of foreign investment, and a new era of resource-based development. Since the 1970s, and under employment and family-reunification policies, migrants have arrived from all regions of the world, but are increasingly likely to have been born in countries of the Asia-Pacific region, such as New Zealand, Vietnam and China.

5.2.2 Ethnic composition

Australia is a diverse multicultural nation built by people from many different backgrounds which reflects the legacy of the external immigration. Australia is one of the most culturally diverse countries in the OECD (ranking only behind Luxembourg and Switzerland in terms of foreign-borns within the total population (Austrade, 2015a). Yet, most of the Australian population are of European ancestry, and reside predominantly in coastal areas. The historic indigenous populations, the Abori-

ginals and the Torres Strait Islanders, make up little more than 2.5% of the total population. Life expectancy at birth for Indigenous Australian males was estimated to be 67.2 years, around 12 years less than for non-indigenous males (78.7 years) (Pink, 2012). The largest overseas born population groups (representing 27% of the total population in 2010) are those born in the United Kingdom, New Zealand, China, India, Italy, Vietnam, Philippines, and South Africa (Pink, 2012). Given the constant need for foreign labour to boost the economy, the presence of ethnic heterogeneities and cultural diversity can be judged as having been important for the economic development process of the country (e.g. Nieuwenhuysen et al., 2011). Some of the major benefits, as exemplified currently by migrants in Western Australia (the Australian state with the highest migrants' proportion) include injections of skilled labour, and increased productivity through innovation (Office of Multicultural Interests, 2012).

5.2.3 Language

English is the national language of Australia and is spoken by the vast majority of the population. In 2011, 81% of Australians aged 5 years and over spoke only English at home. Only 2% didn't speak English at all. The most common languages spoken at home (other than English) were Mandarin (1.7%), Italian (1.5%), Arabic (1.4%), Cantonese (1.3%) and Greek (1.3%) (ABS, 2012a). Considering that English is an important language for development of international economic and trade relations, it can be concluded that the language has been an advantage in terms of economic development for Australia.

5.2.4 Religion

Australia is a religiously diverse country and it has no official religion. Since the first Census, Australians have reported to be predominantly Christian, though the proportion has been substantially declining: 96% in 1911 to 61% in 2011. In 2011, among the Christian population, the largest groups were Catholics (25%) and Anglicans (17%). Other than Christian, the remaining 39% was composed of people without religion (22%) and non-Christian

minorities (7%), including Buddhism, Islam, Hinduism, and Judaism. The missing 10% includes people who inadequately described (supplementary codes) religions and people who did not state a religion (ABS, 2012a). No literature has been found documenting a noteworthy influence of religion on Australia's economic development.

5.2.5 Cultural Norms, Values & Conflicts

The Australian culture has been strongly influenced by the cultural diversity brought by immigrants through history. The attitudes and aspirations of the flood of immigrants arriving after the discovery of gold in the 1850s reflected those in mid-Victorian Britain "where reform of the corrupt and class-based political system and concern at social and economic inequalities were much in evidence. The resulting democratic and egalitarian temperament of 19th century-Australians was surely a major source of their preparedness to challenge existing institutions and policies" (McLean, 2013:252). Moreover, it has been noted that migration is a selective process driven as a rule by the more educated, more skilled, risk takers and entrepreneurs which translates to a general trend of immigrants being economically successful (immigrants have a disproportionately high representation in Australia's Business Review Weekly 100 most wealthy Australians list) (Nieuwenhuysen et al., 2011). Also it has been found that immigrants generally have higher degree qualifications (Nieuwenhuysen et al., 2011). The greater diversity of ethnic backgrounds as a result of large-scale immigration from continental Europe from the late 1940s and from Asia in the 1970s did not alter (but promoted) social norms or attitudes towards institutional and policy changes aimed at promoting growth (McLean, 2013:252).

If examined by Hofstede's model, Australia's population features low in terms of power distance, i.e. the culture is not strictly hierarchical, hierarchy is established for convenience, information is shared frequently, and communication is informal, direct, and participative. Regarding individualism, Australia ranks

very high evidencing a highly individualistic society in which people are supposed to look after themselves and their direct family only. Australia also ranks relatively high in masculinity which means that society and behaviour in school, work and play are based and driven by competition, achievement and success, the "winner takes all". In terms of long-term orientation, Australia ranks low, has a normative culture with a great respect for traditions, a small propensity to save for the future, and a focus on achieving quick results (The Hofstede Centre, 2015). Finally, Australia's culture is defined as indulgent, meaning that people exhibit a willingness to realize their impulses and desires with regard to enjoying life and having fun (The Hofstede Centre, 2015). All these cultural norms, a legacy of the immigration culture, have been important in the economic development of the country.

5.2.6 Civil society & environmental awareness

Civil society activism in Australia has mostly revolved around civil rights struggles for the rights of Indigenous Australian peoples. After WWII the Indigenous Australian peoples were the main minority whose civil rights were not acknowledged. By the 1950s many of them lived in a state of poverty, with state laws regulating where indigenous people were allowed to live, where they could and could not move and who they could marry. Civil rights activism movements were initiated in the late 1950s with the Warburton Ranges controversy drawing the media attention to the bad conditions (malnutrition and disease) in which Indigenous Australian peoples were living in the Warburton Ranges (an area of nuclear testing) (National Museum of Australia, 2014). Protests, campaigns and pressures on politicians to change legislation mounted during the 1960s and in 1967 a Referendum was held to change the Australian Constitution, changing two negative references to Aboriginals and giving the Commonwealth the power to legislate for Indigenous Australians as a group. By 1967 Aboriginal people living in all states but Western Australia and Queens-

land no longer had their civil rights as Australian citizens curtailed by state laws: they were included in the census and were recognized as Australian citizens. Other important campaigns in the 1960s were the Freedom Ride, a campaign for equal wages in the cattle industry, and the Wave Hill walk off as a very important event in the struggle for defining Aboriginal land rights which culminated with the Aboriginal Land Rights (Northern Territory) Act (1976) recognising Indigenous Australian peoples as traditional land owners for the first time. The country has lately been involved in a policy of reconciliation with a formal apology in 2008 by the Prime Minister to indigenous people. As a result of all these movements, in Australia, indigenous issues (e.g. land rights and cultural heritage) have become an increasingly influential factor in obtaining exploration and mining tenure, i.e. the social licence.

The environmental awareness movements in Australia have been very important in its history and have sustained widespread public concerns on environmental issues. The movement began long ago driven by conservationists and naturalists, gaining in more widespread public support and grass root activities during the 1960s, 1970s and 1980s (e.g. against the proposed damming of Tasmania's Franklin River). The Australian Conservation Foundation was established in 1966 as the major national conservation organisation. Since the 1990s, environmental activities are led by the nation-wide Landcare and Coastcare networks, funded by the government, corporations and privates, with over 4000 community groups and over 2000 Coastcare groups. The Australian Greens Party (formed in 1992) has been very active in the political realm. Since the late 1980s climate change has emerged as a key issue. In recent decades there has been a growing cooperation between the indigenous people and the environment movement (AEGN, 2014). Green movements increasingly target mines, both in Australia and abroad. Frequently targeted issues include climate change related emissions and the conservation of biodiversity hotspots (e.g. the Great Barrier Reef).

Such environmental concerns, the awa-

reness of an active civil society and the struggle to ensure that Indigenous Australian people's rights are respected are collected under the term of social licence to operate. Achieving a social licence has become a major requirement for investment in any stage of the mining cycle. Research has found that the usage of the term is contested and that it must be seriously investigated and taken into account for future investments (Bice, 2014).

5.3 Education

5.3.1 Education system

Education was an important matter in Australia since the early days of the colonies. Between 1872 and 1895 all Australian colonies sought to resolve the problems of providing education by the introduction of Education Acts ensuring free, compulsory and secular education. Children mandatorily had to attend school for a given number of days annually. By the beginning of the 20th century educational developments included government and non-government secondary schools and technical education for whites and missions schools for part-Aboriginal and Aboriginal children (Shorten, 1996). The period of the second "golden age" (1945-1973) fostered a transformation in secondary education in Australia, a transformation driven by social demands for extended education. Industrialisation, immigration, full employment and new levels of urbanisation helped create a revolution, where secondary education was consumed for personal economic progress (Burke and Spaul, 2007).

Currently Australia has a universal educational system. Formal education in Australia starts with early childhood education (preschool programmes in which Australia has a comparatively low spending and low enrolment rates), primary and secondary schooling, vocational education and training (VET) (an important part of the post-secondary education system, equipping individuals with the skills to enter or re-enter the labour force via short certificates, apprenticeships and advanced diplomas), and tertiary/higher education. Starting at the age of five, there are 11 years of compulsory educa-

tion (Commonwealth Secretariat, 2014).

Under the Commonwealth Constitution, the state and territory governments are responsible for providing schooling to all school-age children (Pink, 2012). Currently governments still provide the bulk of funds for education. Public primary and secondary schooling is provided without tuition fees. Fees covering the costs of tuition are charged for most postgraduate coursework degrees, for a very small proportion of the undergraduate degree courses taken by Australian students, and for overseas students at all levels of education. About 12% of spending on government schools in the States comes from the Commonwealth allocation, specifically for government schools (as general funds for schools and for some specific-purpose equity programmes) and as capital grants for building. Currently around 71% of schools are government schools, and of the 29% remaining non-government schools, nearly two-thirds are Catholic (Pink, 2012). The first universities in Australia were founded from the 1850s onwards (Sydney 1853, Adelaide in 1874, Queensland 1901), and the first major technical colleges were established after 1870, many as Schools of Mines (e.g. Western Australia School of Mines in 1902), many related to the training needs of the heavy industry during WWI. Nowadays there are 40 universities with more than 1 million students enrolled, 37 of which are public institutions. International students make up 18% of total tertiary enrolment, placing Australia behind Luxembourg among OECD countries, above the OECD average (8%) (OECD, 2014a).

In Australia, educational attainment is high. 74% of 25-64 year-olds hold at least an upper secondary qualification (OECD average is 76%) (OECD, 2013a); if the percentage of 25-34 year-olds who have been through tertiary education are examined, Australia ranks 9th in the OECD (OECD, 2012). The rate of attainment of higher level qualifications among 20-64 year olds increased from 38.3% to 49.9% between 2001 and 2011; an explanation is due to the overseas migration in the last decade. Immigrants had a much higher rate of attainment of higher level qualifications than the rest of Australia, driving higher the level of attainment (higher education and vocational) particularly in capital city regions (ABS, 2014c). Non-school qualified people (in 2011 comprising 49.4% of Australians aged 20 to 64 years) are mostly concentrated in or near greater capital cities (ABS, 2013a). Australia combines a high level of performance with equity in education opportunities (OECD, 2014b); still the link between performance and socio-economic background of students is more marked than in other high performing countries (National Sustainability Council et al., 2013).

Australia substantially increased its education expenditure during the 1970s, peaking in 1976 and then declining with fluctuations during the 1990s and the 2000s (**Figure 5**). More recently, from 2008 onwards the share has been increasing and it reached 5.6% by 2010, slightly below the OECD average of 6.3% (OECD, 2013b). In 2012 it was at 4.9% (World Bank, 2015).

Figure 5: Government public spending on education (% GDP, 1975-2009).



Source: Trading Economics (2015a)

If assessed by international benchmarking educational systems such as PISA¹, TIMMS² or PIRLS³, Australia fares well (above OECD average) but it does not figure among the world's highest positions (e.g. Finland). Even though Australia substantially increased education expenditure in schools between 1964 and 2003 by the reduction of class sizes, Australian students' performance has been falling (Jensen, 2010; Leigh and Ryan, 2008).

At the same time, teachers' salaries are above OECD average and have risen steadily, rising by around 13% since 2000 at all education levels, yet below the average OECD salary rise of 17%.

However, despite increases in salaries, it has been found that between 1983 and 2003 there was a considerable decline in the real and relative earnings of teachers compared to non-teacher graduates. This income drop impacts on teacher quality and on human capital formation, since relatively poor pay makes teaching unattractive for talented Australians (Leigh and Ryan, 2008). It has been argued that investments in improving teacher effectiveness (in contrast to class size reduction) would have a greater impact on economic growth. In other words, evidence seems to show that, in order to create a top performing educational system, it is preferable to invest in improved teacher effectiveness (teaching quality) than in the number of teachers (Jensen, 2010).

In contrast, initiatives like the My School website (an instrument to lift school performance by providing extensive information on Australian schools to the public using the name-and-shame mechanism) or promises of smaller classes are considered populist policies which do not provide a real remedy for a decline in teaching quality (Liew, 2012).

Australia's educated workforce has greatly benefited the economic development process and human capital is considered a key determinant of regional economic development (ABS, 2013a). This has been the result of Commonwealth and state governments' long-term funding policies and policy-oriented skilled

immigration. The literature demonstrates this relationship: in the period 1969-2003, per capita real GDP increased annually by 1.9% and about 31% of this growth was attributed to education (Matsushita et al., 2006).

5.3.2 Education infrastructure

Most students in Australia (around 65%) attend government schools, but since the 1970s there has been a significant rise in the proportion of students enrolled in non-government schools (Catholic and independent schools) as a part of a broader trend towards households paying for services which were before government provisions. These percentages vary among states and territories, with the Northern Territory having the largest proportion of students attending government schools (72.5%) in 2014 and the Australian Capital Territory the least (57.8%) (McCrindle, 2015). In 2014 there were 9,389 schools in Australia (primary, secondary, combined and special schools), 71% of them government schools, 18% Catholic and 11% independent schools, with the proportion of the two latter increasing in the last decade.

Australia has 40 full universities, and around 130 other non-university higher education providers (a range of colleges, institutes, and schools that are authorized to offer higher education qualifications), most of them in the private sector and some for-profit colleges owned by public universities. Most students are enrolled in universities but participation in non-university based higher education is increasing: reaching almost 6% of the total number of reported higher education students in 2013 (Norton, 2014). Australian universities have a good reputation. Australia currently ranks 4th behind the USA, the U.K. and Germany for the number of universities in the Times Higher Education World University Rankings 2014–15, and Australia is home to 20 of the top 400 universities according to the Times (Austrade, 2015a).

Australia's investment in education institutions is similar to the OECD average. Expenditure on education institutions at all levels is 6.1% of GDP (slightly below the OECD average of 6.3%) (OECD, 2014a).

1 Programme for International Student Assessment.

2 Trends in International Mathematics and Science Study.

3 Progress in International Reading Literacy Study.

Between 2005 and 2010, Australia has increased spending by 0.8 percentage points (above the OECD average of 0.4 percentage points). As in most OECD countries, a large portion of the expenditure on educational institutions is from public sources (74.1% in Australia, compared to the 2010 OECD average of 83.6%) (OECD, 2013a). The share of private expenditure is 25.9% (above the OECD average of 16.4%). Most of the private funds are from household expenditure. Funding for schools varies depending on whether the school is public or private. Government (public) schools are resourced by state and territory governments (91.4% their own expenditure and 9% provided by the Australian Government via the National Schools Specific Purpose Payments, associated with the National Education Agreement). The Australian Government has primary responsibility for public funding of higher education institutions. This funding is largely provided through the Commonwealth Grant Scheme. Students pay tuition fees directly or through income-contingent loans.

Mining education has a long tradition and a good reputation in Australia. All undergraduate Mining Engineering degrees in Australia are of four years duration and are offered at the University of Adelaide, Curtin University, the University of New South Wales, the University of Queensland, the University of Ballarat, the University of Wollongong and Monash University. The country hosts some traditional and renowned schools like the Western Australia school of mines or the School of Mining Engineering at the University of New South Wales, which hosts, for instance, the Australian Centre for Sustainable Mining Practices. More recently, the Mining Education Australia (MEA) programme has been created. Such collaborative programme is a joint venture of the University of Adelaide, Curtin University, the University of New South Wales and the University of Queensland to deliver a common national mining curriculum for the Bachelor degree in Mining Engineering. MEA produces around 85% of Australia's Mining Engineering graduates whilst the total number of MEA graduates in 2012 was 200 and similar numbers of

graduates are expected over the next two to three years (School of Mining Engineering, 2015).

Since at least the 1970s the mining education sector in Australia faces the problem of a lack of synchronisation between the number of graduates and the mining business cycle. In order to avoid a skills shortage, the universities under such programme are increasing the marketing of the curricula, granting scholarships, updating and extending the range of postgraduate programmes, providing seed-funding for young academic staff, encouraging international visiting scholars to the Australian Hub of Mining Excellence, among other measures (Hagan, 2015).

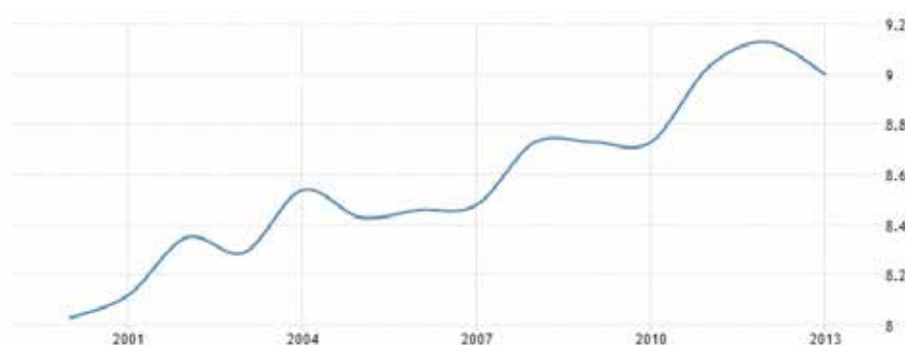
5.4 Health

5.4.1 Health system

The Australian health care system provides universal access to a comprehensive range of services, to a large degree publicly funded (as in all OECD countries, except the USA) through general taxation. The Medicare scheme was introduced in 1984 and covers universal access to free treatment in public hospitals and subsidies for medical services (The Commonwealth Fund, 2015). The Australian Government, through the Health and Ageing portfolio, has significant financial and policy responsibility for health services including hospitals, public health and mental health. The Commonwealth Government holds the greatest power to raise revenue, so states rely on financial transfers from the Commonwealth to support their health systems (The Commonwealth Fund, 2015). State and territory governments, local governments and non-government organisations are responsible for the direct provision of these services, while private, non-salaried practitioners provide most medical and dental care (Pink, 2012).

Australian government expenditure on health has been increasing in the last decade: from around 8.5% of GDP in 2002-2003 to 9.2% in 2012-13 (**Figure 6**), similar to the OECD average of 9% (2012). Rising health expenditures are explained due to the ageing population and the fact that

Figure 6: Australia's health spending (percent of GDP, 2000-2013).



Source: Trading Economics (2015b)

older people tend to be higher consumers of health care services, the use of new and more expensive technologies, increasing consumer expectations linked to growth in incomes (households devote a bigger share to health care), and the fact that Australians are living with chronic diseases (Marassovich, 2014). Australians have one of the highest life expectancies in the world. Life expectancy at birth has consistently improved over the past 125 years, increasing from nearly 50 years in 1885 for males, to 70 years in 1960 and currently 82 years, ranking 10th in the world (CIA, 2015a).

By life expectancy at birth Australia ranks 6th in the OECD countries, ranking 3 if only men are examined (OECD, 2014c). Life expectancy does not vary considerably among states and territories, except for the Northern Territory which has a lower one. There remains a significant gap in life expectancy at birth between indigenous and non-indigenous Australian people estimated at 12 years lower for indigenous men and 10 years for women (Pink, 2012). Also, during the 20th century, particularly during the first half, there was a marked decline in the infant mortality rate, which has also kept falling in the last two decades. Infant mortality rates of Aboriginal and Torres Strait Islanders vary

across Australia but in general are higher than non-indigenous people (Pink, 2012).

5.4.2 Health infrastructure

Australia's health infrastructure is considered to be consistent with the OECD average. There has been a substantial increase in the medical workforce in Australia since 2000, coinciding with a rise in the number of medical graduates. In 2012, Australia had 3.3 practising physicians per 1000 population, up from 2.5 in 2000, and now slightly above the OECD average (3.2) (OECD, 2014c). In terms of number of doctors, nurses and beds Australia ranks around average in the OECD. Australia ranks 21st in the world, below Japan (15th) and Canada (18th), under the indicator "Health infrastructure" which measures if the health infrastructure meets the needs of society (Institute for Management Development, 2014). Total health spending accounted for 9.1% of GDP in Australia in 2011-2012, slightly lower than the average of 9.3% in OECD countries in 2012. The public sector is the main source of health funding in nearly all OECD countries. In Australia, 68% of health spending was funded by public sources in 2011-2012, below the average of 72% in OECD countries (OECD, 2014c).

6. Economic factors

6.1 Economic Geography

6.1.1 Economic structure

The structure of the Australian economy has shifted over time away from agriculture and manufacturing towards a service economy. In other words, the economy has been transformed from one centred on the production and export of primary products to an urbanised economy producing services and exporting largely mineral commodities. Structural change has tended to occur in waves, with significant changes occurring from the late 1960s through to the late 1970s, from the late 1980s through to the mid-1990s and also more recently with the resources boom since 2005.

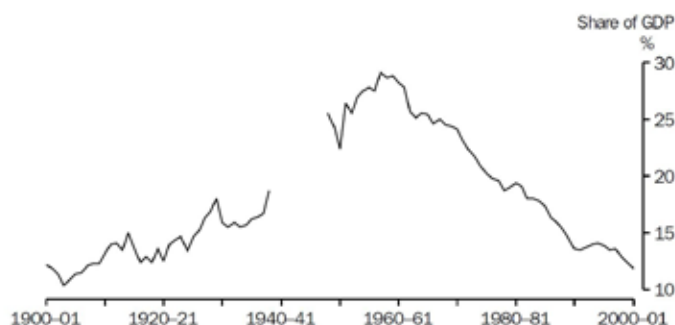
Structural change has been driven by a range of factors including: rising demand for services (the share of income spent on services has increased from 40% in 1960 to over 60%); the industrialisation of East Asia (Japan and China); economic reforms (deregulation of the finance industry in the 1980s and progressive removal of assistance to the manufacturing and agriculture sectors); and technological change (Connolly and Lewis, 2010). In recent decades there has also been a resurgence of the mining industry, lifting the industry's share of investment, output and exports, and contributing to the rising share of the states of Queensland and Western Australia within the economy (Connolly and Lewis, 2010). The service

sector content of Australia's gross mining exports (2009) is above 20% (Adams et al., 2014a).

6.1.2 Industrial Geography

The share of the manufacturing sector in the country's GDP increased considerably during the first decades of the 20th century and by 1940-1941 the manufacturing's share of employment (25%) had overtaken the rural sector's share (ABS, 2012b). After WWII Australia entered an era of sustained growth and heavy manufacturing became the major driver of the expanding sector, with automobiles, chemicals, electrical products, iron and steel growing. Industry clusters developed in Melbourne and Adelaide (white goods and automobiles), textiles and garments in Melbourne and chemicals in Sydney and Melbourne. By 1960, the manufacturing's share of GDP and employment had reached historic highs, and Australia's industrial base could claim to have reached maturity (ABS, 2012b) (**Figure 7**). Unions and arbitration agreements kept wages high, and massive immigration contributed with skilled labour, allowing the sector to keep growing. The sector had developed during the beginning of the 20th century behind tariff protection, under import licensing restrictions and controls.

Figure 7: Australia manufacturing's sector share of GDP (1900-2000).



Source: Trewin (2005)

From the 1960s onwards Australia changed its economy from inward-facing to a more outward-oriented. First, the disturbances in exchange rates following the collapse of the Bretton Woods system, increases in oil prices, and increasing competition from the newly-industrialised countries in Asia served to undermine Australia's comparative advantages (ABS, 2012b). Second, domestic developments such as the move toward equal pay for women, sharp rises in real wage costs generally and tariff cuts (effective rates of assistance were reduced from a 35% in the 1970s to a 5% in 2000-2001) (Connolly and Lewis, 2010) meant higher costs for the local industry.

Thus, manufacturing saw its sectoral share of total employment fall from 25% in 1970 to slightly less than 20% in 1980. In recent decades the share of manufacturing in the GDP has steadily fallen, but actual manufacturing employment levels have not fallen by nearly as much (Clark et al., 1996). Actually, the falling contribution of manufacturing to GDP is explained by the growing participation of the services sector. Currently, the manufacturing sector employs about a million people, about the same as in the 1960s, but with much increased output. Although it has experienced a productivity growth, it is still predominantly low and medium tech.

Although overshadowed by the resources boom, the manufacturing sector remains important due to its role in generating innovation and technological change, addressing trade vulnerability and creating high skills jobs (Green and Roos, 2012). The sector has kept pace with the economy but it has not been the key to Australia's sustained economic growth in the last 120 years; thus, it is evaluated as having had a moderate to high importance.

6.1.3 Commercial Geography

As a small open economy, Australia's economy has traditionally been closely linked and dependent on the international market conditions and trade. During its history exports were driven mainly by the British economy and by other European countries. From the 1960s international trade has shifted towards Asia-Pacific partners and the USA. In terms of balance of payments, Australia has had persistently increasing current account deficits since 1959. This is due to its less diversified export base and increased imports of capital goods from overseas. Current account deficits averaged minus 3.2% between 1960 and 2014. Australia's balance of trade (goods and services) has also been falling in the last four decades (**Figure 8**).

Figure 8: Australia's balance of trade (million Australian dollars, 1971-2015).



Source: Trading Economics (2015c)

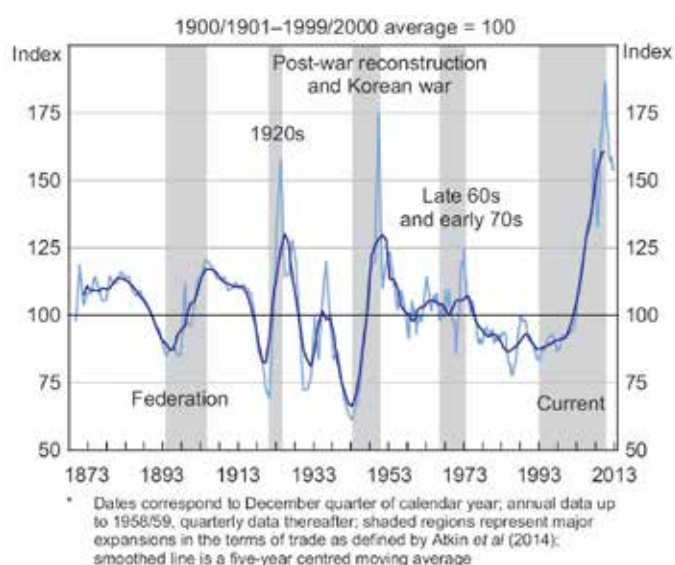
Through much of its history Australia has faced declining and highly volatile terms of trade (ratio of export prices to import prices). The most dramatic increases in the terms of trade were due to the impact of sharply rising commodity export prices

in the early 1920s and the Korean War at the beginning of the 1950s, with both episodes reflecting the boom in (and in the 1950s, the subsequent collapse of) wool prices, accounting for more than half of Australia's goods exports at its peak in the

early 1950s. Further, the Great Depression and the Second World War coincided with periods of sustained declines in the terms of trade (Commonwealth of Australia, 2002). From 1973 until 1986 the terms of trade fell steadily; however, since the trough reached in 1986, they have been less volatile and have risen since 2000 (**Figure 9**). The rising terms of trade in the last decade and a half explain the increase in the real purchasing power of domestic output linked to an appreciation of the real exchange rate, and high coal, gold and mineral ore prices, and falling prices for audio, visual and computing equipment (ABS, 2007).

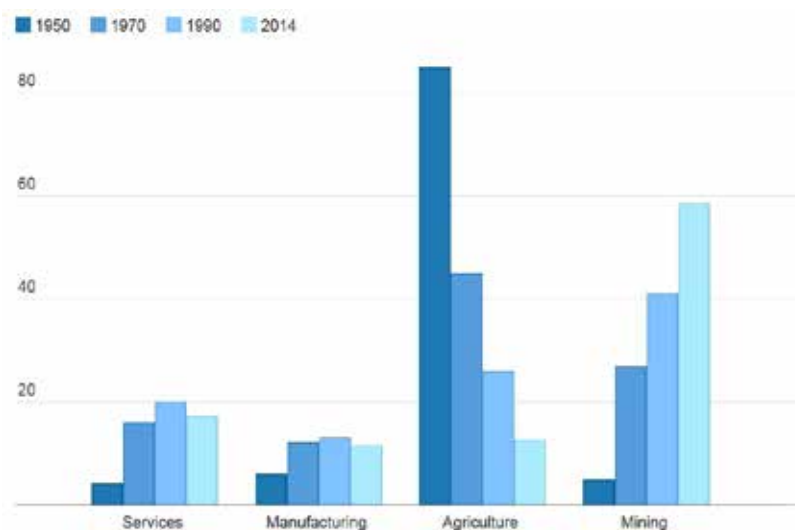
Australia is considered a trading nation (Adams et al., 2014b). The ratio of trade to GDP increased from 25% to 37% over the years from 1970 to 2004 (Varghese, 2014) and currently stands at a 42%, with exports contributing to around 20% of GDP (2012). The agriculture sector has lost in relative importance against a growth of the mining sector and resource-intense exports. Since the early 1980s Australia's export incomes have been dominated by commodities (resources exported with little domestic value-added). The mining sector is a major driver for export growth (between 2000 and 2010, the value of ex-

Figure 9: Australia terms of trade (index points, 1870-2013).



Source: Atkin et al., (2014)

Figure 10: Contributions to Australia's exports by sector (%).



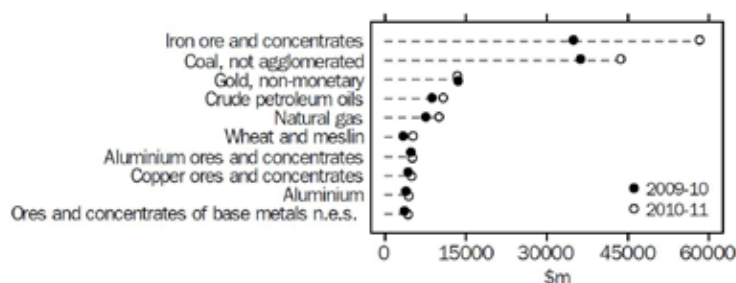
Source: Garnett (2015)

ports from mining rose by over 120% (Garrett, 2015, **Figure 10**).

Currently, Australia's top exports of goods and services involve mineral commodities (**Figure 11**). Australia is the largest supplier to the global market of

iron ore and coking coal, two key inputs for the production of crude steel (Atkin et al., 2014). In recent years, exports of liquefied natural gas (LNG) have started to increase.

Figure 11: Exports of major commodities (commodity groups, Australian dollars).

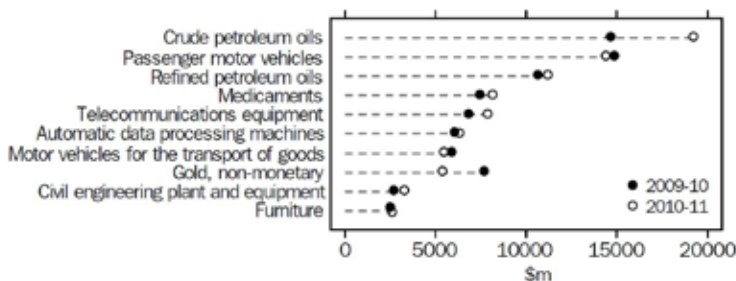


Source: Pink (2012)

Australia's top imports (ranked per value) include oil and vehicles (**Figure 12**) (DFAT, 2015a; Pink, 2012). Australia's top two-way trading partners are currently China, Japan, the USA, and the Republic

of Korea. The UK is in 7th place. Australia's top export markets are China, Japan, Korea, USA and New Zealand; its top import sources are China, the USA, Japan, Singapore and Germany (DFAT, 2015b).

Figure 12: Imports of major commodities (commodity groups, Australian dollars).



Source: Pink (2012)

6.1.4 Agricultural Geography

Historically, highly-productive agriculture played an important role in the early development stages of the colonies, and then during the first half of the 20th century, when it accounted for around 25% of Australia's output and between 70% and 80% of Australia's exports. The agricultural and pastoral sector was so important that wool became Australia's key primary product, with Australia being the largest world supplier and Australia having the second highest per capita GDP in the world after Netherlands in 1820 (Kay et al., 2012). However, during the second half of the 20th century its relative impor-

tance has been steadily declining, mainly due to the growth of the services sector (which includes agricultural services too). Agriculture's share of GDP fell from around 14% in the early 1960s to 6% in the early 1980s, and has ranged between 4 and 6% over the last two decades (Productivity Commission, 2005). It is currently only around 2.4% (ABS, 2012c). Also its share of total employment has been declining and has more than halved since the late 1960s when it accounted for around 9% of the workforce (Productivity Commission, 2005); it currently represents over 3%. Yet, the agriculture sector is an important source of employment in regional

and rural Australia. The fall in the sector's importance in the GDP is consistent with the experiences of other developed countries - there is a strong inverse relationship between per-capita income, GDP and the proportion of employment accounted for by agriculture. That said, the Australian agriculture sector's share of output remains one of the highest in the OECD (OECD and FAO, 2009). Agriculture historically received some support in the form of tax concessions and subsidies, but this support has decreased over time (from an effective rate of assistance of around 28% in the 1970s to 5% in the 2000s).

6.2 Economic Key Figures

6.2.1 Economic diversity

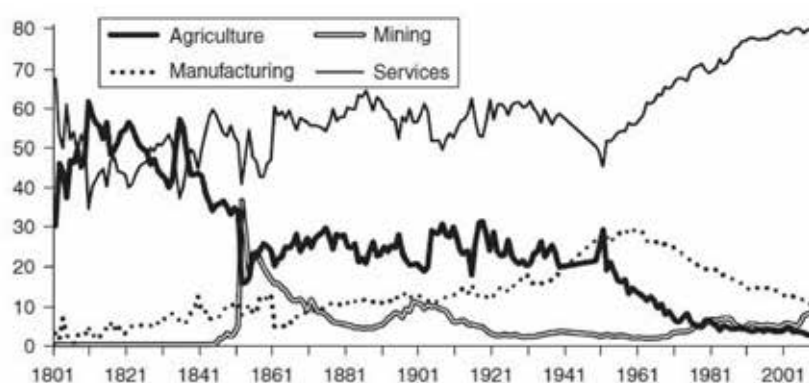
The structure of the Australian economy has gradually shifted away from agriculture and manufacturing towards a services economy, reducing its diversity. Although Australia has a diversified domestic industrial base, this is not reflected in the diversity of its exports. Australia has considerably lower economic complexity than most advanced economies

(Department of Industry, 2014). Economic activity has also shifted towards the resource-rich states of Queensland and Western Australia. Even though the economy shows a low degree of diversification, regional economies are more economically diverse than usually assumed (Regional Australia Institute, 2013). Economic diversification plays an important role in providing resilience and flexibility for regional Australia's economies. Without this cushion, regional economies may suffer disproportionately during adverse external shocks, with exacerbated negative effects on employment security, income and living standards.

6.2.2 Economic output

Australia is currently the world's 20th largest economy as measured by GDP (CIA, 2015b) and has the 24th highest Purchasing Power Parity (PPP) per capita (CIA, 2015c). During the first half of the 20th century agricultural production and manufacturing (protected by high transportation costs and tariffs) were the cores of Australia's developing economy with mining totalling around 10% of the GDP by 1900 (**Figure 13**).

Figure 13: Australia's industry shares of GDP (percent, 1801-2010).



Source: Ville and Withers (2014)

Between 1860 and 1950 the agricultural and pastoral sector experienced cyclical variations, ranging between about 20-30% of Australia's GDP. The mining sector's share of GDP peaked at around 35% in the middle of the 19th century. Its relative importance has contracted significantly

since then, despite a permanent expansion in the economy.

During the 20th century the economic output of Australia was severely negatively impacted due to external economic shocks during WWI, in the 1930s due to the world recession and in the 1970s due

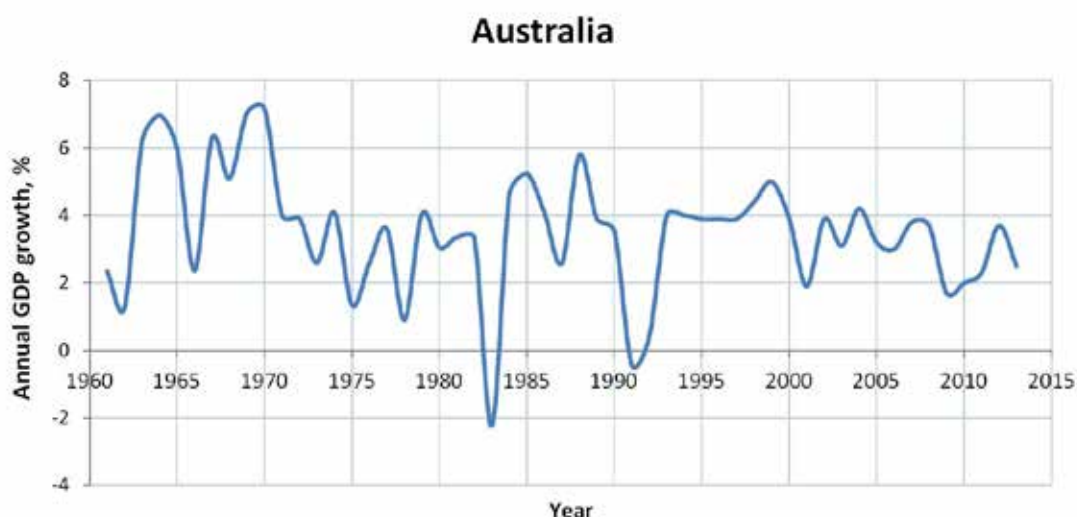
to the oil price shocks. During WWI Australia suffered a severe economic downturn (GDP declined by 9.5% in the period 1914-1920) due to the disruption of trade with its principal export partner, Great Britain. The economy slightly recovered and by the 1920s Australia had adopted an inward-oriented growth strategy, favouring import-substitution induced by tariff protection, controls on immigration and the centralisation of the national labour market to ensure that workers' real wages were maintained (McLean, 2013). By 1929 the Australian economy already faced economic problems due to falling international commodity prices and rising foreign debt levels. The 1930s depression was felt in Australia but not as much as in other countries mainly due to increases in productivity in the manufacturing sector. WWII stimulated economic growth, partly because the interwar expansion of manufacturing had reduced the economy's vulnerability to trade disruption and partly because Australia started providing clothes and equipment to its own military and USA's military forces.

During the decades of 1950 and 1960 Australia experienced rising living standards, low unemployment, and low inflation partly due to favourable international economic conditions and partly also because Australia exploited new mineral discoveries for which strong foreign demand existed, especially from the rapidly industrializing Japanese economy.

GDP grew notably during most of the 1960s, slowing down its growth during the 1970s. A major expansion of Australia's aluminium industry followed the decision to mine bauxite in the Darling Ranges, Western Australia, in the early 1960s. The perception that high-grade iron ore resources were limited in Australia was turned around with the discovery of vast resources in the Pilbara region. Some previously uneconomic deposits became economic to mine because of technological advances, which lowered the cost of mining and transporting huge quantities of material. These advances would not have been decisive without the emergence of Japan as a major buyer of commodities (Kay et al., 2012). The economic growth of Australia was thus marked by a diversification in exports, away from agriculture, and into mineral-based commodities (iron ore, coal, bauxite, copper, oil, gold, liquefied natural gas, uranium) and towards Japan and other East Asian markets.

From the early 1960s, Australia's GDP growth rate has fluctuated with strong contractions in 1983 and 1991, and a stabilisation of growth between 2% and 4% in the last decades (**Figure 14**). Over the past 52 years, Australia's economy has achieved an annual GDP average growth rate of 3.5% sustained by sound macroeconomic policies, strong institutions and conti-

Figure 14: Australia's annual GDP growth rate (percent, 1961-2013).



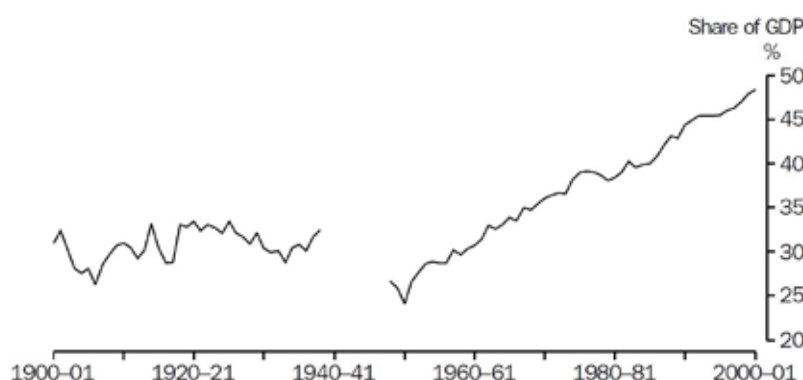
Source: United Nations (2015b) based on World Bank indicators

nued demand for hard and soft commodities from Asia. Australia is the only developed economy to have recorded no annual recessions during the past 23 years (the third “golden age”; Austrade, 2015a). Australia was comparatively unaffected by the global financial crisis as the banking system has remained strong and inflation is under control (CIA, 2015d) and the export of commodities to China kept flowing. Presently the mining sector and the services sector explain the economic growth of the Australian economy. As a result of sustained economic growth, low unemployment and an excellent health coverage Australia ranks second in the world in the Human Development Index (2013) only after Norway (United Nations Development Programme, 2014).

The services sector had an early prominence in the Australian history. In 1861 it

already comprised 60% of GDP, meaning that Australia already had an economy with 20th century characteristics (McLean, 2003). This fact is partly explained by the construction sector and the high urbanisation rate of a relatively affluent society. Since then the service sector's share of the economy has steadily increased (**Figure 15**). It now represents around 70% of Australia's GDP and 75% of jobs (CIA, 2015d). The services sector embraces a wide range of services including: wholesale trade; retail trade; accommodation, cafes and restaurants; communication services; finance and insurance; property and business services; education; health and community services; cultural and recreational services; and personal and other services (Trewin, 2005).

Figure 15: Australia's services industry share of GDP (1900-2000).



Source: Trewin (2005)

In the 1950s services were closely linked to manufacturing, with wholesale trade and transport supporting the production and distribution of manufactured goods. The fastest growing service industries in recent years have been business services, including financial and professional services, and social services such as health and education. The service sector also plays an important role in the mining industry, accounting for above 20% of the value of mining exports in 2009 (Adams et al., 2014a). The mining equipment, technology and services sector (METS) has become a very important industry sector in the last 30 years, especially now as the

mining boom recedes. According to the Australian Department of Industry and Science, the METS sector was found the largest in output across other important sectors (Lewis-Gray, 2015). The companies in this sector (84% of which are Australian owned) accounted for around (Australian dollar) \$90 billion of revenue and employ over 380,000 workers. 58% of these companies fund or undertake R&D and 53% collaborate directly with mining companies (Austmine, 2013).

Productivity growth (e.g. multi-factor productivity) has considerably contributed to the output growth, particularly in the 1970s and 1990s (but not in the 1980s

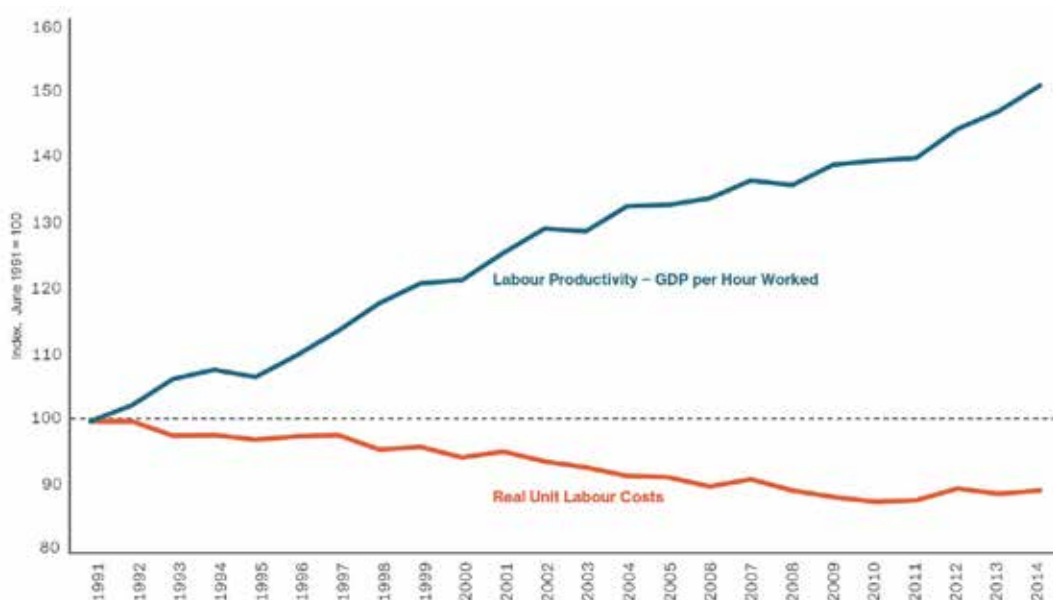
or 2000s) (McLean, 2013:237). Increases in multifactor productivity explain 65% of Australia's per capita growth over the last 40 years, but this is below the median of 19 OECD countries (Liew, 2012).

6.2.3 Labour costs, mobility & employment

Over the last decades Australia has enjoyed a sustained period of labour productivity growth (GDP per hour worked) with real unit labour costs (adjusted for general inflation) falling each year (**Figure 16**) (Austrade, 2015b). Yet, in contrast, productivity in the mining industry has

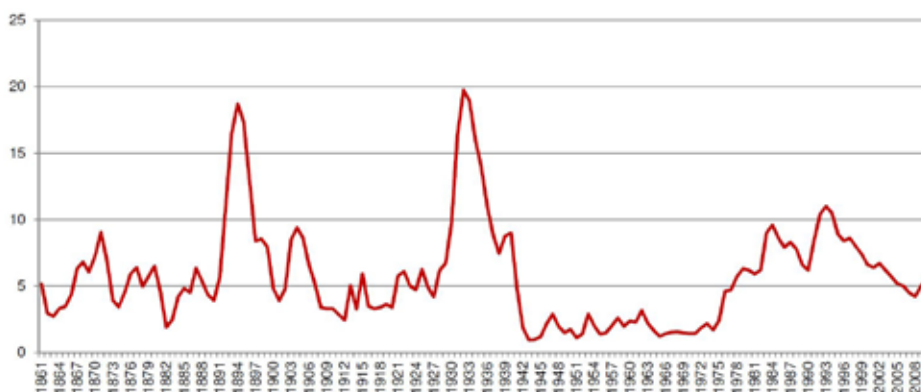
been declining significantly since 2000, particularly due to declines in labour productivity in mining (a worldwide trend), rising labour costs, and declines in capital productivity (long times between investment and production) (Ernst and Young, 2014). The mining industry continues to pay the highest wages in the country, with average weekly earnings at (Australian dollar) \$ 2,499 by May 2014 (ABS, 2015). Geographic labour mobility has traditionally been an important element in the Australia labour market, and in the demographic adjustments shaping the Australian economy (Productivity Com-

Figure 16: Labour productivity and real unit labour costs (index points, 1991-2014).



Source: Austrade (2015b)

Figure 17: Australia's total unemployment rate (percent of workforce, 1861-2011).



Source: Butlin (2014)

mission, 2014). More recently, advances in transport and communication technologies have broadened the scope of mobility.

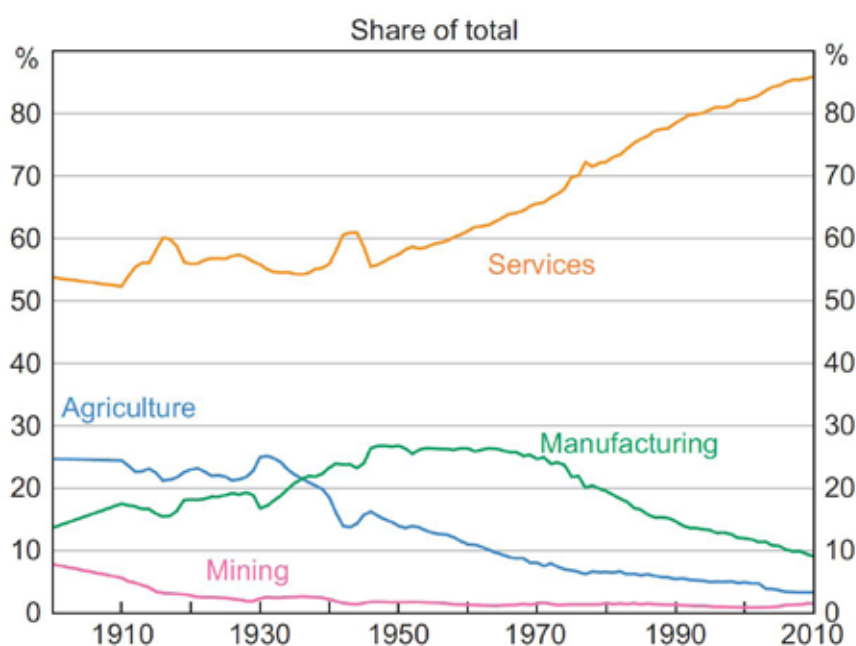
During the last 150 years the unemployment rate has been generally kept below 10%, only peaking in 1894 and during the 1930s (**Figure 17**). During WWII the rate fell below 2% and stayed around 2% until 1975. The rate increased to a 10% peak by 1983, and peaked again at 11% in 1993. From then the unemployment rate has declined and it is currently at around 6%.

The resource sector provides well paid employment to relatively low-skill as well as to high-skill labour (Liew, 2012). The mining sector currently employs directly 2.3% of Australia's total workforce (Department of Employment, 2014) (**Figure 18**); even though the number is small,

employments in the mining sector have a major impact on employment in regional Australia and in support industries across the whole economy. Moreover, each direct job in the resources sector leads to a further one to three indirect jobs in other industries, with the multiplier effect tending to be higher in regional centres (NRSET, 2010).

Australia's low formation of domestic human capital forces the Australian economy to rely highly on inflows of foreign human capital. Australia ranks second among OECD countries in its level of dependence on inflows of tertiary educated labour from overseas, while it ranks sixth for its proportion of students in advanced research programmes who come from overseas (Liew, 2012). Asia features as a major supplier of human capital to Australia.

Figure 18: Australia's employment by industry (1900-2010).



Source: Connolly and Lewis, (2010)

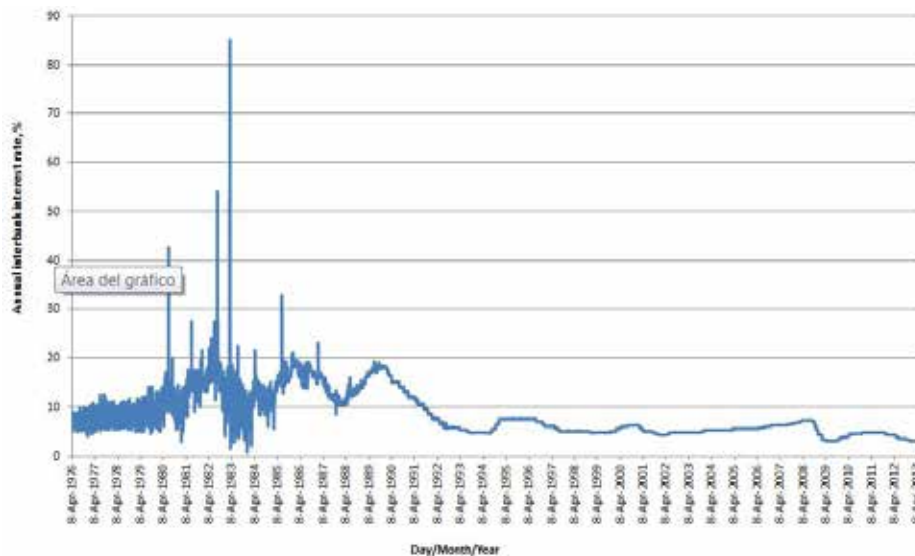
6.2.4 Interest rates

In Australia the Reserve Bank of Australia (RBA) is responsible for formulating and implementing monetary policy, i.e. management of short-term interest rates. Since the 1970s Australia's interbank interest rate has averaged 8%, with some

daily peaks in 1980, 1982, 1983, and 1985 (**Figure 19**).

After an increase during the early 1990s recession, the RBA has been lowering the interest rate. In recent years, it has reached a historic low of 2% with the aim of further stimulating the economy by boosting domestic investments.

Figure 19: Australia's interest rate evolution (1976-2013).



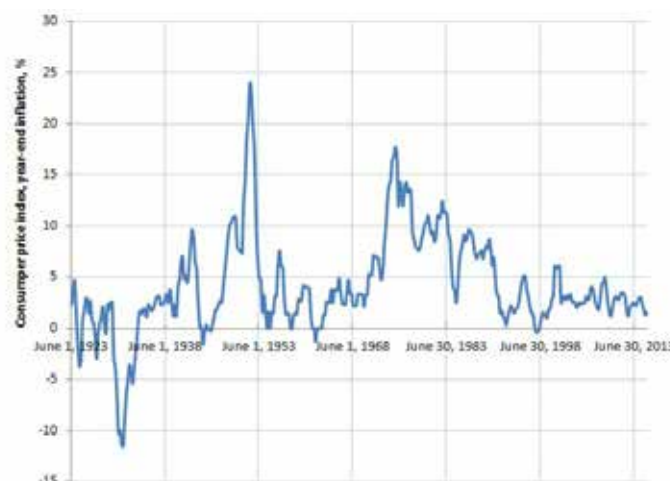
Source: RBA (2015a)

6.2.5 Inflation rates

The RBA has an inflation target (an average of 2% or 3% to be achieved over a period of years) which is used to guide monetary policy. The rationale behind a low inflation rate is that there is considerable international evidence that high inflation is harmful to economic performance: countries that have had relatively high rates of inflation in the post-war period have tended to experience lower rates of economic growth than low-inflation countries. Although not mecha-

nic, this relationship is evident in terms of averages over long periods of time (RBA, 2015b). Since the 1920s Australia's inflation rate has gone through cyclical changes, with a tight deflation of prices during the 1920s and the 1930s, and then high inflation in the period 1948-1952. Inflation was then returned to low levels until the oil crises in the mid-1970s when it rose again. From then on it has gone cyclically down and in the last 25 years it has averaged 2.8%, reaching the targets set by the RBA (Figure 20).

Figure 20: Australia's inflation rate (year-end, percent, 1923-2015).



Source: RBA (2015c)

6.2.6 Customer liquidation and spending power

Australian household savings (residual of household disposable income and final consumption expenditure) have shown a

steady decline from the 1980s to the mid-2000s, and more recently a return to levels near 10% of disposable income which indicates a more “normal” level of liquidity (Trading Economics, 2015d) (**Figure 21**).

Figure 21: Australia household savings (percent, 1959-2015).



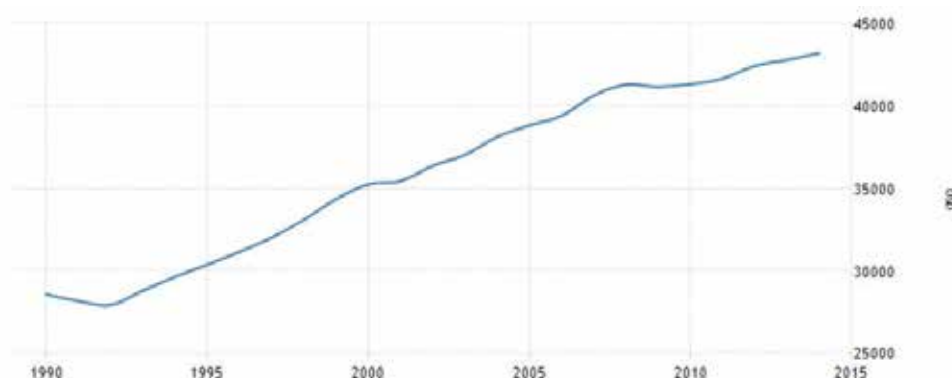
Source: Trading Economics, (2015d)

During the early 1970s household savings dropped due to inflation. During the 1980s there was a decline in savings triggered by easier access to credit as the nominal interest rates had been going down, thus, consumption increased with a decline in household savings. This is shown by the debt-to-income ratio which has been increasing since the early 1990s (Hartstein, 2013). The more recent growth in savings reflects the boom in the terms of trade.

Australian incomes have risen substantially and unemployment is low on a world scale. Australia's purchasing power has increased appreciably over recent decades due mainly to the improvement in the terms of trade, productivity gains, and increased employment (ABS, 2007) (**Figure 22**).

Australia's current purchasing power ranks 20th in the world, and on a per capita basis, 24th (CIA, 2015c).

Figure 22: Australia GDP per capita (purchasing power parity, \$, 1990-2015).



Source: Trading Economics, (2015e)

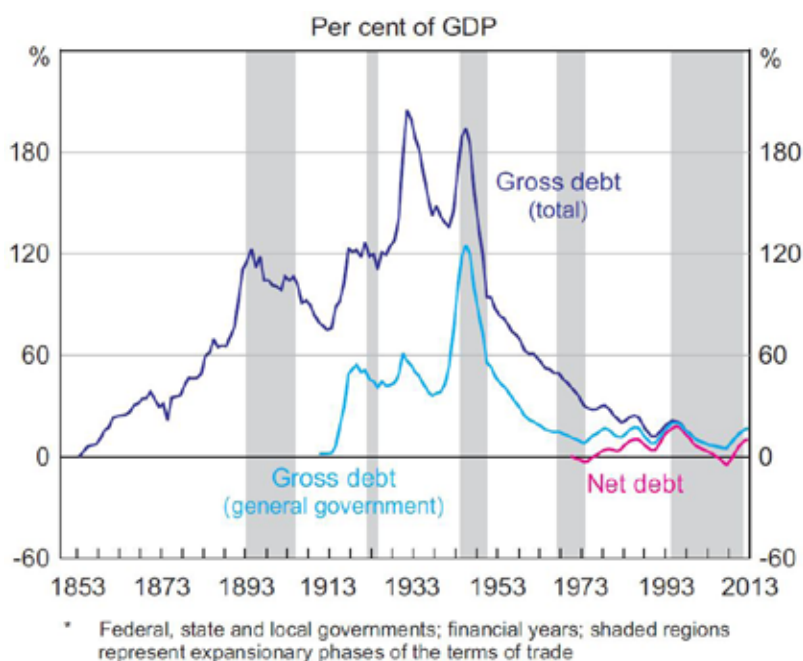
6.2.7 Foreign investment

Since its foundation, Australia has been largely built on foreign capital. During its history Australia has been a large recipient of overseas direct and indirect investment; already by the 1930s the level of foreign investment was 160% of GDP (Varghese, 2014). The bulk of direct investments originates in developed countries like the USA or the U.K., which are the countries also holding the largest stock of foreign investments and are also top destinations for Australian investment abroad (DFAT, 2013). Also Japan has played an important role in the development and expansion of Australia. A number of large multinational mining companies including BHP Billiton (76% foreign owned), Newcrest, Rio Tinto, Alcoa, Chalco, Shenhua (a Chinese mining company), Alcan and Xstrata operate in Australia which shows the investor friendly approach of the country. Moreover, the development of mining has relied heavily on foreign investment (Garnett, 2015). A proactive foreign investment regime, coupled with a well-defined system of laws and procedures, is considered key in encouraging large-scale investment in major mining projects (Chambers, 2013).

6.2.8 Public finance situation

The debt crisis in Australia has its origins in the WWI-related borrowing of the Federal Government, some of which was foreign debt. But the borrowing programmes of the state governments during the 1920s considerably augmented the total debt. Resource rents have benefited the Australian public finance situation substantially from the successive minerals booms since the 1960s and by the beginning of the 1970s the government debt had been largely eliminated. During the early 1970s net debt was mainly negative and reached lows of minus 3.1% of GDP. In 1987 30% of total borrowings were in foreign currencies (di Marco et al., 2009). In 1988 the government decided to concentrate its debt issuance in Australian dollars. From 1995-96 onwards, the combination of successive budget surpluses and Public Trading Enterprises sales led to the elimination of net debt (**Figure 23**). Net debt as a proportion of GDP gradually declined to its historical low of minus 3.8% of GDP in 2007-08, and then increased to reach a plus 17% of GDP in 2014.

Figure 23: Australia's public debt evolution (1852-2013).



Source: Atkin et al., (2014)

The good performance of Australia in keeping the net debt low can be observed in its AAA credit rating. Australia's business environment is favoured by the ease of getting credit (ranks 4th out of 189 economies in the Ease of Doing Business indicator 2015 by the World Bank) and since 2011 Australia has consistently received triple A rating by the three leading credit rating agencies in the world (Moody's, S&P and Fitch) (Darby, 2013).

6.3 Energy and Infrastructure

6.3.1 Energy system, consumption & access

Most of Australia's energy is generated centrally and relies heavily on traditional energy sources (fossil fuels). Domestic energy consumption for 2013/2014 relied on 38.4% on oil, 31.7% on coal and 24% on gas (Department of Industry and Science, 2015). During history Australia's electricity generation has been dominated by coal, which is cheap and accessible. This has underpinned Australia's economic development (Australian Government, 2015a). Australia's transport system is heavily dependent on oil: currently the combined dependency on crude and fuel imports is around 90% (30% higher than in 2000, mainly due to a decline in production). Renewable energy sources account for only modest proportions of Australia's primary energy consumption (around 5%) and electricity generation (7%), although their use has been increasing strongly in recent years (Geoscience Australia and ABARE, 2010). Australians have improved the efficiency of their energy use over the last 50 years. Despite a sustained high level of population growth, energy consumption has grown at a slower rate. There are two main reasons explaining this: technological improvements and fuel switching have resulted in more efficient use of energy; and the growth in the economy has come from the services sector, which is less energy intensive. Yet, when internationally rated on energy consumption, Australia does relatively poorly. It is the world's 20th largest primary energy consumer and ranks 16th for per capita consumption (Future Directions International, 2010).

6.3.2 Transport infrastructure

Australia's economic history as a trading nation has been notably influenced by the development of inland freight transport infrastructure. The construction of roads, railways and terminals, ports (gateways for exports) and intermodal transport infrastructure has been very important for a competitive and stable development of trade, and has been done geographically following the development of Australia's major cities and the mineral resources sector. The first railways in Australia were built between 1850 and 1875, and the railway age followed until 1920 (Lee, 2003). Rail lines developed at different paces in each state with the standardisation of Australia's interstate track gauge only completed in 1995.

Aside from physical infrastructure development, technological innovations were very important to Australian prosperity during the 19th and 20th centuries. Important innovations were the replacement of sailboats with steamships, the invention of bulk carriers during the 1950s making it viable to ship low-value and bulky mineral and energy products, and the decline in the cost of long-distance air travel (especially for passengers, such as for fly-in fly-out schemes) following the arrival of jet aircraft (McLean, 2013). A cheap and stable foreign supply of oil has also been crucial for a petroleum-intensive development. Drive-in and drive-out schemes have also been instrumental for overcoming shortages of workforce at mines.

6.3.2.1 Road infrastructure

For passengers, mainly concentrated in the Australia capital cities, road transport in federal and state highways and local roads represents over 70% of all domestic passenger movements within Australia.

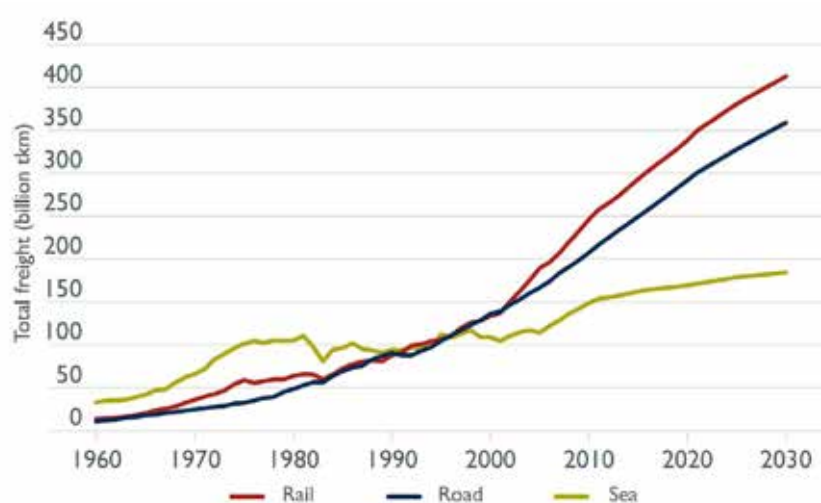
6.3.2.2 Rail infrastructure

Australia's domestic freight activity is currently led by rail transport (**Figure 24**) in an operational heavy railway network comprising around 33,000 route-kilometres, with 10% being electrified and the rest powered by diesel since the 1950s (before which they were coal-fuelled). The role of rail in Australia's economic activity has increased dramatically in recent

years. Rail presently accounts for 49% of the freight activity, up from about 36% at the turn of the 20th century. This is largely due to rail transport of iron ore and coal exports (rail transport from mines to ports) which account for over 80% of total rail freight. While road usage has increased, the increase has been less pronounced. Road and coastal sea freight cover around 35% and 17% of total freight respectively, with air freight comprising a minimal amount when examined by weight (Department of Infrastructure and

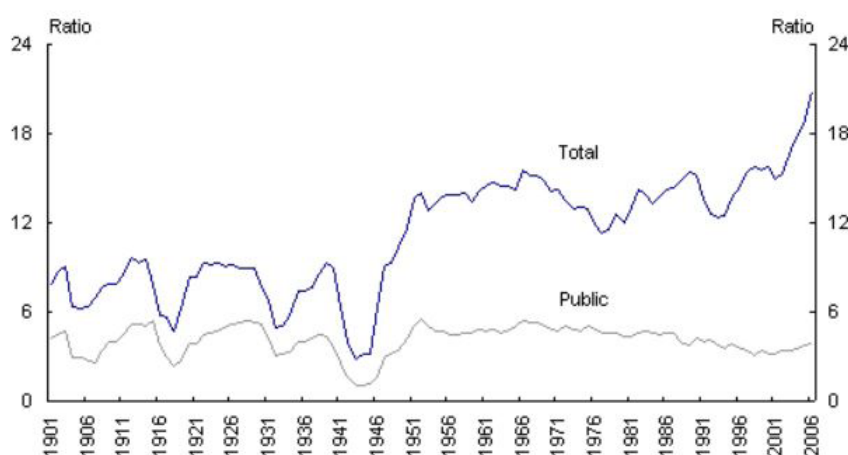
Regional Development, 2014a). Bulk movements dominate railway transport, and intrastate bulk freight in Western Australia (iron ore) accounted for over 56% of national rail freight tonnes in 2012-2013. The East Turner River valley in the Pilbara has the third-busiest railway corridor in the world, and the corridor carries the world's heaviest rail wagon payloads (BITRE, 2014). Rail is also important for non-bulk freight, and it accounts for the majority of intercapital freight.

Figure 24: Domestic freight activity growth, inclusive of projections to 2030.



Source: BITRE (2009)

Figure 25: Australia's ratios of total and public investment in infrastructure to GDP, 1901-2006.



Source: Coombs and Roberts (2007)

6.3.2.3 Port infrastructure

Bulk commodities, such as aluminium ores, iron ore and petroleum account for over 70% of domestic coastal shipping movements. By volume, the major iron ore and coal exporting ports in Australia are: Port Hedland (world's largest bulk export port), Dampier, Cape Lambert, Newcastle (world's largest coal export port), Hay Point and Gladstone. Together they account for around 80% of total merchandise export volumes. Capital city ports - Sydney, Melbourne, Brisbane and Fremantle (Perth) - number among the next five largest ports (after the bulk coal and iron ore ports) by total trade volume

(Department of Infrastructure and Regional Development, 2014a).

Throughout the 20th century total fixed capital investment in infrastructure as a proportion of Australian GDP has fluctuated widely from around 3% to around 19% (**Figure 25**). Australia's private and public infrastructure expenditure, as a percentage of GDP, compares favourably to other OECD countries. While slipping during the global financial crisis, the private sector is now contributing about 50% of Australia's infrastructure investment (Department of Infrastructure and Regional Development, 2014b).

7. Political and legal factors

7.1 Political factors

7.1.1 Administrative structure

Australia has a federal system of government, with a national (Commonwealth) government and six states (New South Wales, Queensland, South Australia, Tasmania, Victoria and Western Australia) and two territories (Australian Capital Territory and Northern Territory) (**Figure 26**). In 1901, The Commonwealth of Australia was formed by the federation of the independent colonies (which then became the states). Government is divided into three levels: Commonwealth, state and territory, and local.

7.1.2 Governmental stability & transparency

Australia follows a Westminster system of government and law inherited from the British who colonized the country. Australia is considered a mature, politically stable democracy and ranks high among the world's most stable political environments. Australia ranks 51st in a list of 144 countries in the field of transparency of government policymaking (World Economic Forum, 2014); 11th in the world in Transparency International's corruption perceptions index (Transparency International, 2015). Australia ranks 25th in the field of Public trust in Politicians,

Figure 26: Australia's political division.



Source: University of Texas Libraries, (2015)

below Canada (ranked 13th) and Japan (ranked 21st) but above the USA (ranked 48th) and South Africa (ranked 90th) (World Economic Forum, 2014). Long-term national stability and security of tenure are considered top decision criteria for exploration in the mining industry. This political stability has been important in the socio-economic development of the country, for instance in the attraction of foreign investments during decades.

7.1.3 Fiscal policies

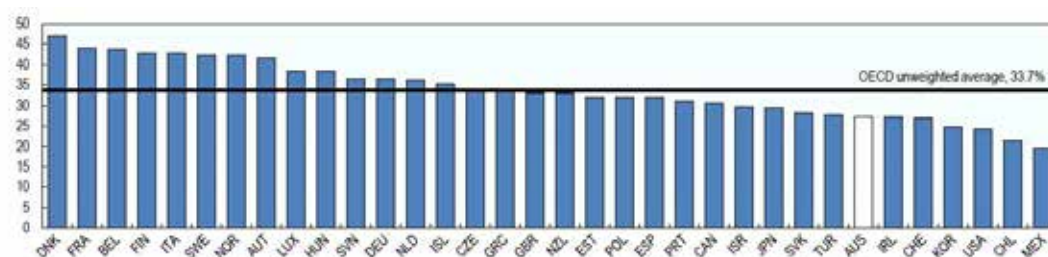
The central role of Australia's tax system is to raise the revenue needed to fund essential government services, infrastructure requirements and a strong social safety net. The role of the public sector in the Australian economy has changed considerably over the past century. Public revenue and expenditure have become larger as a share of the economy. For example, tax revenue has increased from

5% of GDP at the turn of the 20th century to over 20% today. Meanwhile, there has been a shift away from indirect taxation, which had been favoured due to reasons of feasibility, towards personal and company income taxation (Atkin et al., 2014).

In Australia mineral rights belong to the Crown and are administered by states (rather than by the Commonwealth). As a result individual and usually different royalty regimes are legislated and enforced by each Australian state and territory. The Commonwealth Government has centralised power in terms of legislating and enforcing laws relating to the assessment and collection of off-shore minerals and petroleum royalties, and of corporate income tax from mining operations (Guj, 2012).

In terms of competitiveness, Australia has a relatively low overall tax burden of 27.3% (2012), below the OECD average (33.7% for 2012) (**Figure 27**).

Figure 27: Overall tax burden as a percentage of GDP for OECD countries (2014).



Source: OECD (2014d)

The tax scheme is less competitive due to higher taxes on income and profits (15.9%; OECD average: 11.4%) (OECD, 2014d). However, in overall terms the taxation scheme of Australia ranks 5th in the International Tax Competitiveness Index mainly due to low consumption and property taxes (Pomerleau and Lundeen, 2014) but negatively affected by a high corporate income tax (30%) while the average of its competitors in the Asia-Pacific region is 23.5% and across the OECD is 25%.

The average rate of corporate tax paid in Australia by the mining industry in 2008-2009 was 13.9% of the industry's gross operating surplus. This is significantly lower than the theoretical 30% corporate

income tax (of taxable income) mainly due to tax deductions available for the sector (Richardson and Denniss, 2011). In addition to income tax, companies must pay mining royalties to the relevant state or Territory governments. Each of these jurisdictions has its own arrangements. A Minerals Resource Rent Tax (MRRT) imposing a 30% tax on profits exceeding (Australian dollar) \$75 million was introduced for iron ore and coal projects in July 2012. However, this was repealed in 2014. The mining sector receives substantial assistance by state governments in the form of: tax holidays or concessional treatment with respect to payroll tax; in-kind assistance through the provision of cheap or free water and power; fast-track development

arrangements; and the construction of airports and other site-specific infrastructure (Richardson and Denniss, 2011). In terms of promoting exploration, Australia allows a new asset used in exploration or prospecting to be written off provided the miner satisfies certain criteria as set forth in the Taxation Act.

7.1.4 Government spending priorities & allocation

Government spending in Australia has been steadily increasing since the 1960s. In the last 15 years the main drivers of growth in government spending have been social security and welfare and health, followed by general public services and education. Currently Australia's budget outcome for 2014-2015 (Australian dollar \$417 billion, or close to 25% of its GDP) was destined in its majority to social security and welfare (35% of the total), followed by other purposes (including public debt interest, Nominal superannuation interest, natural disaster relief, etc.) (20%) and health spending (16%) (Australian Government, 2015b).

7.1.5 National Security

For most of its history, Australia was protected by Britain's imperial might via a close cooperation, even after WWII. This changed during the 1960s with the UK's attention turning towards Europe and North America (Killen, 1976). From the 1970s economic and political changes occurring in East Asia redefined Australia's national security and defence. Currently Australia's most basic strategic interest remains the defence of Australia against direct attack, and the security, stability and cohesion of close neighbours. Yet, other pillars include countering terrorism, espionage, preserving Australia's border integrity, the Australia-U.S. Alliance, and preventing and disrupting serious and organised crime (Department of the Prime Minister and Cabinet, 2013). At the core of Australia's national security lays the Australian Defence Force (ADF). During the 20th century Australia's military expenditure's as a share of GDP has declined peaking during WWI and WWII to average around 2% during the following decades (Watt and Payne, 2014); cur-

rently it is around 1.7% of GDP, ranking 50th in the world, spending much less than the USA (4.3%) but more than Canada (1.2% of GDP), Japan or South Africa (both around 1% of GDP) (CIA, 2015d).

7.1.6 Safety & crime

Australia is considered a safe country and crime levels are relatively low by international standards. Australia has low homicide rates (UNODC, 2014), and two of Australia's capital cities (Sydney and Melbourne) rank in the top ten of the world's safe cities index (The Economist, 2015). Australia ranks 23rd (1 being most crime prone) in the list of 144 countries in the field of organized crime (World Economic Forum, 2014).

7.1.7 Trade policies

Australia's trade policies have shifted throughout history accommodating to the international environment. Throughout the 19th century the Australian economy was very open to international influences, with few barriers to trade, few restrictions on immigration levels or composition, and few impediments to foreign capital (McLean, 2003). From the 1920s to the 1960s Australia became a highly protected economy, particularly sheltering the manufacturing industries, with the aims of job creation and security. It was believed that without protection Australia's small domestic market, high wages and infant industries would not survive in the international economy (Varghese, 2014). During this protectionist period mineral exports and investments collapsed, the terms of trade remained weak but unemployment remained low. A very important milestone for Australia and Japan took place in 1957, when both countries signed a Commerce Agreement, with Australia becoming the first nation to establish a free trade agreement with Japan after WWII.

During the 1970s the prices for commodity exports (and the terms of trade) deteriorated and Australia shifted its trade and industry policies away from protectionism. A major change occurred in 1973 when the Commonwealth Government cut tariffs by 25% arguing the reduction would stimulate greater efficiency and competitiveness in the industry, and would help

fight inflation. Yet, the measure precipitated a backlash and reforms in tariffs persisted for over a decade, and only by 1996 virtually all tariffs (or effective rates of assistance) had fallen to 5% or less (Banks, 2005). The Trade Practices Act (1974) was passed to promote competition by outlawing anti-competitive activities such as price-fixing, collusion, monopolisation and anti-competitive mergers. During the 1980s Australia introduced a floating dollar and has inserted itself in the world order as more open, market and efficiency-driven economy with minimal restrictions on imports of goods and services. At the same time, Australia has grown in bilateral and regional trade and free trade agreements, seeking to promote a two-way investment.

7.1.8 Bilateral, Multilateral & International agreements

Australia is a founding member of the modern Commonwealth of Nations and is the third-largest contributor to the Commonwealth budget. Australia plays an active role in the United Nations (founding member), provides core funding to the Asian Development Bank and the World Bank Group, and participates actively in the World Trade Organisation, APEC, the G20, MIKTA, and other trade forums. Australia has free trade agreements (FTA) in force with the ASEAN (with New Zealand), Chile, New Zealand, the USA, Korea, Malaysia, Singapore, and Thailand, and it has had an Economic Partnership Agreement with Japan since 2014. In June 2015 Australia signed a landmark FTA with China, its largest trading partner. FTAs under negotiation include Australia-Gulf Cooperation Council, Australia-India Comprehensive Economic Cooperation Agreement, Indonesia-Australia Comprehensive Economic Partnership Agreement, Pacific Agreement on Closer Economic Relations (PACER) Plus, Regional Comprehensive Economic Partnership (RCEP), Trade in Services Agreement (TiSA) and the Trans-Pacific Partnership Agreement (DFAT, 2015c).

7.1.9 Sustainable development policies

The Australian National Strategy for Ecologically Sustainable Development was adopted by all levels of government in 1992. It aims to ensure that development improves total quality of life, now and in the future, in a way that maintains the ecological processes on which life depends. Core objectives include enhancing individual and community well-being, providing equity within and between generations and protecting biological diversity (Department of the Environment, 2010). Australia is committed to implementing the agenda for sustainable development that was agreed by world leaders at the UN Conference on Sustainable Development (Rio+20) held in Rio de Janeiro, Brazil in June 2012. Australia's priorities are: the sustainable management of oceans; sustainable development goals; indigenous land and sea management; mining for sustainable development; gender equality; food security; and disaster risk reduction. Sustainability issues have been widely embraced by government agencies and the private sector during the last decades which can be seen under aspects of environmental reporting, sustainable procurement, the spread of environmental management systems, and specific topics like water efficiency in government operations and in agriculture and mining operations. Yet, despite the strength of the strategy, Australia still has a number of unresolved environmental issues including increasing greenhouse gas emissions and deterioration of its biodiversity (National Sustainability Council et al., 2013).

7.2 Legal Factors

7.2.1 Legal Framework

The Australian legal system developed from the legal system of Britain, which was installed in Australia as a part of the process of colonisation beginning in the 1770s. Each of the six colonies was granted a right by the British Parliament to develop its own laws and legal system. Finally, the Australian Constitution was passed as an Act of the British Parliament and took effect on 1901. Since Federation, Australians have been subject to the

laws (the rule of law) of two legal systems, federal (Commonwealth) laws and the laws of the states or territories in which they live (Banks, 2006). Likewise, local governments pass by-laws. An important feature of the Australian legal system is that it is 'adversarial', meaning that the competing claims of the two parties to a case are put forward for decision by an independent decision maker (a court or tribunal) (Banks, 2006:3).

A key factor in Australia's development of the resources sector has been the systematic development of a legal framework which aims to protect miners and secure their interests, particularly when moving from exploration to development and operational stages (Chambers, 2013). In the Fraser Institute's most recent survey it has been consistently indicated that roughly 40% of mining companies' investment decision is determined by policy factors (Jackson and Green, 2015). Australia has been consistently considered the world's most secure location (lowest political risk) for mining investment in the Behre Dohlbear ranking in the period 2005-2013, being passed only by Canada in 2014 (Wyatt and McCurdy, 2014). Western Australia has been Australia's most attractive location for mining investment in the "Investment Attractiveness Index" by the Fraser Institute, followed by South Australia, Queensland and the Northern Territory. Western Australia was the world's most attractive location in 2013 but it has since dropped to 5th position (Jackson and Green, 2015).

The Australian mining sector has developed and grown framed by an open and transparent licensing system, which secures the transition from exploration to the mining phase in a project. The licensing system provides a clear means through which ownership of the minerals is transferred from the state as the owner to the private miners who are then able to engage in mining operations (Chambers, 2013). Also important is the legislation recognising and protecting native title rights and interest of indigenous people as described in the Commonwealth Native Title Act (1993). This act gives registered native title claimants or native title holders a right to negotiate with project

developers in certain issues, including the grant of an exploration, mining or petroleum permit or title (Chambers, 2013).

Mineral resources in Australia are subject to two jurisdictions: Commonwealth and State. Onshore mining is primarily a State Government matter, although the development of a mining project will require consideration of certain Commonwealth laws. Offshore projects fall within a complex matrix of Commonwealth, State and Territory areas. While most mining related legislation is made by the states (Mining Acts granting mining licensees and leases, state agreements for particular projects), some ancillary issues (such as indigenous affairs) are regulated by the Commonwealth. In practice, the divisions of powers between the two levels of government are generally clear and unambiguous, and Commonwealth powers are concurrent to the powers of the States. In Australia mining leases are regarded as the most valuable form of mining interests (Chambers, 2013). In Australia each state maintains its own court system, and has also established Warden's Courts to manage specific issues relevant to mining law.

7.2.2 Resources Ownership & Property Rights Law

Australia is a constitutional monarchy with The Queen as the Sovereign. Since February 7th 1952, the Australian Sovereign has been Her Majesty Queen Elizabeth II (Pink, 2012). In Australia ownership of mineral and energy resources generally lies with the Crown (in practice, the State, Territory and Commonwealth governments), regardless of who owns the surface rights (Industry Commission, 1991). The mineral and surface land rights are separated to recognise the belief that benefits from the use of Australia's mineral deposits belong to the entire community and not solely to whoever owns the surface rights (Eggert, 2013; Industry Commission, 1991). Mining is not explicitly mentioned in the Australian Constitution and thus, as a result of a historical evolution and tradition, ownership of minerals found onshore and off-shore within the three-nautical-mile limits belongs to the relevant state or Territory holding jurisdic-

tion (in some exceptions mineral rights have been awarded to Aboriginal Land Councils and to private owners); minerals located beyond the limit belongs to the Commonwealth.

The mineral regulatory and fiscal regime of the states comprises a large number of laws dealing with all aspects of taxation, licensing, occupational health and safety, environmental and other aspects of mineral exploration, mining activities, compensation (e.g. to land holders for allowing exploration) and subsequent land rehabilitation. The obligation for mining companies to pay special mineral royalties and taxes is generally embodied in provisions of the mining laws of various states, with the actual rates and administrative processes and procedures contained in supporting regulations. A small proportion of the Australian land mass is privately owned. The vast majority of it is in government hands (un-alienated Crown Land, e.g. 93% of Western Australia, a rich mining state), vacant or subject to long-term leases to pastoralists, or occupied by nature reserves, national parks or indigenous reserves. If negotiated land access agreements fail, land use conflicts may arise when commercially viable mineral or energy resources are co-located in productive agricultural lands. Since 2013 discussions have been taking place in the Senate with regards to a bill titled "Landholders Right to Refuse (Gas and Coal)" which intends to establish that Australian landholders have the right to refuse the undertaking of gas and coal mining activities by corporations on their land, and bans hydraulic fracturing operations by corporations without prior written authorisation of each person with an ownership interest in the land.

The Australian permitting procedure for mining is considered stringent but effective with a permitting delay of around two years, similar to Canada and much better than for the USA (SNL Metals & Mining, 2015). A good example is the underground nickel-copper Nova project located in the Fraser Range in Western Australia. The Nova deposit was discovered in July 2012, a feasibility study was completed in July 2014 and an agreement with the Ngadju people, owners of

the surface rights, was entered in August 2014. Shortly thereafter the Nova Mining Lease was granted by the Western Australian Department of Minerals and Petroleum, and the project is currently under construction (IGO, 2015). Another good example is DeGrussa, Western Australia's largest copper-gold mine, which marked first production three years after the discovery drill hole in April 2009 setting a new benchmark for the efficient development of resources in WA. A last good example is given by the project to expand the Olympic Dam mine with an open pit operating simultaneously with the underground mine, an expensive and challenging project from engineering and environmental points of view. The state governments worked with BHP closely on the approval procedure and all permits for this major expansion were obtained by BHP within a 9 month period. Finally, the expansion did not take place due to economic conditions.

It is also important to note the role of the government, proactively working with exploration companies to ensure that documents are appropriately prepared for lease and permit applications. Usually the government assigns case managers (or project officers) to complex projects (a service called comprehensive case management services in the Department of Mines and Petroleum, WA, or a one-stop-shop in South Australia). The case manager works closely with the company to assist in the resolution of bottlenecks and to negotiate agreed approval timelines across government. They support the company by ensuring that their permit application is fully aligned with the relevant state and Federal Government regulations and expectations (Tyne, 2015). The Department of Mines and Petroleum publishes an Approvals Performance Report in which it discloses an internal target (timeline in business days to come to a decision) for the approval of applications and the actual performance.

7.2.3 Business legislation

Business legislation has in general been very favourable to promote investments. Australia ranks 10th in the world under the indicator "Ease of doing business", parti-

cularly driven by a high credit rating, enforcement of contracts and ease of starting a business (World Bank, 2014).

7.2.4 Employment, Labour laws & Unions

The Australian labour movement (trade unions and labour-affiliated parties) originated in the 19th century out of the prolonged depression of the 1890s and through the 1890s Great Strikes (sheep shearers complaining against poor conditions and wages and over freedom of contract). The passage of the Trade Union Acts in the late 19th century made it legal for the first time for workers to negotiate collectively with their employers over wages and conditions. By the beginning of the 20th century (and due to sustained defeats and repression) most workers were non-union, but unionism grew rapidly due to its own organising efforts, the expansion of the manufacturing sector and more favourable market conditions (Bowden, 2011). By 1920 unions represented more than 50% of all employees. Union membership increased during the 20th century under the peculiar nature of arrangements for the compulsory conciliation and arbitration of industrial disputes, which were adopted by the Commonwealth and most States after the Act of 1904. At the heart of this system was an independent industrial tribunal which possessed compulsory powers over industrial disputes including the power to issue binding determinations described as awards. In the end, arbitration court awards typically gave preference in employment to unionists. Another important victory of unions was the establishment of a minimum wage.

National union membership never fell below 40% between 1913 and 1992. Nowadays less than 20% of the workforce is unionized (Bowden, 2011). Losses of union membership between 1954 and 1971 are explained partly due to mechanisation. A rapid loss in unionism took place during the 1980s with the dismantling of the arbitration mechanism, a growth in precarious employment and employer anti-union strategies. In 1996, the Liberal-National Party Coalition federal government ('the Coalition government')

was elected to office proposing further 'deregulation' of Australian labour law, establishing a system of individual agreements (WorkChoices). The WorkChoices legislation was replaced in 2009 by the Fair Work Act which covers unfair dismissal, the 10 National Employment Standards (maximum weekly hours, flexible working arrangements, parental and annual leave, among others), adverse action and redundancy. This Act empowers trade unions as the default representatives of employees and requires the establishment of "enterprise agreements".

7.2.5 Environmental regulations & their enforcement

There is a history of public environmental concerns in Australia but the scope and number of pollution-related statutes increased with population growth and industrialisation. Until the 1950s there were no significant anti-pollution laws in Australia (Norberry, 1995).

Between 1970 and 1985 some significant environmental events occurred, including the Love Canal toxic chemical emergency in the United States, the Bhopal poisonous gas release in India in 1984, the Seveso air pollution disaster in Northern Italy in 1976, the Amoco Cadiz oil spill in 1978, as well as the recognition of such global problems as the Greenhouse Effect and the hole in the Ozone Layer. Around 1985, due to these and many other environmental problems, the passage of environmental legislation in Australia increased dramatically. During the 1990s one most important umbrella legislation was passed: the Commonwealth Environment Protection and Biodiversity Conservation Act (1999).

Environmental protection is a major issue for Australia's environmental enforcement authorities, both the Commonwealth and the States. The Federal Department of the Environment and the Environmental Protection Authority (EPA) for each State are the most relevant. The Clean Energy Regulator and the Great Barrier Reef Marine Park Authority are also important. Any mining investment needs to comply with environmental regulations before the commencement of exploration and during production and closure of

the mine. Conservation of the natural environment of mining operations is among the most important responsibilities of each state government. Each state has formulated its own mining management process aimed to ensure that mining projects comply with minimum environmental standards (Chambers, 2013).

Climate change and the extent to which it is caused by human-induced greenhouse gas emissions is a major topic of discussion for the Australian Government. Australia ranks 17th in the world in terms of CO₂ emissions (from energy consumption) (CIA, 2015e) and does not figure among the top cumulative CO₂ or greenhouse gases emitter country in the 1990-2011 period (Ge et al., 2014). Australia features 19th in the world ranking of top 20 contributors to global temperature change but ranks 7th if contributions per capita are considered (Matthews et al., 2014). In the last 15 years Australia's GHG emissions fell by 2% and per-capita and per unit of GDP emissions have fallen by 19% and 33% respectively since 2000. Thus, the energy intensity of the Australian economy has generally improved (Australian

Government, 2015a). Yet, net carbon dioxide emissions continue to rise (National Sustainability Council et al., 2013) and Australia remains one of the leading coal export nations to China and Japan which involves also significant (indirect) contributions to the CO₂ emissions in recipient countries.

Australia's current target is to reduce GHG emissions to 5% below 2000 levels by 2020, but the government has recently announced that it intends to reduce GHG emissions to 26-28% below 2005 levels by 2030. In 2012, the Labour Government introduced a carbon pricing scheme (floating carbon tax), which was repealed in 2014 by the Coalition Government arguing the tax was ineffective (Taylor, 2014). The Coalition Government has instead implemented a policy suite called Direct Action, which includes a (Australian dollar) \$2.5 billion Emissions Reduction Fund and Safeguard mechanism. The fund is a voluntary policy which creates an incentive for Australian businesses to adopt smarter practices and cut the amount of GHG emissions they create.

8. Technological factors

8.1 Research and Development (scientific infrastructure)

8.1.1 Knowledge and resource base

Australia's knowledge and resource base infrastructure ranks relatively high in comparison to the rest of the world. In terms of total research and development (R&D) personnel nationwide and total R&D personnel in business per capita (full-time work equivalent per 1,000 people) Australia ranks 18th and 23rd respectively in the world (2012) (Institute for Management Development, 2014). Australia ranks 10th in the world for total expenditure on R&D per capita. For the indicator "Researchers and scientists", which measures if such professionals are attracted or not to a country, Australia ranks 14th in the world (Institute for Management Development, 2014). In terms of (absolute) business expenditure on R&D, Australia ranks 8th in the world (2012), one position higher than Canada, but ranks 17th in the world (and 15th in the OECD – 2013) regarding business expenditure on R&D as a percentage of GDP (Institute for Management Development, 2014; OECD, 2013c). Australia ranks 27th in the world for the availability of scientists and engineers; this places Australia below Japan (3rd), the USA (5th) and Canada (12th) although much higher than South Africa (102nd) (World Economic Forum, 2014).

R&D expenditure in Australia, like in most OECD countries and the EU-28, is dominated by business enterprises, followed to a lesser extent by higher education institutions, and then by the government and private non-profit institutions. Australia, similar to Canada and Japan, provides a significant part of support to business investments in R&D indirectly via tax incentives. In contrast, the USA and South Africa provide most of the government support via direct funding (OECD, 2011). Significant R&D activities and technical innovations certainly feature in the natural resources industry, but they camouflage Australia's far from stellar over-

all performance in R&D. Two signifiers of Australia's overall R&D performance are intellectual property outcomes and innovation outputs. Both show that strong R&D and innovation in the resource sector do not compensate for weaknesses in other sectors (Liew, 2012).

The Australian state and territory governments undertake various geoscience programmes to support mineral and petroleum exploration in Australia. These programmes acquire and make available pre-competitive geoscience information and datasets, particularly covering important areas, as a basis for exploration in both proven and green-field mineral provinces. The geoscience archive includes regional surveys (airborne geophysical surveys, ground gravity, geochemical surveys), geological mapping, mineral occurrence mapping, core photography and hyperspectral core scanning, geochronology, rock property data. It is believed that collection and low-cost dissemination of geoscientific data by government agencies is critical for exploration success, encourages exploration in high risk frontier regions, reduces risk and uncertainty across the exploration industry, encourages participation of a larger number of small investors and prevents exploration activity falling to ineffectively low levels.

The state of Western Australia provides special incentives to promote exploration such as the Exploration Incentive Scheme, a co-funded drilling programme available for competitive companies (Acil Allen Consulting, 2015).

8.1.2 R&D culture

There is strong empirical evidence that innovation has a positive impact on the economy and the competitiveness of Australian businesses (Department of Industry, 2014). The public sector science and engineering base in Australia has generally been regarded as strong. However, Australia is not ranked high (i.e. in the top ten) as an innovative country, e.g.

in the Bloomberg Innovation Index 2015 (Bloomberg, 2015). Several of the emerging economies have now overtaken Australia (for example, South Korea and Taiwan) particularly in physical and engineering disciplines. The strengths of the Australian Innovation System include a broad scientific base, world class in some areas, success in converting knowledge into patents and high growth in several areas including biotechnology (Biotechnology R&D indicator, OECD, 2013c), pharmaceuticals, office and computing equipment. Yet, weaknesses include insufficient attention to the development of human capital (e.g. entrepreneurship) and small average company size which may hinder competition in new industries (Roos et al., 2005).

Despite generally positive business conditions for innovation, evidence shows that Australian exporters are, on average, not high performers of innovation by OECD standards (Department of Industry, 2014). Large Australian businesses account for around 66% of investment in R&D and around 95% of exports. However, Australian large businesses rank 21st out of 32 OECD countries on the proportion of businesses innovating, and are well below other less developed resource-exporting countries like Brazil and South Africa. In contrast to large firms, Australian small to medium-sized enterprises (SMEs) are innovative by OECD standards, ranking 5th out of 29 OECD countries on the proportion of businesses innovating. The predominant innovation that occurs in Australian firms of all sizes is the adoption and modification of innovations developed elsewhere, rather than delivering new-to-market (including new-to-world) innovations (Department of Industry, 2014). Australia's moderate to low performance on innovation - particularly new-to-market innovation - is a result of a poor business innovation culture in association with average to poor management performance (Department of Industry, 2014). Australian business R&D investment in manufacturing is below the OECD average, particularly in high-tech manufacturing. Food, paper and basic metals manufacturing have relatively high R&D intensities by OECD standards. Many service sectors

such as finance and insurance services, and information and communication services also have relatively high R&D intensities (Department of Industry, 2014). Australia ranks 13th for global innovation (GE, 2013).

The mining sector has played an important role in Australia's innovation history. For instance, flotation (the most effective method of separating minerals from the gangue) emerged in Broken Hill in 1903. Heap leaching of low grade ore bearing gold was pioneered in Western Australia. More recently, research in Australia has discovered that a large number of gold-vein ore deposits represent fault zones that were active during seismic aftershocks along major geological faults. Another important discovery is the Rock Mesh which installs protective meshes on mine walls, improving safety of mine workers (Minalliance, 2012).

Industry investment for Australia's mining sector is mainly focused on applied research and experimental development work commercially oriented, i.e. where less risks exist of capturing a return on the investment. In contrast, government-funded research tends to focus on basic and applied, particularly where there may be broader industry benefits but the private sector decides not to invest in. R&D relevant to mineral exploration is conducted within individual companies, industry-government partnerships and public organisations. Investment by industry and government in R&D and subsequent technology adoption by the industry and the public geological surveys are important factors underlying the Australian minerals industry competitiveness (Hogan, 2004).

Australia, particularly the Pilbara region in Western Australia, is nowadays a pioneering and innovation field where several companies are testing and some others already running automation technologies. One of the best known examples is Rio Tinto's world-class innovation programme "Mine for the Future™" conceived in 2007 which is highly focussed on autonomous technologies like driverless haul trucks, an automated wheel changer for haul trucks, remote train and ship loading, remotely operated drill and smart blast activities, as well as the deve-

development of a new class of tunnelling machines for underground mines (Fisher and Schnittger, 2012). This programme was initiated at the beginning of the rise in iron ore prices and was designed to deliver productivity increases at the downside of the price cycle in order to strengthen the company's resilience. This programme was created under the conviction that productivity and cost control are critical business drivers, and that technologically advanced operations are more productive, safer, yield higher value, are internationally competitive, and yield higher relative tax revenues.

Since commencing Rio Tinto's automated haulage system (AHS) trucks moved the first 100 million tonnes by April 2013 and then the next 100 million tonnes just 13 months later. Currently there are 53 autonomous trucks operating across Rio Tinto mine sites at Yandicoogina, Namuldi and Hope Downs 4. They respond to GPS directions to deliver loads 24 hours a day supervised by remote operators. Rio Tinto's main remote operation centre is located next to Perth airport and from there the company operates some 14 mines, all rail and port infrastructure plus power and water distribution systems. This programme has been supported by the Australian Centre for Field Robotics (ACFR) at the University of Sydney which established Rio Tinto's Centre for Mine Automation in August 2007. Another important investment by Rio Tinto was in big data to help it make smarter operational decisions. The company opened a data analytics centre in India back in March 2015, to assess massive volumes of data captured by hundreds of sensors fixed to equipment around its sites. Rio Tinto is using predictive mathematics, machine learning and advanced modelling to identify a range of problems before they occur in the hope maintenance costs can be predicted and reduced (Heber, 2015).

In Perth, BHP has also set up an integrated remote operations centre from where they coordinate all Pilbara-based iron ore operations from pit to port. Other examples of automation include the Roy Hill iron ore mine also in the Pilbara region and the Meandu coal mine in Queens-

land. Both projects have contracted the services of Wenco International Mining Systems Ltd, a Hitachi Group company, which consists of a variety of advanced drive and traffic control systems components and on-board machines. Roy Hill received in March 2015 the first driverless locomotives to be remotely operated from the control centre in Perth.

Many of the companies within the METS sector are also conducting research into new exploration techniques, e.g. sonic drilling.

8.2 Patents, products, technologies generated

Australia ranks 12th in the world (2011) in terms of scientific articles published by origin of author, below USA (1st), Japan (3rd) and Canada (7th). Yet, in terms of patent applications Australia lags behind and ranks 21st in the world (2012); regarding patent grants (average 2010-2012), Australian applicants rank 16th in the world below Japan (1st), the USA (2nd) and Canada (14th). If patents in force (2012) are considered, Australia ranks 19th in the world below Japan (1st), the USA (8th) and Canada (17th) (Institute for Management Development, 2014). Australia's research institutions have a solid reputation for quality and rank favourably with other leading innovative countries. Australian researchers produce 6.2% of the world's most cited publications and the country ranks as one of the top in terms of the number of publications in highly influential journals as a percentage of population (Austrade, 2015a).

8.3 Telecommunications & E-commerce

Telecommunications play an important role for Australians. Australia ranks 12th in the ICT development index which measures access, use and skills toward information and communication technologies (ITU, 2014). Australia has a high internet penetration rate: it ranks 9th in the world in terms of internet users (2013) (per 1,000 people), and ranked 11th in terms of investment in telecommunications as a percentage of GDP (0.59% in 2012) (Institute for Management Development, 2014). Australia ranks 50th in the world

(2014) for the communications technology indicator which describes how well the sector meets business requirements. In terms of computers in use (2013) Australia ranked 15th in the world with a global share of 1.1% and 14th in terms of computers per capita (2013). Australia leads in the OECD the “E-business uptake” indicator, which measures the proportion of firms (with at least 10 persons employed) receiving electronic orders (OECD,

2013c). Regarding the e-commerce, Australia has recently been ranked as the 10th largest global retail e-commerce market (AT Kearney, 2015). Currently the National Broadband Network (NBN), a national wholesale-only, open-access data network, is being developed. This new network is seen as crucial by many for the new mining projects which increasingly are expected to rely on more and more automated operations.

9. Conclusions

9.1 Overview of economic development – history and drivers

Australia is currently the world's 20th largest economy as measured by GDP (by purchasing power parity) and has the 24th highest GDP (PPP) per capita. Australia ranks 2nd in the world on the Human Development Index (2013) and features a service based economy with mining and manufacturing making smaller but significant contributions to the GDP. Australia's economic development process during the last 200 years can be largely explained by the shifting interactions between resource abundance and institutional arrangements, and between international economic conditions and policy responses to them (e.g. changing trade and immigration policies). This has resulted in significant shifts in the sources of Australia's economic growth. Resource abundance has been closely linked with the changing international demand for different commodities, and in the mineral and energy resources sector, with the investments in exploration and the major discoveries of deposits. In the first half of the 20th century, Australia adopted an inward orientation and protectionist strategy. This was a result of a disruption in its international demand for wool and minerals which lead government to promote domestic industry over imports. After WWII, international markets changed rapidly due to the rapid industrialisation of Japan and West Germany. This led Australia to re-orientate its economic growth strategy, favouring trade. More recently, Australia's enduring good economic performance has been closely linked to the emerging Chinese market, though Japan still remains its second largest trading partner, buyer of commodities and an important source of capital. These changes demonstrate the adaptability of Australia's resources economy. Australia has demonstrated a willingness to adapt the institutional context (via economic reforms and policy shifts) to take advantage of its location in the Asia Pacific region.

A highly skilled labour force sustained by a well-developed educational and health system has also been a pillar of Australia's good performance. Labour immigration has also been integral to the development of Australia's population, economy and society. As a small, settler economy, Australia has continuously promoted inward immigration in order to secure a skilled labour force. Immigration policies have changed through time, first favouring European immigration, and then shifting after WWII to a massive not-only-European immigration which greatly contributed to entrepreneurship and the provision of foreign investments. Temporary migration has also proved important in meeting the demand for skilled labour for Australia's mining sector.

9.2 Conclusions specific to the non-energy raw materials sector

9.2.1 Industry and trade

The minerals industry has been critical for Australia's economic health and this is expected to continue. It provides the biggest share of Australia's exports and has a significant impact on the broader economy through income effects, wage levels (influence on the terms of trade) and contributions to tax revenue and employment. Successive mining booms have largely contributed to shaping the Australian economy and have been the backbone of the country's economic development. The mining industry has successfully developed in Australia due to: i) a substantial mineral endowment (identified via prospecting and exploration investments), and ii) a political and economic environment friendly to mining investments and supported by the government on a long-term basis.

The Australian mineral endowment, areas of mineral potential and high quality ore deposits, have been a pre-condition of the industry allowing competition with lower cost countries. Likewise, information about endowment such as geos-

science data, including geologic databases freely available in many states, has been a highly important enabler of exploration for mineral resources.

For a long time Australia has provided a stable institutional and political environment which has enabled mining companies to invest in new technologies, aiming the exploration and development of new mines. The taxation framework has been instrumental to attract mining investments. However, in recent years, a lack of stability in government tax policy (e.g. the introduction and subsequent removal of the Minerals Resource Rent Tax) has been seen as a hindrance for the mining industry.

Another important factor has been the ownership rights (mineral rights are held by the state, making ownership and access negotiations easier). While the health of the mining industry (particularly mineral exploration) waxes and wanes with global commodity investment cycles, local factors have had a significant effect on the amount and type of investment. In the last three decades other factors of importance have been: i) the relative cost and efficiency of permitting procedures in the different Australian states (efficient permitting times with low costs have been and still remain a key driver of the mining industry); ii) security of tenure and the cost of negotiating land access agreements with Indigenous Australian peoples; and iii) the high cost of labour, particularly during the recent boom when competition for skilled personnel resulted in extreme salary rises, without a concomitant rise in productivity.

The continuous expansion of the mining industry, particularly in the last three decades, has resulted in the development of the METS sector into a strong component of the Australian economy. METS companies are generally well positioned to withstand the financial shocks caused by international markets with the ability to export goods and services in down cycles of the mining business. The importance of social and environmental issues varies geographically but they have significant impact on Australia's mining industry.

Australia-based companies have in general been successful in obtaining a

"social licence to operate". On one hand this is due to continuous efforts in implementing best social and environmental practices, including agreements with Indigenous Australian peoples. On the other hand, the industry has benefited from most major mining centres being located in remote areas, away from major population centres and areas of intensive agriculture. This has been influential in reducing community objections to mining and instrumental for the granting of the social licence.

Australia's large size and long distances have not become a deterrent for mining companies. Many mineral deposits areas in Australia had been isolated but companies have simply built the needed infrastructure themselves (e.g. transport, energy, workforce). The lack of skilled workforce in the country has been traditionally resolved via employment-based immigration, and the local shortages have been overcome using fly-in fly-out or drive-in drive-out schemes, and again via immigrant labour.

A more complete and detailed analysis of this issue will be found in the Transactional Analysis Report produced in WP1.4 (D 1.5 Report on transactional analysis of Industry and Trade).

9.2.2 Education and outreach

Mining education has a long tradition and a good reputation in Australia. However, a structural problem in the industry since the 1970s has been the lack of synchronisation between the number of graduates and the fluctuations in the mining business cycle. The pattern has developed of students starting their studies during an upward cycle and graduating during a downward cycle when the demand is not high enough to provide jobs for all of them. Mining Education Australia, a joint industry-university collaborative partnership intends to overcome these problems by a number of measures to constantly attract larger number of undergraduate students to mining engineering courses. However, there remains uncertainty as to whether, in the next five years, there will be sufficient graduates to meet manpower requirements in the next upward commodities cycle.

A more complete and detailed analysis of this issue will be found in the Transactional Analysis Report produced in WP1.3 (D 1.4 Report on transactional analysis of Education and Outreach).

9.2.3 Research and innovation

Australia has traditionally maintained a high level of investment in R&I in the mining sector. One of the most significant Australian innovations was the development of flotation (the most effective method of separating minerals from the gangue) in Broken Hill in 1903. This is a method widely used in the international metal mining industry (e.g. in copper mines). Similarly influential was the development of heap leaching of low grade ore bearing gold in Western Australia. Nowadays Australia keeps pioneering R&I

to increase productivity and cost control and the Pilbara region acts as the main focus for innovation activity in mining. In this region several companies, including some from the METS sector, are testing and running automation technologies such as driverless haul trucks, automated wheel changers for haul trucks, remote train and ship loading, remotely operated drill and smart blast activities, as well as the development of a new class of tunnelling machines for underground mines. All such innovations are expected to continue to provide Australia with a competitive advantage in the field of mining.

A more complete and detailed analysis of this issue will be found in the Transactional Analysis Report produced in WP1.2 (D 1.3 Report on transactional analysis of Research and Innovation).

Appendix A1: Multi-factor matrix and radar charts

The multi-factor matrix

The information in the preceding sections of this report is summarised in a multi-factor matrix which is presented in Appendix A2. In each Country Report, the findings of the research (presented in Chapters 4 to 8 inclusive) have been used to develop a “multi-factor matrix”. The matrix for each Reference Country aims to both summarise the findings of the research and to represent the relative importance of each factor to the economic development of each country.

The weightings ascribed to factors in the matrices (and the ‘radar charts’ to which they give rise) are included for completeness in this report; this organisation of information and preliminary analysis of findings provides the basis for ongoing discussion within the WP1 team and between the WP1 team and the expert panels.

Each matrix has 6 columns as indicated below.

Category | Code | Subcategory | Weight | Justification of judgement | Source

Five main categories of factors have been considered (column 1), reflecting the main chapter headings in each of the country reports (see above).

These are further divided into subcategories, consistent with the sub-sections of each chapter (one for each of the 49 explanatory factors), and the codes ascribed to the sub-categories are the sub-section numbers (columns 2 and 3). The importance of each subcategory has been ascribed a numerical weight in column 4, using the following scale:

Table 2: Numerical weights for fulfilling the multi-factor matrix

Weight	Level of importance
5	Very high importance
4	High importance
3	Medium importance
2	Low importance
1	Very low importance

The assignment of weights for the multi-factor matrices has been a collaborative effort between WP 1 partners with input from the country experts. A short justification for the ascribed weighting is given in column 5 and the source(s) of information are given in column 6.

Sub-totals are given for the weighting scores at the end of the matrix section for each main category and, at the end of the matrix, an average score is created for each main category by dividing the sum of the weighting scores by the number of factors (subcategories) considered.

Radar charts

The information and weighting scores assigned in the matrix have been summarised via 5- and 12- axis “radar charts” (**Figure 28** and **Figure 29**). The five axis charts depict the relative importance of the five main categories of factors considered, by plotting the average weighting score on the relevant axis. To further emphasise the relative importance of the primary factors, the sizes of the points on the radar chart are proportional to the average scores.

To provide more detailed insight into the relative importance of factors in the multi-factor matrices, a more 'granular' radar chart has been produced for each country, with 12 axes, each representing one (or a group) of the subcategories in the matrix. The 12 factors selected are as follows (numbers in brackets are the codes (and subsection numbers) relating to the 12 factors chosen):

Geo-environmental Factors (Chapter 4)

1. Natural and mineral resources (4.2)

Socio-cultural Factors (Chapter 5)

2. Demographics and immigration (5.2.1)
3. Cultural norms and values (5.2.5)
4. Education system & infrastructure (average of 5.3.1 and 5.3.2)

Economic factors (Chapter 6)

5. Economic output (6.2.2)
6. Foreign investment (6.2.7)
7. Energy system and consumption (6.3.1)
8. Transport infrastructure (6.3.2)

Political and legal factors (Chapter 7)

9. Resources ownership & property rights law (7.2.2)
10. Trade and trade policies (average of 6.1.3 and 7.1.7)

Technological factors (Chapter 8)

11. Knowledge and resource base and R&D culture (average of 8.1.1 and 8.1.2)
12. Patents, products and technology (8.2)

The choice of 12 factors and groups of factors from the 49 subcategories in the multi-factor matrix was subjective and the final selection was based on discussion within the WP1 team and with the country experts. These are intended to allow for more detailed characterisation of and comparison between the reference countries and, ultimately, with EU countries. They have been selected to be broadly consistent with key factors provided by the World Economic Forum in its Global Competitiveness Report, and to be equally relevant to explaining economic development in general and the raw materials sector in particular in all countries included in this project. Unlike the 5 axis chart, the plotted points on the 12 axis chart are all the same size.

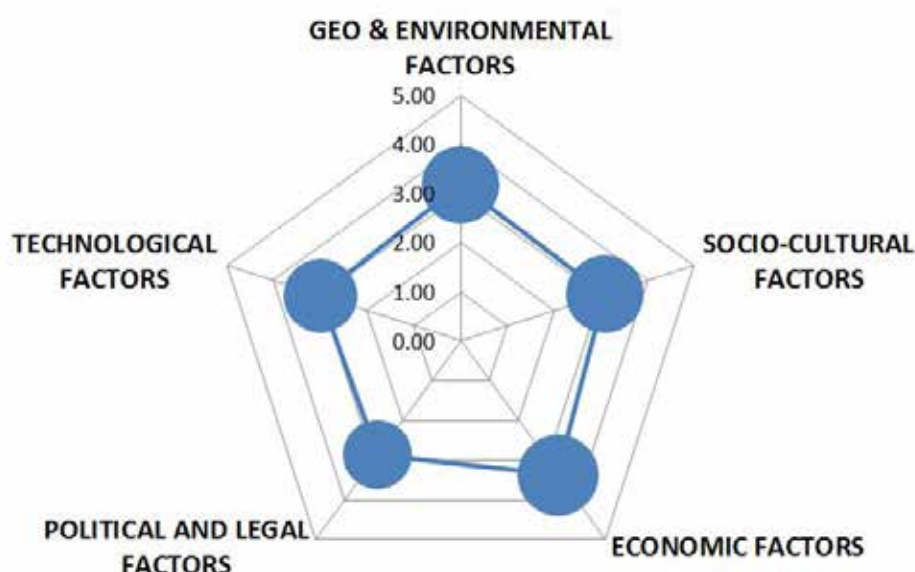
5 axis radar chart for Australia

The five axes radar chart allows concluding that economic and geo & environmental factors are the most important factors explaining the country's economic development, but are closely followed by technological and socio-cultural factors. Geo & environmental factors indicate the importance of known mineral resources, i.e. not only the mineral potential but also of exploration investments and geoscience data which indicates different levels of mineral potential per regions.

The high importance of the economic factors is explained due to the sustained good management that the country has implemented, taking advantage of its natural and mineral resource endowment (geo & environmental factors). Australian governments have been flexible in adapting to the changing international market conditions and have achieved to sustain long periods of GDP growth (the golden ages) by changing the necessary economic policies and by using an efficient management of the available resources (promoting foreign investment in mining exploration, efficient management of scarce resources such as water, efficient permitting procedure, a sustained successful trade policy with changing trade partners, reliable infrastructure).

Technological factors have been important as Australia has remained in the top 20 in the world in terms of innovation, R&D. In the mining sector, the country has driven innovation with an important history of process innovations. In the socio-cultural dimension, the role of immigration has been a key issue in growing the population and ensuring a skilled, well-educated and healthy labour force sustained by universal access to education and health care system.

Figure 28: Five axes radar chart for Australia.



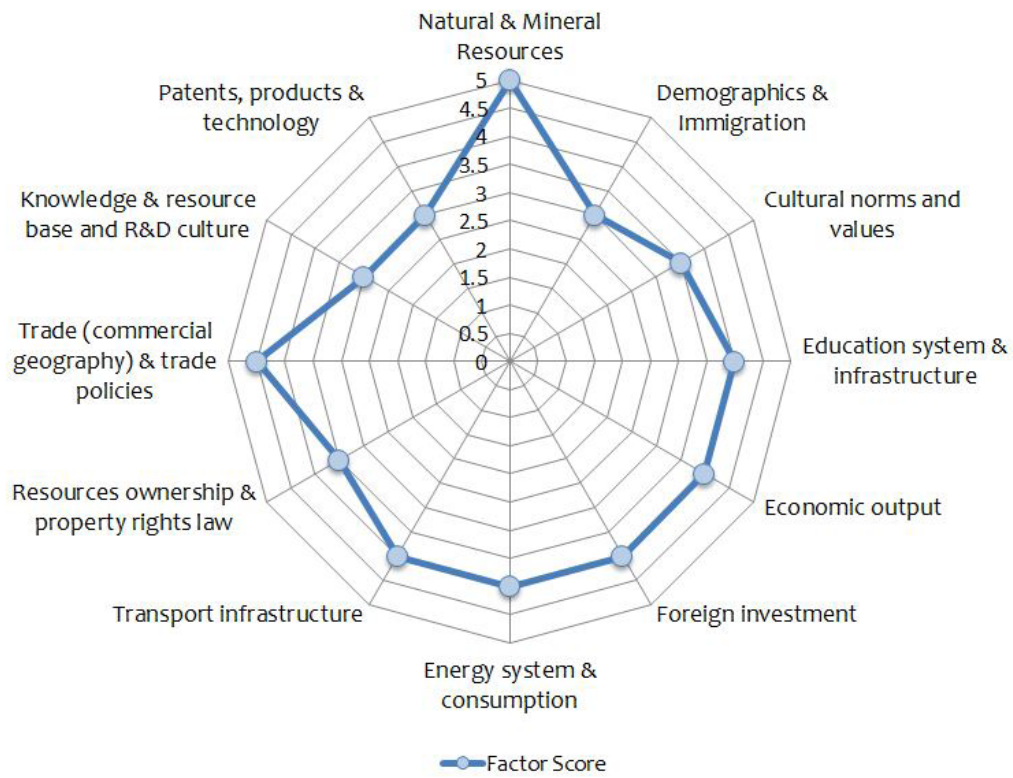
12 axis radar chart for Australia

The twelve axes radar chart enables a more detailed view of the relative weights of the factors and clearly reflects the high importance of the natural and mineral resources endowment (inclusive of geoscientific data which has identified via exploration mineral reserves and resources) of the country. This appears as a sine qua non condition for the economic development experienced, particularly due to the mining booms but also with wool during the first half of the 19th century. Trade & trade policies, changing from an open era to a protectionist era during the first half of the 20th century, and then back to a gradually more and more open economy have enabled Australia (the “trading economy”) to successfully secure international markets for its commodities exports and likewise secure the necessary imports for the economy to function, e.g. oil, petroleum, motor vehicles, medicaments, etc.

The radar chart also highlights the importance of the institutional context (Australia is considered a politically stable, mature representative democracy ranking low in the corruption perceptions index) favouring foreign investments (a key aspect during Australia’s economic history of heavy reliance on inbound investments, mainly from the USA, U.K. and Japan) in crucial sectors like the mining one. Also continued strong investments in education (attainment levels and infrastructure), health (at an average OECD level but good) and transport infrastructure (mainly freight via railway and ports for bulk commodities, but also for passengers in cities) have been the pillar of the country achieving high living standards.

Cheap and abundant oil (mainly imported but also domestically produced) and coal have also been important as they have historically been the backbone of Australia’s energy matrix and competitiveness, e.g. of manufacturing, but also of the mining sector. Also a sustained positive economic output (GDP growth) explained due to increases in productivity (e.g. multi-factor productivity) has been of importance for the country to maintain a competitive exporting sector.

Figure 29: Twelve axes radar chart for Australia.



Appendix A2: Australia multi-factor matrix

Category	Code	Subcategory	Weight	Justification of judgement	Source
GEO & ENVIRONMENTAL FACTORS	4.1	Geographical situation	5	Australia's geographical situation has been quite important during its economic development process as it enabled it to be less impacted during the First and Second World War, and it has benefited the country substantially after WWII given its ease of access to the Asian Pacific market rapidly industrializing, and more recently to the growing demand for minerals by China and India.	McLean, 2013
	4.2	Natural & mineral resources	5	Australia's natural and mineral resources wealth has been a key factor in its economic development process and it the high living standards achieved by its population. These have been of key importance continuously, but particularly during the five mining booms and the three golden ages.	McLean 2013; Battelli-no 2010
	4.3	Water resources	4	The availability of water has had an important influence on the pattern of economic development in Australia. Throughout Australia's history, the link between water availability and agricultural production has been very important and so it has been for the development of the mining sector. Moreover, the country has overcome its water availability inequality by efficient water management programmes, which indicates how important this input for the economic history has been.	McLean 2013; National Water Commission 2011
	4.4	Climate	2	Catastrophic and extreme weather events have at times caused significant economic damage to regions of Australia but they have not been, from a historical perspective, a main cause of socio-economic development. They are expected to gain importance, though, in the near future due to climate change issues.	CEDA, 2014; Pink, 2012; Massola, 2011; Smith, 2011; Massola, 2011; Smith, 2011
	4.5	Geological Factors	1	Even some earthquakes of importance have hit Australia and caused economic damages, earthquakes and earthquake hazard risks have not been a major factor explaining the economic development of Australia.	Middelmann, 2007
	4.6	Ecologically Sensitive Areas	2	Australia's ecologically sensitive areas and biodiversity-rich ecosystems have not played a significant role either detracting or enabling economic development and mining investments.	-
Subtotal		All geo & environmental factors (6)	19		
SOCIO-CULTURAL FACTORS	5.1	Historical Background	5	The four inflection points have had a high influence on Australia's economic development. All of them reflect policy shifts and a re-orientation of the economic growth strategy according to changing international economic conditions.	Butlin, 2014; Vile and Withers, 2014; McLean, 2013

5.2.1	Demographics	3	Australia's population growth, in large parts of its history and now led mainly by external immigration, has been moderately important in achieving economic development. A skilled labour force (quality) has been very important and remains of importance in order to gain in productivity and innovation, but per se the sustained growth of the population is not an explanatory factor of high importance in the economic development.	Kay et al., 2012; ABS, 2014b; Butlin, 2014
5.2.2	Ethnic composition	4	Because of its significant level of immigration and cultural mix of the population, Australia has become a multicultural nation with people from many different backgrounds and cultures. It ranks 3rd in the OECD in terms of foreign-borns. Yet, this has been predominantly achieved by external immigration, with the roles of Aborigines and Torres Strait Islanders being left aside of the economic development process. Yet, given the high influence that European and non-European settler and immigrants had on the country formation, the "Ethnic heterogeneity" is considered of high importance.	Austrade, 2015a; Pink, 2012; Nieuwenhuysen et al., 2011; Office of Multicultural Interests, 2012
5.2.3	Language	2	English the national language of Australia and is spoken by the vast majority of the population. The language has facilitated the integration of Australia in the world economy led by English speaking nations (USA and United Kingdom).	ABS, 2012a
5.2.4	Religion	1	No literature has been found investigating the role of religion in Australia's economic development and thus the importance is considered low in this case.	-
5.2.5	Cultural Norms, Values & Conflicts	3.5	Cultural norms and the value of education, reflecting the legacy of immigration, have been found to have played a moderately important role in the Australian economic development process. The individualistic and masculine character of the society (competition-driven) (according to Hofstede's model) also explains values and norms behind the economic success of the country.	Nieuwenhuysen et al., 2011; McLean, 2013:252; The Hofstede Centre, 2015
5.2.6	Civil society & environmental awareness	2	The Australian civil society has been active during history struggling for the recognition of the rights of Aborigines and has been successful in this during decades, with now the country oriented towards a reconciliation policy. Also the environmental awareness movements have been strong in the country acting as "watchdogs" of the environmental authorities. Yet, the overall influence of both movements in the country's economic development has been low (low importance).	National Museum of Australia, 2014; AEGN, 2014
5.3.1	Education system	4	The level of education reflecting in a skilled, creative and productive workforce has been recognized since early in Australia's history at all levels (Commonwealth, states, territories and communities). Australia's immigration policies have been influenced by this, Australia fares well in international benchmark comparisons and within the OECD. Thus, education can be considered to have had a high importance during Australia economic history.	OECD, 2013a; OECD, 2012; OECD, 2014a; ABS, 2014c; ABS, 2013a

5.3.2	Education infrastructure	3.5	Schools and universities have existed in Australia since before the time of Federation, which shows the importance of education and educational infrastructure for the country, and for the public sector (74% of expenditure on educational institutions is from public sources)	McCrindle, 2015; Norton, 2014; Austrade, 2015a
5.4.1	Health system	3	Australia has consistently provided a universal health care system, especially from the 1970s. This system, among other factors, has contributed to the rise in the life expectancy at birth (currently the 10th largest in the world), the reduction of infant mortality rates. Thus, a healthy population without significant differences in access among states and territories (except for the Northern Territory which has a lower life expectancy rate) has been important for comparatively, moderately important for the economic development process.	CIA, 2015a; OECD, 2014c; ABS, 2013b
5.4.2	Health infrastructure	3	Australia's health infrastructure is average in the OECD but ranks 21st in the world under the indicator "Health infrastructure". Maintaining a healthy workforce has helped in the country's economic development in a moderate way	Institute for Management Development, 2014; OECD, 2014c
Subtotal	All socio-cultural factors (10)	34		
ECONOMIC FACTORS				
6.1.1	Economic structure	4	Long-term shifts in the economic structure of the country reflect the process of economic development of a small, open, settler economy which transitioned towards a service economy largely boosted by resource booms and sustained by a manufacturing sector of medium importance.	Connolly and Lewis, 2010; Adams et al., 2014a
6.1.2	Industrial Geography	3.5	The Australian manufacturing sector has risen and fallen in relative importance through the 20th century, with a substantial rise after WWII until the 1960s, and then a fall in relative importance. Yet, the sector remains important in its generation of innovation and technological changes, addressing trade vulnerability and creating high skill jobs, and it employs currently around a 10% of the workforce (around 1 million people). Thus, it is evaluated as having had a moderate to high importance.	Green and Roos, 2012
6.1.3	Commercial Geography	5	Australia's shifting trade structure and partners has been a key factor in the country's economic development. Australia has changed its trading partners through history to accommodate to the international economic conditions and the demand for natural and mineral resources. This changed from early trading with the British empire, to a more diversified export structure in the 1960s (led by Japan but also with other Asia Pacific countries and the USA) to a more recent re-orientation towards China and India. Australia's balance of payments has been predominantly negative and current account has experienced deficits since 1960. Yet, despite this negative numbers, trade has had a very important role in the country's history.	Adams et al., 2014b; Varghese, 2014; DFAT, 2015a; Atkin et al., 2014; DFAT, 2015b

6.1.4	Agricultural Geography	2.5	<p>Agriculture had a very important role in the Australian economy during the first decade of the 19th century but from then on its relative importance has been declining in comparison to other sectors which have gained in importance. Thus, although remaining as important in regional and rural Australia, its overall importance in the national economy has been low to moderate.</p>	Kay et al., 2012; Productivity Commission, 2005; ABS, 2012c; OECD and FAO, 2009
6.2.1	Economic diversity	2	<p>The country's economic diversity has never been one of its strengths: the Australian economy has traditionally had a lower complexity than most advanced economies. Even though diversity is important for the regions within the country, the overall importance of economic diversity has not been an important explanatory factor of its economic development.</p>	Department of Industry, 2014; Regional Australia Institute, 2013
6.2.2	Economic output	4	<p>Australia's GDP growth averaged 3.5% for the past 52 years and in the past 23 years (after the recession in 1990-91) Australia has been the only developed economy to have recorded no annual recessions. The gross domestic product has been a key indicator of the economic development process. Also productivity gains (e.g. multi-factor productivity) have been very important in keeping the Australia sectors competitive.</p>	United Nations 2015b; Austrade, 2015a; CIA, 2015d
6.2.3	Labour costs, mobility & employment	3	<p>Real unit labour costs in the overall Australian economy have been falling since the early 1990s but they have been increasing in the mining sector. Mobility has traditionally played an important role in the Australia economy, with the workforce moving according to the employment possibilities. Unemployment has not been a sustained noteworthy problem (if seen from a long-term perspective), only surpassing the 10% unemployment rate high during peaks in the 1890s, during the 1930s and in 1983. All in all these three factors have had a medium importance in the economic development.</p>	Austrade, 2015a; Austrade 2015b; Ernst and Young, 2014; Productivity Commission, 2014
6.2.4	Interest rates	3	<p>The management of interest rates by the RBA has only had a moderate influence in Australia's economic development as the economy has been more closely related to factors outside the scope of domestic policies, like international market conditions, supply from the Asia Pacific and international mineral prices (Australia is a price taker in the world market).</p>	RBA 2015a
6.2.5	Inflation rates	3	<p>Australia's inflation rate was important in urging a re-orientation of the economic policy, particularly during the big inflation peaks in the period 1948-1952 and during the 1970s due to the oil embargos. Also deflation played a role only in 1924. The inflation rate has had a medium importance setting the economic development of the country.</p>	RBA, 2015b
6.2.6	Customer liquidation and spending power	2	<p>Australian's level of household savings (indicating the liquidity) declined during the 1980s due to easier access to credits and have only more recently recovered normal levels around 10%. This factor has had a low importance during the economic development as the domestic Australian market is affluent but small if compared to other developed economies. The spending power of Australian is not amongst the highest in the world but has been moderately important for the domestic consumption</p>	Hartstein, 2013

6.2.7	Foreign investment	4	Important in the economic development process have been foreign investments which, since the country's foundation, have initiated important economic sector, like for instance the mining one.	Garrett, 2015; DFAT, 2013; Varghese, 2014
6.2.8	Public finance situation	3	Australia's healthy public finance situation was achieved during the second half of the 20th century fuelled by the successive resource booms. Yet, the elimination of the public debt was rather a consequence and not an explanatory factor of why the country developed. Yet, the long-term commitment of Australians to eliminate the debt has influenced their credibility (e.g. high credit rating) and has played a moderate role in the economic development process.	Atkin et al., 2014
6.3.1	Energy system, consumption & access	4	The Australian energy matrix is (and has traditionally been) highly dependent on fossil fuels (mainly coal and oil). Thus, the price of these inputs (coal domestically produced, oil mostly imported) has had a substantial influence	-
6.3.2	Transport infrastructure	4	Australia's transport infrastructure, especially freight, has been a key development for the country's economic development as a trading nation (or a quarry-economy). Railways, roads and ports have formed a circuit enabling the country to export its bulk mineral commodities and profit from it.	BITRE, 2014; Department of Infrastructure and Regional Development, 2014a; Coombs and Roberts 2007; Department of Infrastructure and Regional Development, 2014b
Subtotal	All economic factors (17)	47		
POLITICAL AND LEGAL FACTORS				
7.1.1	Administrative structure	2	The administrative system in Australia is considered stringent but effective, e.g. in relation to permitting for the mining industry. Yet, in overall this has had a low importance in the country's economic development.	SNL Metals & Mining, 2015
7.1.2	Governmental stability & transparency	3.5	Australia is considered a politically stable and mature democracy and ranks high amongst the world's most stable political environments, e.g. an important factor for attracting (foreign) mining investments. It is considered a low corruption country ranking 11th in the world corruption perceptions index (2014). During its economy history this stability and transparency has had a moderate to high importance.	World Economic Forum, 2014; Transparency International, 2015

7.1.3	Fiscal policies	3	Australia's tax scheme is considered competitive in the international arena, despite having a high corporate tax of 30%. The percentage of the overall tax burden in the GDP is low for Australia, showing that taxes have helped the country to develop but have not been a key explanatory factor, i.e. they have had a moderate importance in financing the Commonwealth, States and Territories	OECD 2014c; OECD, 2014d
7.1.4	Government spending priorities & allocation	3.5	Government spending has been increasing since the 1960s and has had a moderate to higher role in the economic development by supporting social welfare (mainly health and education expenditures)	-
7.1.5	National Security	1	National security has involved a low expenditure in Australia throughout its history	Department of the Prime Minister and Cabinet, 2013
7.1.6	Safety & crime	2	Australia's safety is high by international standards and this has had some impact because the low rates of crime have contributed to investment and development	The Economist, 2015; World Economic Forum, 2014
7.1.7	Trade policies	4	Australia's shifting trade policies have been very important for the country's economic development.	McLean, 2003; Var-ghese, 2014; Banks, 2005
7.1.8	Bilateral, Multilateral & International agreements	4	Trade agreements have been very important during Australia's economic history, being the first agreements with the Great Britain, with the Japanese and more recently by signing a free trade agreement with China and on-going negotiations with India.	DFAT, 2015c;
7.1.9	Sustainable development policies	2	Sustainability and sustainable development aspects have recently (the last three decades) gained in importance and attention in the political agenda and the industry. Thus, such aspects remain more important now than in the past and are of low importance for explaining from long-term perspective the country's economic development	Department of the Environment, 2010; National Sustainability Council et al., 2013
7.2.1	Legal Framework	3.5	The rule of law (legal framework) has had a moderate to high importance in the economic development of the country, e.g. By attracting mining investments.	Chambers, 2013; Jackson and Green, 2015; Wyatt and McCurdy, 2014
7.2.2	Resources Ownership & Property Rights Law	3.5	Surface and mineral rights are separable in Australia, with mineral rights often belonging to the Crown (in practice managed by the Commonwealth, States and Territories), with the mining companies paying royalties and taxes to the corresponding States. These aspects have been important in the competitive development of the mining sector, a major one in the Australian economic development process.	Eggert, 2013; Industry Commission, 1991

7.2.3	Business legislation	3	Business legislation has generally been moderately important to promote investments in Australia	World Bank, 2014
7.2.4	Employment, Labour laws & Unions	3	The existence of unions during the entire 20th century, coupled with the mechanisms of compulsory conciliation and arbitration of industrial disputes did not represent a major cause of industry success or failure; the industry's competitiveness was more closely related to the tariffs and protectionist measures established by the government. Thus, the unions and labour laws protecting the workers played an important part during a certain part of the Australian history but are not considered a key explanatory factor of the Australian economic development process.	Bowden, 2011
7.2.5	Environmental regulations & their enforcement	2	The existence of environmental regulations and their enforcement by environmental authorities has not impeded Australia from becoming a major commodity exporter with good and sound environmental practices. Likewise, Australia has improved its energy intensity but carbon dioxide emissions continue to rise. Thus, environmental regulations cannot be credited to have played an essential role in Australia's economic development.	Norberry, 1995; CIA, 2015e; Australian Government, 2015; National Sustainability Council et al., 2013; Taylor, 2014
Subtotal	All political and legal factors (13)	40		
TECHNOLOGICAL FACTORS				
8.1.1	Knowledge and re-source base	3	Despite a good educational and knowledge creation national system, on an international comparison and in terms of providing research infrastructure, Australia does not rank among the top ten countries in terms of availability of scientists & engineers, R&D personnel nationwide, total R&D personnel in business, researchers and scientists attracted to the country.	Institute for Management Development, 2014; OECD, 2013c; World Economic Forum, 2014
8.1.2	R&D culture	3	Australia is not ranked as an innovative country and does not have a strong R&D culture. Australia has a moderate to low performance on innovation due to a poor business innovation culture. Yet, innovations in the mining sector have been and remain of significant importance (as driver of productivity increase).	Department of Industry, 2014; Minaliance, 2012
8.2	Patents, products, technologies generated	3	Australia is not a leader in patents and innovative products, generally ranking in the top 20 for scientific articles published, patent applications, patent grants, patents in force.	Institute for Management Development, 2014; Austrade, 2015a
8.3	Telecommunications & E-commerce	3	Telecommunications, and more recently e-commerce, have had a moderate influence on Australia's economic development. Australia rank 12th in the ICT development index, 9th in the world in terms of internet users and 11th in terms of investment in telecommunications as a percentage of GDP	Institute for Management Development, 2014; ITU, 2014
Subtotal	All tech factors (4)	12		

RADAR CHART	Sum of weights	Number of factors	Average	Multiplied by ten (to create the size of the point in the radar chart)
GEO & ENVIRONMENTAL FACTORS	19	6	3.17	31.7
SOCIO-CULTURAL FACTORS	34	11	3.09	30.9
ECONOMIC FACTORS	47	14	3.36	33.6
POLITICAL AND LEGAL FACTORS	40	14	2.86	28.6
TECHNOLOGICAL FACTORS	12	4	3	30

Appendix A3: References for Australia country report

- ABS, 2015. Employee Earnings and Hours, Australia, May 2014 - All employees [WWW Document]. URL <http://www.abs.gov.au/ausstats/abs@.nsf/Latestproducts/6306.0Main%20Features2May%202014?opendocument&tabname=Summary&prodno=6306.0&issue=May%202014&num=&view=> (accessed 8.13.15).
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