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Oil and Gas Industry Competitiveness Assessment

**Report on the Framework, Baseline Score,
Insights and Opportunities**

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NERA (National Energy Resources Australia) is an industry-led, not-for-profit initiative, which aims, through a national focus, to improve competitiveness, collaboration and productivity, in energy resources industries, by focusing on reducing cost, directing research to industry needs, improving work skills, facilitating partnerships and reducing regulatory burden. We support the Australian energy resources sector to identify and deliver projects and activities to enhance the sector's innovation, competitiveness and productivity.

Introduction

NERA, in association with Accenture, has completed the Australian Oil and Gas Industry Competitiveness Assessment (ICA), including an Industry Competitiveness Framework (ICF) and Industry Competitiveness Score (ICS). The score provides NERA with a data-driven analysis of how to effectively allocate and direct their resources to deliver maximum industry impact. It also delivers a baseline against which the industry can measure its performance in future releases. This report outlines the methodology utilised and the results and insights gained from the ICS.

From the baseline results, Australia has an overall competitiveness score of 6.4 out of 10, ranking seventh on the Leader Board of global peers, above the world median of 5.5, and lagging behind the world best, the United States, at 7.3. Modelling and analysis finds that improvements across several priority areas have the ability to improve this score by 15%, to align with the world's best.

According to the ICS, Australia ranks first in the world in the Exploration phase of the value chain; however, in the Development and Execution, Production and Abandonment phases, the country ranks at, or below the world median. For the industry to be truly competitive, excellence must run through the entire value chain. Importantly for Australia, the industry is shifting from the Development to the Production phase; as a result, the focus should primarily be on improving operations performance, with a view to building capability in the Abandonment phase.

To achieve improvements in Australia's overall industry competitiveness, this report has identified four priority areas where changes in the short term have the ability to affect the country's performance:

- **Supply chain:** Collaboration between operators and service providers to share resources and infrastructure, as well as setting up regional supply hubs, could see Australia overcome many of its structural supply chain disadvantages.
- **Research and innovation:** Increased collaboration between universities and industry, combined with a focus on commercialisation of research would see Australia become a world leader in oil and gas research and innovation.
- **Workforce:** Investing in building local capability for the Production and Abandonment phases, so that Australia's workforce maintains its high quality.
- **Regulatory reform:** Increasing engagement between industry and government to reduce the "red tape" that adds costs and extends timelines within the industry.

The ICS provides a comprehensive, data-driven assessment of the Australian oil and gas industry from a global viewpoint. The results identify numerous areas for more rigorous study and suggest a number of innovative and collaborative improvements, that if implemented will have a dramatic impact on industry competitiveness. In future years, the ICS will provide a solid baseline against which the industry can measure improvement.

Methodology

Findings from this report are based on research conducted over the course of ten weeks from May to July 2016. The objective was to create an industry relevant measure of oil and gas industry competitiveness that was robust and repeatable, allowing improvements to be tracked over future releases. The initial scope focuses on the oil and gas industry; however, the framework has been designed to expand across the entire Energy Resources sector (Coal and Uranium).

The ICA comprises of two core components: a framework for measuring competitiveness (ICF), and an index score of country competitiveness (ICS). The ICS is displayed in a dashboard to illustrate Australia's relative performance (Dashboard), and a leader board to rank the world's most competitive industries (Leader Board).

To assess competitiveness effectively, a clear definition of the scope of the measurement is required. The business dictionary defines competitiveness as:

*"Ability of a firm, Industry, or a nation to offer products and services that meet the quality standards of the local and world markets at prices that are competitive and provide adequate returns on the resources employed or consumed in producing them"*¹

This analysis considers competitiveness of the industry in the context of a system of interdependent entities who participate in the industry. Within this context, the extent to which a single actor can excel in terms of overall performance is dependent the capacity and capability of the system as a whole. The competitiveness framework considers the four phases of the oil and gas value chain; Exploration, Development & Execution, Production and Abandonment, while also considering operators, supply chain entities (including entities that manufacture, and or deliver products and services), as well as the regulatory environment within which the industry operates.

To identify a collectively exhaustive list of factors that influence industry competitiveness, value driver trees (VDTs) were created for each of the four phases of the value chain, addressing 4 key questions.

- **Capacity** – Does the Oil and Gas industry have the required skills, infrastructure and equipment to produce oil and gas to meet market demand?
- **Capability** – Does the industry, collectively, have the capability (labour, capital and technology) to deliver energy molecules to the market at market competitive prices?
- **Regulatory Environment** – Is the regulatory environment contributing to and enabling the success of the Oil and Gas industry?
- **Political and Social Environment** – Are the political and social environments conducive to and supportive of the Oil and Gas industry?

These broad drivers are further broken down to specific metric level data points. A high-level breakdown of the VDT is shown in Figure 1.

The competitiveness measurement requires a comparison of Australia's performance against a peer group of oil and gas producers. This peer group was selected based on two criteria; market size and data availability. Countries were included if they had a greater than 0.2% share of world production for either oil or gas and if they were captured in more than 80% of the data sources. This resulted in an overall peer group of 30 countries.

Data was collected primarily through secondary research from both public and proprietary data sources. The ICS uses 57 specific data points from 14 different sources across all 30 countries. All data is taken from 2015 data sources, although some metrics utilise longer periods. Key data sources used include; Wood Mackenzie², International Gas Union (IGU)³, International Association of Oil and Gas Producers (IOGP)⁴, the Fraser Institute Global Petroleum Survey⁵, and Accenture's "Ready or Not?" Study⁶.

Where data on a specific industry group or value chain phase was not available, suitable proxy data points were used. Country specific data and surveys have also been used throughout the report to support findings of the ICS; however, these are not included in the competitiveness score. The complete list of data sources is included in the Appendix.

Industry Competitiveness Score

To calculate the ICS, data points from the VDTs were logically split into eight components. Measures specific to a single phase of the value chain were included in their respective phase. Metrics that ran across the value chain were split into four industry growth enablers; Supply Chain, Research and Innovation, Workforce, and Government and Public Involvement. These growth enablers represent core capability, essential to the operation of a successful oil and gas industry. The structure is illustrated in Figure 2.

The combination of the 57 separate data points into a single score of overall industry competitiveness is achieved in three steps:

1. All data points are scored relative to the peer group, between 0 and 10, (where 0 represents the weakest performance and 10 represents the maximum achievable score).
2. A weighted average of data scores is taken at the category level (i.e. Exploration or workforce), generating eight scores for each country.
3. The overall ICS is calculated as a weighted average of the eight components.

This approach takes into consideration the broad definition of competitiveness used throughout this assessment. It also accounts for the interdependencies in the industry between the growth drivers and the different phases of the value chain.

Figure 1: ICF Value Drive Tree

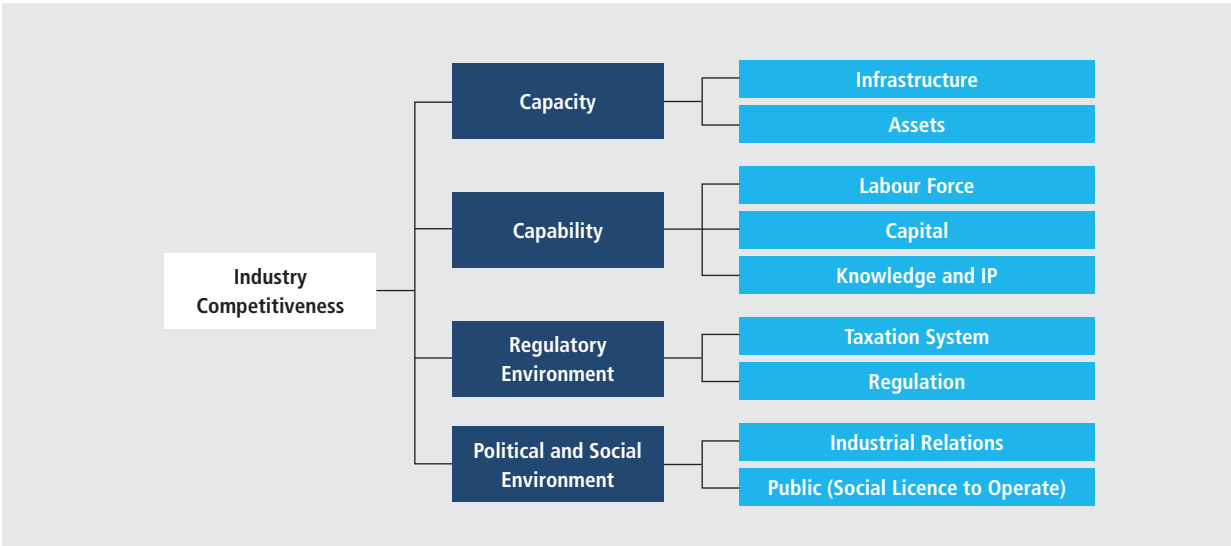
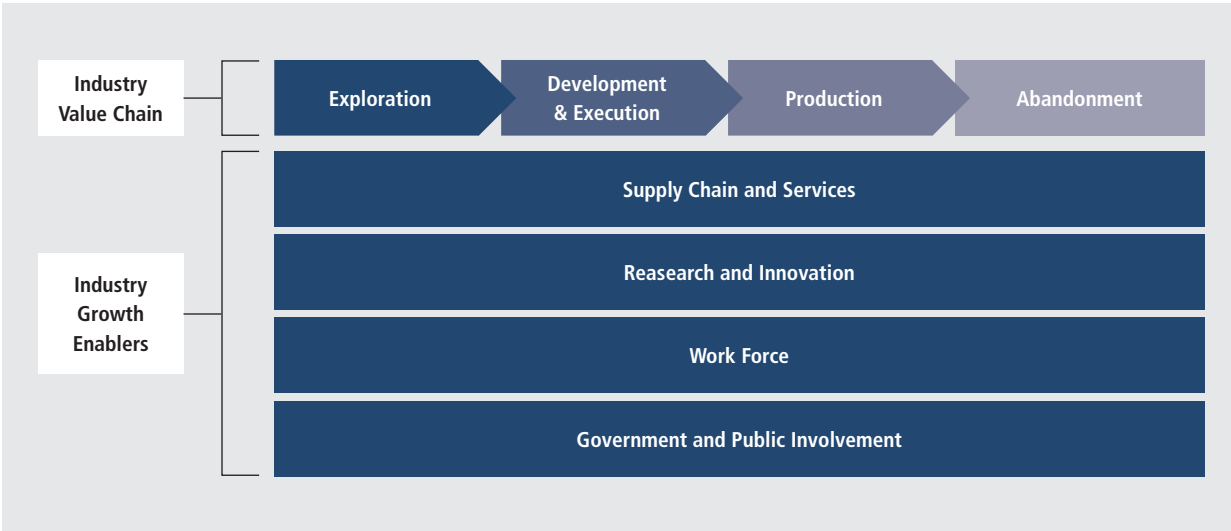


Figure 2: ICS Structure



Industry Competitiveness Results and Insights

Industry Competitiveness Score

Consistency across all key performance measures results in Australia achieving a strong competitive position amongst its peer group, while providing plenty of opportunity to improve.

From the analysis completed, Australia has an Industry Competitiveness Score of 6.4 out of 10, behind the world best, the United States, but above the world median of 5.6. Across the value chain, Australia ranks as the world's most effective and efficient oil and gas explorer; however, the country's lacklustre performance in Development and Execution and Production ultimately affects the economics of delivering

molecules to the market, undermining the country's overall competitiveness score.

Although Australia has a weak score in Development and Execution, the focus needs to shift to maximising performance in Production operations, while carefully considering how best to manage the inevitable wave of decommissioning activities in the Abandonment phase.

The industry growth enablers represent core capability essential to overall success of the oil and gas industry across all phases of the value chain. These enablers are key to improving competitiveness in the near term. Australia performs close to the median across, supply chain, workforce, and government and public enablers, and while Research and Innovation is above the median, it is still far below the world best.

Figure 3: Industry Competitiveness Score Dashboard



Figure 4, presents the ICS Leader Board, where Australia ranks as the world’s seventh most competitive oil and gas producing nation. This places the country in the top quartile of the peer group, and among esteemed company.

While Australia’s performance has some way to go to become the best in the world, Figure 3 shows Australia is well positioned to make a leap forward. By focusing on the Production phase, and making tangible improvements across all four of the industry growth enablers, the country has the ability to move on par with the world best, the United States.

Interestingly, not one country in the peer group scored well enough across the categories to be considered top quartile on an index score basis (7.5 or above). The United States was the closest with a peer group leading score of 7.3. While the index is calculated on a relative basis, the holistic nature of the framework means that any country, in order to score in the top quartile overall, must score highly across all eight measured categories. This approach takes into consideration the complexity and interdependencies of the oil and gas industry, where performance is dependent on the system as a whole.

Figure 4: Industry Competitiveness Leader Board

Country	Competitiveness Rank
USA	1
Norway	2
Qatar	3
Netherlands	4
Canada	5
United Arab Emirates	6
Australia	7
Malaysia	8
United Kingdom	9
China	10

Exploration

Best in class, but what for?

While Australia performs well in the Exploration phase, this remains meaningless if the discovery of hydrocarbons cannot be monetised at scale and at pace.

Australia leads the world as the most competitive country in the Exploration phase of the oil and gas industry with a score of 7.5, well above the global median of 5.3. To effectively measure exploration competitiveness, the assessment considers a number of factors; wells drilled, success rate, well cost, and seismic data availability, across both onshore and offshore operations. While the country does not excel in a single area, the scores across each of the 11 measured data points are consistently above average (Figure 5, onshore and offshore scores have been combined), resulting in the highest average score overall.

One key area of strength for Australia is in the availability, maturity and completeness of geological and seismic data. The Australian government maintains an online repository of data that is free and publically accessible. This encourages information sharing and greater collaboration across the industry. In a survey of oil and gas industry stakeholders, 93.4% believe Australia’s open data on exploration was an asset that encourages worldwide investors and explorers to pursue opportunities within the country 5. Figure 6 compares Australia’s seismic data quality against the peer group.

While the high score in Exploration represents a great advantage for the country, it is important the industry does not become complacent. The abundance of readily available energy resources will not last forever; new techniques will be required to find more complex resource deposits. For Australia to develop further, there are a number of opportunities that can be taken.

Figure 5: Exploration Metric Scores

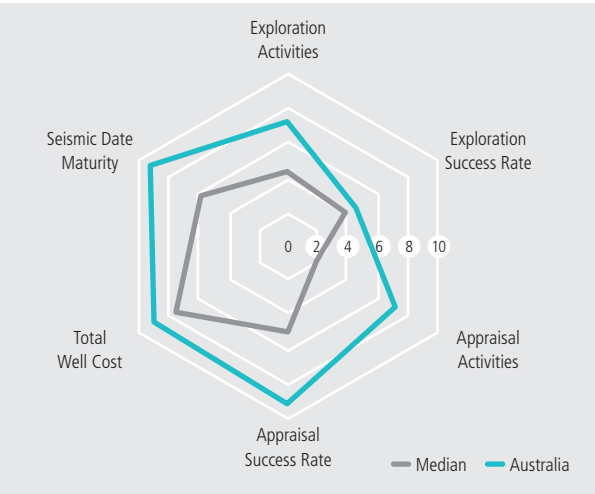
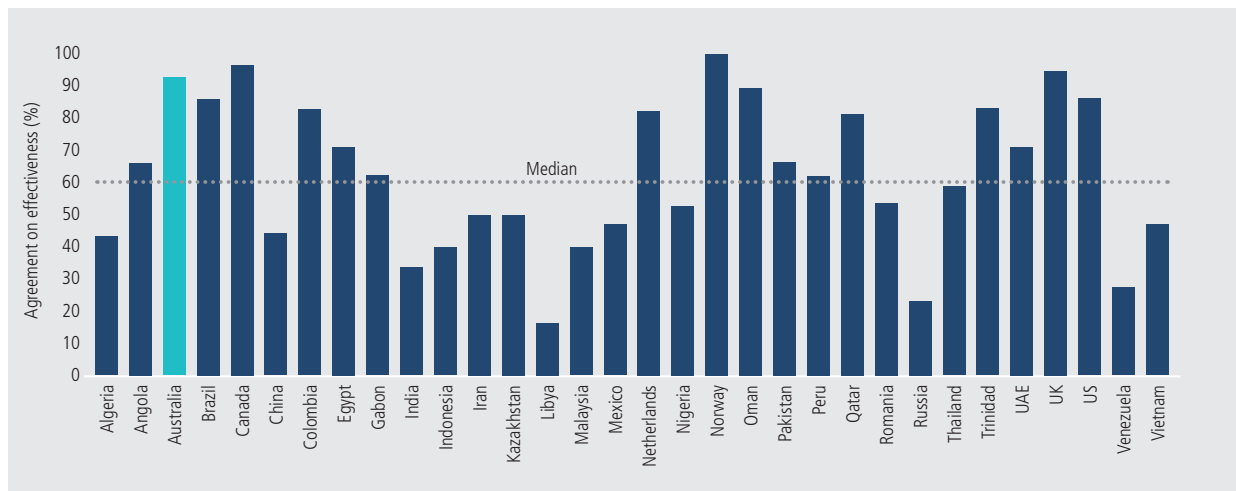


Figure 6: Seismic Data Quality (Fraser Institute)



Australia's competitive advantage in seismic data can be built upon by investing in advanced exploration and seismic technology, and finding new ways to use the data. While Australia has an enormous reserve of seismic data, until now it has been underutilised. Research and data analytics have the ability unlock new insights from this valuable resource. Another way of maximising performance in Exploration is to streamline supply chain activities by coordinating exploration activities, for example, by sharing resources and infrastructure. This would ultimately lead to a reduction in overall exploration cost.

While Australia can make further progress in the Exploration phase, the primary focus should be on the Development and Execution and Production phases of the oil and gas value chain. The country's weaker performance in these phases provides greater opportunity for improvement. Ultimately, if a country cannot deliver molecules to the market competitively, its ability to find them is not important.

Development and Execution

Australia has a poor track record in major capital project development. With construction ramping down, the industry needs to shift its focus to Production.

Australia scored 5.2 (lowest quartile) in the Development and Execution phase of the value chain. The country lags behind the world median of 6.5, and is a long way from the world's best, Qatar, with a score of 8.9. There are several factors contributing to Australia's weak performance in this area:

- Geographical location and remoteness of operating asset sites. The remoteness index indicates that LNG operations in Australia are located in challenging environments (68% difficulty), with large distances between assets and suppliers, and infrastructure (e.g. warehousing) being the most pronounced⁷.
- The high labour cost. According to research Australia ranks as the most expensive workforce in the world (USD\$143,640 per annum)⁸.
- Restrictive industrial relations (66.3% of survey respondents see industrial regulation in Australia as a deterrent to invest), which can cause schedule delays in construction projects due to frequent and extended industrial action⁵.

While there are no new Greenfield projects on the horizon, they will come. If the country wishes to learn from its mistakes, and become a world leader, a number of steps can be taken to improve Development & Execution performance.

Figure 7: Development Schedules

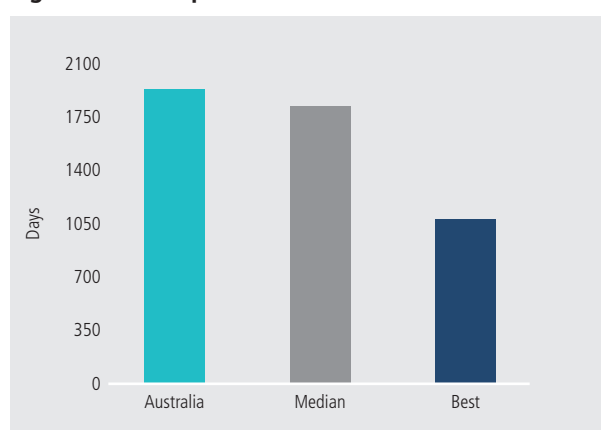


Figure 8: Development Costs

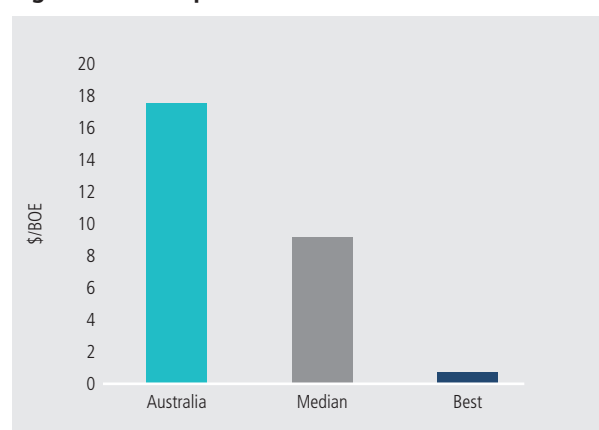
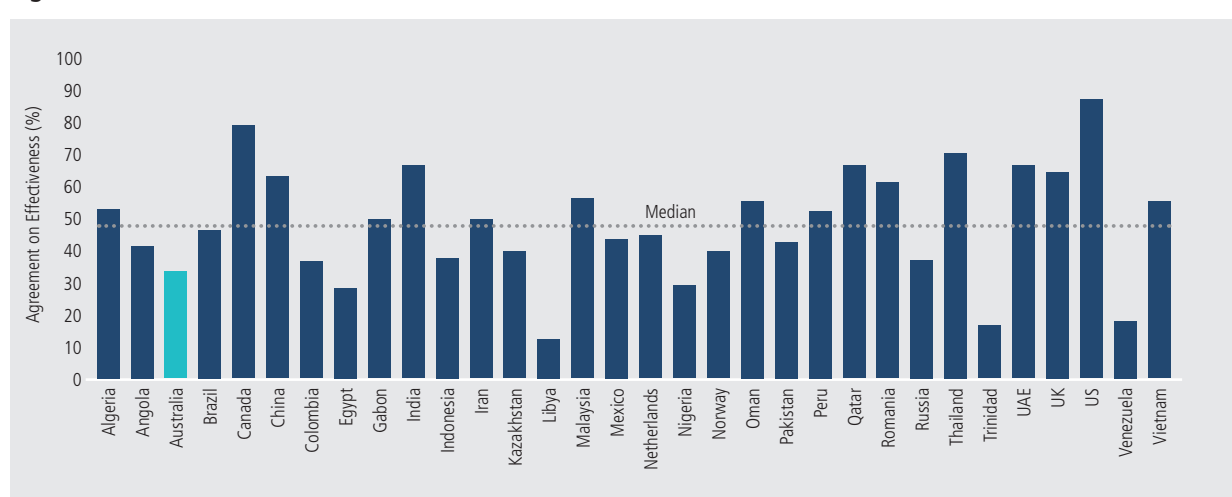


Figure 9: Fraser Institute Industrial Relations Effectiveness



The geographic remoteness of Australian operations is seen as a major limitation to the industry. By collaborating at an industry level to share resources and infrastructure, costs will be reduced significantly. The country could also consider leveraging advanced manufacturing innovations, such as investing in 3D printing capabilities, on-site, to print equipment parts, just in time. This will ultimately reduce cost, reduce warehouse inventory, and remove supply chain wait times. Action should be taken now, to invest in technologies like additive manufacturing so the industry is better prepared.

Building and modularising assets overseas, and then installing and commissioning the assets on-site in Australia, is another option that the Australian industry should consider. This would likely reduce overall construction times and costs, but would mean significantly reduced local content and local capability not developed. It is a longer term strategic decision that all parties need to be involved in and carefully consider.

Industrial relations in Australia is a major burden to the industry, contributing to the high labour costs and major schedule delays. Figure 9 shows Australia's poor performance in the Fraser Institute survey on Industrial Relations

Effectiveness. To improve this the industry must increase long-term open and transparent communication and engagement with unions and other industrial relation bodies.

The country should also review and streamline organisation structures that were created during the Development and Execution phase. EPC companies have a "one-for-one" organisation structure matching the industry operator, which creates too many high cost and overly qualified "white-collar" jobs, which may not add as much tangible value in progressing projects. The focus should instead be on engaging the construction workforce to ensure they are rightly skilled and competent to deliver large scale projects.

While there is significant room for improvement, the Development and Execution phase of the value chain is nearing a close in Australia. The last decade has seen approximately AUD\$230 billion spent in developing some of the world's largest and most technologically advanced LNG facilities⁹. With many of these coming online in the next two years, and with no MCPs in the pipeline, Australia needs to shift the focus to Production operations to maximise value and increase its overall industry competitiveness.

Production

Slashing costs and workforce numbers can only deliver limited short term value. The industry needs to innovate and find new ways of working to maximise value in the Production phase.

Australia performs unremarkably in the Production phase of the industry value chain, with a score of 7.4, slightly above the world median of 6.9, and trailing behind the world's best, Iran, with a score of 9.0. As construction of the MCPs reaches completion by the end of the decade, Australia is set to become the world's largest LNG exporter³. To capitalise on this opportunity and capture long-term (20 to 30 years) value from the enormous development that has occurred, maximising operational excellence is crucial.

Australia has two distinct forms of oil and gas production, onshore (primarily in Queensland) and offshore (primarily in North West Western Australia). While Australia's offshore operations are more competitive, both lag behind the world best (Figure 10). Several structural factors of the industry explain this severe cost disadvantage; geographical location, high labour costs, and restrictive industrial relations. Since the price crash of 2014, the industry has attempted to boost competitiveness through extensive cost cutting exercises. While this has maintained profitability in the short term, it is not sustainable. For the industry to continue to improve, collaborative and innovative solutions are required.

Australia's oil and gas industry is relatively small, accounting for only 0.9% of global production². The country is also home to some of the world's most remote operations. Collaborative solutions are essential to help overcome these disadvantages and compete with large nations like the United States and Russia. Important lessons can be learned from the United Kingdom oil industry, which faces similar disadvantages. Oil and Gas UK, an industry trade body created on the back of successful initiatives such as CRINE¹⁰, has created an efficiency taskforce. The organisation has identified three themes to improve the industry; Business Process; Standardisation; and Cooperation, Culture and Behaviours. Under each theme the oil and gas UK is undertaking a number of collaborative projects that will benefit the industry as a whole. The recent "Simplifying Subsea Projects" initiative found that standardisation has the ability to reduce project costs by as much as 30%.

Increased collaboration is also vital between operators and service providers. This should begin with increased levels of collaboration to share resources and infrastructure and the creation of "regional supply hubs". Ultimately, the industry in Australia needs to change the dynamics of the operator – supplier relationship. Value-based and outcome-focused contracts and agreements need to be established. This will provide greater incentives to suppliers, encouraging more innovation (e.g. 3D printing on-site) and collaboration, which will deliver more value to operators, and the industry as a whole.

Figure 10: Production Operating Costs

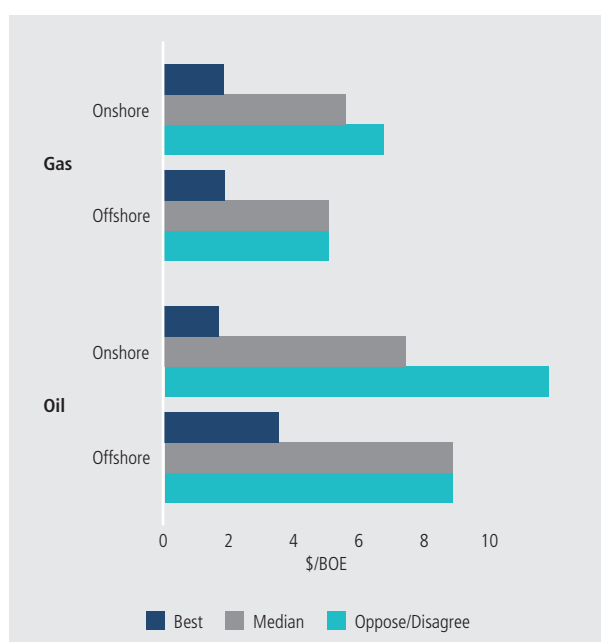


Figure 11: Supply Chain Comparison



Asset integrity management throughout the value chain, especially in the Production phase, is vital for the country to be able to extend the life of its operating assets. Following the example in the United Kingdom, many assets in the United Kingdom Continental Shelf (UKCS) are still operating past their original design life. This was done through successful Asset Life Extension studies and by applying asset management methodologies and technology accordingly. It is estimated that there is an additional 12 to 24 billion barrels of oil to be recovered from the North Sea ¹¹. With a number of large assets already commencing operations and several more to come online in the next two years, there is significant opportunity to extend operation timeframes and generate long-term value for the oil and gas industry.

The recent construction boom has seen some of the world's most technologically advanced LNG facilities be built in Australia. The industry should focus on improving its data analytics capability so it can recover the full value of its investments. The technology has the ability to predict process and equipment failures, leading to increased asset utilisation and overall operating cost reductions, significantly boosting competitiveness. Australia has the ability to lead the world in this space.

From a broader governance perspective, there are approximately 150 statutes and more than 50 agencies regulating the oil and gas industry in Australia ¹². The industry should collaborate with regulatory bodies and the government to constructively review regulation and reduce "red tape" together.

Cutting costs and workforce numbers is beginning to see diminished returns. Australia's current performance in the Production phase still leaves significant room for improvement. Now is the time to invest in finding innovative ways to grow Production capability and maximise long-term value for the industry and the broader economy.

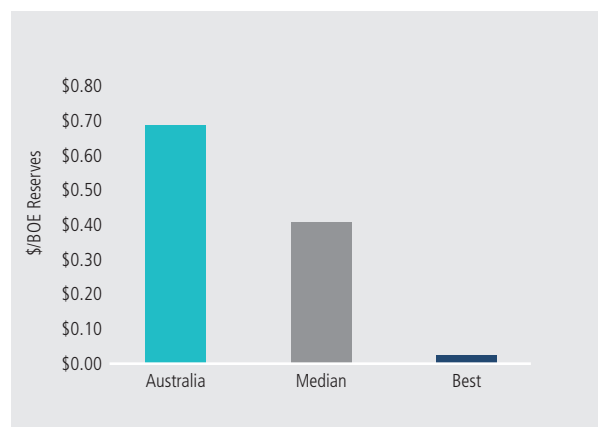
Abandonment

The industry must carefully consider strategies to reduce Abandonment costs in the near term to avoid being on the "back-foot" when the wave of Abandonment projects commence.

Australia scores poorly in the Abandonment phase (bottom of the second quartile) with a score of 1.8, below the world median of 2.2, and significant behind the world's best, Norway, with a score of 8.6.

Australia's poor performance is due to its enormous future liability (USD\$21 billion over the next 50 years ²) combined with a lack of substantial local decommissioning experience. Figure 12 shows the cost of Australia's future Abandonment liability over BOE reserves compared to the world median and world's best. Australia's above average costs are explained

Figure 12: Future Abandonment Liability



by the country's significant offshore production capacity (67.5% ¹³). Decommissioning offshore assets is more costly than onshore, so country's like Australia, the United Kingdom and Norway have a larger future liability than other nations.

There is time for the industry in Australia to manage the risk and inevitable wave of Abandonment projects. Australia should ensure regulations are robust and effective to support the industry during the Abandonment phase. While also collaborating and investing in industry lead research to develop the next generation of equipment and technology to enable more efficient and streamlined decommissioning activities.

To find innovative solutions, the Australia should collaborate with other countries who are currently in the Abandonment phase of the value chain. Australia can look into growing local workforce capability through international exchange programs, where Australian workers would have the opportunity to be involved in Abandonment projects around the world, and bring the expertise back, and transfer knowledge accordingly. Australia can leverage the opportunity to learn lessons and gain insights from projects around the world, e.g. UKCS.

The opportunity and business rationale is clear for Australia to invest and build the relevant capability before the wave of decommissioning activities commences. By finding innovative solutions to reduce the risk, time, and cost of decommissioning, Australia could maximise value in this phase of the oil and gas value chain.

Priority Areas and Opportunities

Analysis in the previous section of the report considers the four phases of the value chain, and identifies a number of industry improvements that can boost Australia's competitiveness. These ideas have been grouped into four priority areas; Supply Chain, Research and Innovation, Work Force, and Regulatory Reform. Analysis suggests that by focusing on innovative and collaborative solutions within these priority areas, a 15% increase in the competitiveness score is achievable. This would place Australia on par with the current world's best and capture significant value for the industry.

The priority areas focus on improvements to the industry that are achievable within the short term and through an industry wide approach to improving competitiveness. An "others" category is also included to capture potential improvements outside of the four priority areas. There are also areas where the industry will not be able to improve in the near term; for example, the geographical remoteness of operations, and the high cost of Australian Labour.

Detailed modelling of the opportunities was conducted using the Dashboard at the metric level. The Dashboard allows for detailed scenario modelling, with a 15% increase representing

the short term plausible scenario. Longer term changes are harder to forecast; however, improvements are potentially much greater. Figure 13 displays the possible increases across each measured category and shows how Australia could move to be on par with the current most competitive oil and gas producer in the world, the United States.

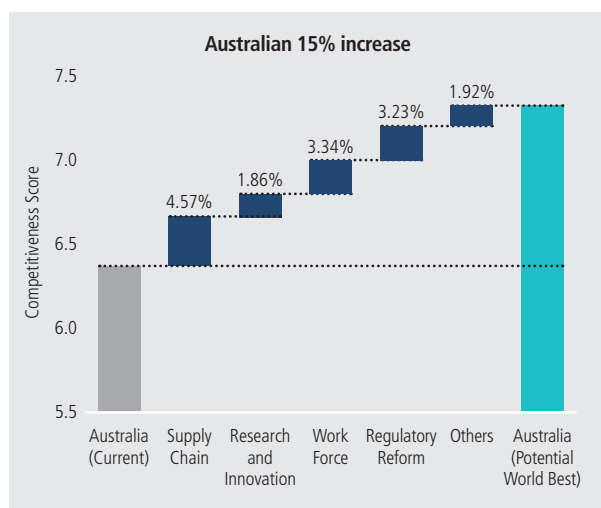
Supply Chain

Australia's Supply Chain score of 6.4 places the country in the third quartile, leaving significant room for improvement, while the world's best, Netherlands, scores 8.0. The performance of the supply chain affects the industry over all four phases of the value chain, so improvements have the ability to have major impact. Analysis suggests, of the five categories, supply chain improvements and innovations will have the biggest impact on overall competitiveness, with an increase of 4.57%.

Australia has structural characteristics that hinder the country's ability to compete with the world's best, namely; the size and age of the industry, and the remote and challenging environments in which most operations are situated. In recent years, supply chain improvements have focused on procurement processes. However, going forward, major gains to industry competitiveness will come from sharing of resources, and finding innovative solutions to alleviate structural disadvantages. Some include:

- Learning from the United Kingdom oil industry and the CRINE initiative, have shown that by working collaboratively to solve issues, the entire industry can benefit.
- Finding collaborative solutions to the size and geography of the Australian market. Industry operators should work towards sharing infrastructure and developing regional "hubs" to better manage and streamline the supply chain process.
- Investing in advanced manufacturing, which provides an enormous opportunity in the Development and Execution and Production phase. The industry needs to invest in trialling 3D printing and other advanced manufacturing techniques to reduce the reliance on supply chain in construction and maintenance areas.

Figure 13: Scenario Modelling



The industry must find innovative and collaborative solutions to overcome the structural disadvantages inherent to Australia. Improvements in this area provide the biggest potential impact on Australia's competitiveness.

Research and Innovation

Australia performs well in the Research and Innovation, scoring above the world median of 3.7. This result runs contrary to popular perception. However, rather than a sign of Australia's strong performance in this area, this score highlights the relative position of Australia against the study peer group of other oil and gas producing nations, some of which have relatively poor research and innovation capabilities. An opportunity exists for Australia to learn from leading nations in research and innovation including the United States, the United Kingdom, and the Netherlands.

Improvements in Research and Innovation will have flow on effects to other priority areas and to the industry as a whole. The Industry Competitiveness Score (ICS) measures seven specific metrics relevant to a country's research and innovation capability. Targeted and focused actions that impact those seven metrics would boost Australia's overall competitiveness score by around 1.86%. Two areas where achievable changes in the near term would boost Australia's overall competitiveness are:

- Increasing engagement between industry operators and universities and research institutions. Universities and research institutes can play a larger role in developing innovative solutions to solve the latest industry problems. Industry participants should collaborate more effectively to unlock this underutilised resource.
- Improving the commercialisation of research in Australia. Progress needs to be made in finding ways of turning innovative ideas across the entire value chain into commercial successes.

While these two changes are vital, finding the right areas to focus Australia's research and innovation capability is key to its success. Examples of innovation that Australia can build on to increase its competitive advantage include:

- Building world-class data analytics capability. Australia has some of the world's most advanced production facilities, which allows for scaling of data analytics. Data analytics can be used within these assets to find innovative ways to improve production efficiency, and predict downtime and events. This is not a skill inherent to the industry, so collaboration is essential.

- Investing in new and innovative ways of reducing the cost and difficulty of decommissioning oil and gas fields. Abandonment represents a significant liability for the industry if current technology is used. By finding new and innovative ways to reduce costs, risks and associated timelines, Australia has the ability to become a world leader in asset decommissioning.

A focus on building a successful research and innovation capability will have significant benefits for the rest of the industry. While NERA will pursue building a stronger research and innovation mentality, the industry needs to support this work to translate opportunities into tangible results.

Workforce

The ICS's measure of workforce competitiveness considers both cost and quality. Australia scores 6.2, behind the world's best, China, with a score of 8.3. The balance between cost and quality are vital, while Australia's costs are among the highest in the world, the current quality is of a high standard. Across the value chain, improvements in the capability of Australia's workforce have the ability to boost overall competitiveness score by 3.34%.

As Australia's industry moves from the Development and Execution phase into Production and Abandonment phases, there are significant risks and opportunities. The country's workforce must capitalise on this transition and become the world leader in oil and gas operations. Key changes to achieve this goal include:

- Investing in training and education as necessary to ensure the industry is prepared for the Production phase, particularly in maintenance and technical operational knowledge.
- Improving organisational structures to limit the level of overheads. Australia has seen some of the world's highest development costs in the recent construction boom. If new Greenfield projects are to happen, operators must engage the construction workforce and ensure they are skilled and competent to deliver projects on budget and on schedule.
- Building and scaling Abandonment and decommissioning capability. This could include forming partnerships with organisations outside of Australia and undertaking exchange programs to build local capability.

A high quality workforce is essential to a competitive oil and gas industry. As the industry moves from development to operations, maintaining and improving Australia's workforce competitiveness is paramount.

Regulatory Reform

Australia's Government and Public Involvement score is 6.1, which is comparable to the world median, and provides ample room for improvement. Australia performs very well in the government policy and perception area; however, the regulatory component is a key area of weakness and presents the greatest opportunity for overall improvement. Changes here could have 3.23% on overall competitiveness, the second largest in this analysis.

Complexity, duplication and "red tape" increase costs and extend timeframes for all participants. While some work has been done to improve the situation, if Australia wishes to become a leader in the industry, there is a strong need for both regulatory bodies and industry stakeholders to work more closely together. Specific potential improvements include:

- Streamlining regulatory statutes and agencies to reduce the uncertainty surrounding regulation. There are approximately 150 statutes and more than 50 agencies regulating the oil and gas industry¹².
- Providing clear directives on environmental regulation. This area is currently a significant deterrent to investment in Australia. The government must end the coal seam gas debate so the industry can move forward, in either direction, with certainty.
- Revising the industrial relations framework. 75% of industry stakeholders reported feeling the country has an inflexible industrial relations framework⁶.
- Providing constructive and tangible feedback from industry. Government and regulatory bodies need to do their part by engaging with industry stakeholders to understand the voice of the customer.

Both industry and government have a common goal to maximise value for Australia. There is significant benefit to be gained from collaborating and improving competitiveness within this area.

Other Opportunities

Public Perception

Public perception and the Social License to Operate (SLO) are a vital component of today's oil and gas industry. Oil and gas companies cannot function sustainably without the backing of the society in which they operate. Unfortunately, there is currently no reliable data source to measure SLO competitiveness across a broad range of countries on a yearly basis.

Data that was available from the World Bank Public Perceptions Survey on Extractive Industries found that, in Australia, 41% believe the industry does not have a positive impact on the environment and 24% believe the industry does not have a positive impact on local communities. While this data suggests Australia has room for improvement, without a global data set it is not possible to understand the country's relative performance. The industry should collaborate to define measurable KPIs, and identify opportunities to increase the public's trust in oil and gas companies.

Cost Cutting

Industry operators have spent the past two years slashing costs and reducing workforce numbers. While the cost decreases have allowed operators to stay profitable, it is not a sustainable option and does not help to build Australia's competitive edge in the longer term. Industry operators need to continuously improve and streamline their operations. Apart from doing this internally, there is added benefit to increase competitiveness through collaborating with other operators, suppliers and stakeholders. A significant focus has been placed on these forms of initiatives, so continued effort will provide limited returns, made evident by the 1.92% improvement found in the ICS analysis.



Conclusion

The development of the Industry Competitiveness Framework and baselining of the Industry Competitiveness Score has allowed Australia to measure its competitiveness in a structured and repeatable manner. The data-driven and comprehensive nature of this assessment provides numerous insights into the current industry performance, and improvement opportunities.

While Australia scored well in the overall oil and gas Industry Competitiveness Score, across the global peer group, it is clear that there are areas where improvement can be made.

Australia needs to look at the oil and gas value chain in its entirety and strategically consider what it chooses to invest in, when and why. With the country moving into a phase of Production operations, Australia needs to

innovate and find new ways of working to maximise value over the next two to three decades. Australia also needs to consider investing in Abandonment in the near future, and consider the viability of further investment in the Exploration and Development and Execution phases.

All parties, regardless whether they are a large multinational industry operator, government body, or small local supplier, have a role to fulfil by working together to implement innovative and collaborative solutions to improve Workforce, Research and Innovation, Supply Chain and Regulation Capability in Australia. This will allow the country to become one of the most competitive oil and gas producers in the world, and ultimately bring about significant tangible benefit to the nation.

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Appendix

Glossary

Below is a list of commonly used acronyms referenced throughout the report:

Acronym	Term
ABS	Australian Bureau of Statistics
APPEA	Australian Petroleum Production & Exploration Association
BOE	Barrel of Oil Equivalent
ICA	Industry Competitiveness Assessment
ICF	Industry Competitiveness Framework
ICS	Industry Competitiveness Score

Acronym	Term
IGU	International Gas Union
LNG	Liquefied Natural Gas
MCP	Major Capital Project
NERA	National Energy Resources Australia
SLO	Social License to Operate
VDT	Value Driver Tree



Peer Group

Country	Country	Country	Country	Country
Algeria	Ecuador	Malaysia	Pakistan	Trinidad & Tobago
Australia	Egypt	Mexico	Peru	United Arab Emirates
Brazil	Gabon	Netherlands	Qatar	United Kingdom
Canada	India	Nigeria	Romania	USA
China	Indonesia	Norway	Russian Federation	Venezuela
Colombia	Kazakhstan	Oman	Thailand	Vietnam

Data Sources

Subgroup	Metric Name	Source
Regulatory	Regulation Cost	Fraser Institute Global Petroleum Survey 2015
Regulatory	Environmental Regulation	Fraser Institute Global Petroleum Survey 2015
Regulatory	Regulation Uncertainty & Duplication	Fraser Institute Global Petroleum Survey 2015
Regulatory	Taxation Perception	Fraser Institute Global Petroleum Survey 2015
Regulatory	Tax Rate	KPMG Corporate Tax Rates Table
Political	Geopolitical Risk Index	Fraser Institute Global Petroleum Survey 2015
Political	Labour Regulation	Fraser Institute Global Petroleum Survey 2015
Industry	Citizens % of Workforce	SPE Salary Survey
Industry	Labour Availability	Fraser Institute Global Petroleum Survey 2015
Industry	Top Universities	Topuniversities.com
Competence	Labour Cost	SPE Salary Survey
Competence	Experience / Age	SPE Salary Survey
Competence	Training	WEF Global Competitiveness Index
Safety	Total Recordable Injury Rate (TRIR)	IOGP Safety Performance Indicators 2015
Safety	Lost Time Injury Frequency (LTIF)	IOGP Safety Performance Indicators 2015
Collaboration	University / Industry Research Collaboration	WEF Global Competitiveness Index
Innovation	R&D	WEF Global Competitiveness Index
Innovation	Patents	WEF Global Competitiveness Index
Innovation	Adoption of new technologies	WEF Global Competitiveness Index
Innovation	Capacity for innovation	WEF Global Competitiveness Index
Knowledge	Scientific & Technical Articles	Global Innovation Index 2015
Knowledge	Citable Documents H Index	Global Innovation Index 2015
Services	Number of Rigs / Reserves	Baker Hughes International Rig Count
Services	State of Cluster Development	WEF Global Competitiveness Index
Services	Supplier Quantity	WEF Global Competitiveness Index
Services	Supplier Quality	WEF Global Competitiveness Index
Services	Degree of Customer Orientation	WEF Global Competitiveness Index
Logistics	Logistics Quality and Competence	World Bank Logistics Performance Index
Logistics	Infrastructure Quality	Fraser Institute Global Petroleum Survey 2015
Logistics	International Shipments	World Bank Logistics Performance Index
Logistics	Customs	World Bank Logistics Performance Index
Logistics	Tracking and Tracing	World Bank Logistics Performance Index
Logistics	Timeliness	World Bank Logistics Performance Index
Logistics	LNG Operations Remoteness Index	IGU Remoteness Index
Exploration	Onshore Exploration Activities	WoodMackenzie Upstream Data Tool
Exploration	Onshore Exploration Success Rate	WoodMackenzie Upstream Data Tool
Exploration	Onshore Appraisal Activities	WoodMackenzie Upstream Data Tool
Exploration	Onshore Appraisal Success Rate	WoodMackenzie Upstream Data Tool
Exploration	Onshore Total Well Cost	WoodMackenzie Upstream Data Tool
Exploration	Seismic Data Maturity	Fraser Institute Global Petroleum Survey 2015
Exploration	Offshore Exploration Activities	WoodMackenzie Upstream Data Tool
Exploration	Offshore Exploration Success Rate	WoodMackenzie Upstream Data Tool
Exploration	Offshore Appraisal Activities	WoodMackenzie Upstream Data Tool
Exploration	Offshore Appraisal Success Rate	WoodMackenzie Upstream Data Tool
Exploration	Offshore Total Well Cost	WoodMackenzie Upstream Data Tool
Development	Development Cost	WoodMackenzie Upstream Data Tool
Development	Schedule	WoodMackenzie Upstream Data Tool
Development	Active Projects	WoodMackenzie Upstream Data Tool
Production	Gas Operating Costs	WoodMackenzie Upstream Data Tool
Production	Oil Operating Costs	WoodMackenzie Upstream Data Tool
Production	LNG Utilisation	IGU World LNG Report 2016
Production	Pipeline Utilisation	WoodMackenzie Upstream Data Tool
Production	Oil Reserves	WoodMackenzie Upstream Data Tool
Production	Gas Reserves	WoodMackenzie Upstream Data Tool
Production	Resource Production Ratio	WoodMackenzie Upstream Data Tool
Abandonment	Abandonment Activities	WoodMackenzie Upstream Data Tool
Abandonment	Abandonment Future Liability	WoodMackenzie Upstream Data Tool

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