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Executive summary
Lowering the cost of business in the Pilbara, through a DMFS, generates transformational economic outcomes

Introduction
Arup were engaged by the Pilbara Development Commission (PDC) to understand and demonstrate the direct and indirect impacts to the Pilbara economy of a direct and regular maritime freight service into and out of the region. The freight service is proposed to reduce logistics costs to businesses in the region in addition to opening potential export opportunities. Over the medium to long term the DMFS is expected to contribute to a general lowering of business costs in the Pilbara with transformational economic outcomes.

This report comprises phase two of the engagement with the PDC.

Background
The economy of the Pilbara is comprised primarily of the natural resources industry including both mining and oil and gas production. The region generated revenue of $60.2 billion in 2017 (REMLAN) and was responsible for 12.3% of revenue in Western Australia.

Inbound flows of freight to the Pilbara region are generally imported over land via road trains from Fremantle or Perth. As a direct result of inefficient import trades routes, the costs to local business of importing goods is prohibitively high and has a direct impact on the competitiveness of businesses in the region.

In order to address the problem of high import costs, alleviate the issues facing road-based inbound cargo to the Pilbara as well as offering wider economic benefits to the region, the PDC propose the creation of DMFS into the Port of Dampier, located in the Pilbara region.

Case studies
Case studies have been identified that demonstrate how a reduction in operating costs for businesses in a region can result in transformational economic outcomes.

Parkes and Inland Rail
Parkes, a town in regional NSW, is located on the route of the proposed ‘Inland Rail’ project, a $10bn freight investment linking Brisbane and Melbourne. Inland Rail is expected to create 150 new jobs in agriculture, manufacturing and mining in the NSW central coast region.

The new rail link should result in a significant reduction in transport costs in Parkes, attracting investment and generating new markets in the town. Pacific National have already invested $35m in a logistics hub to capitalise on the expected reduction in transport costs. Inland rail is an excellent example of how freight investment may help attract investment and diversify a regional economy.

Toowoomba and transport investment
Toowoomba is a city in QLD dominated by the mining and agriculture sectors.

Private and government investment in infrastructure projects such as a new regional airport has resulted in lower business costs, growing GRP and increased employment in the Toowoomba region. In 2017/18, the region’s economy reached $10.8 billion, making it one of the key employment and economic centres in Queensland.

In addition to inland rail, Toowoomba has benefited from investments in road connections including a $1.6bn range crossing.

Albury and logistics investment
Albury is located just north of the Victorian border, about 310km north-east of Melbourne and 570km south-west of Sydney.

The region has benefited from public and private investments into infrastructure within Albury including $9.9bn of state funding into a new rail hub. The infrastructure investments have been essential in transforming the accessibility of the region and lowering the cost of transporting products in and out of Albury. From 2006 to 2018, the Gross Regional Product for Albury steadily increased from $4.3bn to $6.9bn.

Renewable Energy Investment in Midwest America
Much of Midwest America was, and to some extent still is, reliant upon the agriculture industry. However, effective investments have reduced the cost of doing business and transformed the Midwest region.

Private investment in renewable energy has encouraged economic growth and attracted investment. Wind projects have been catalysts for further investment and assisted in unlocking additional markets. The U.S. Department of Energy’s ‘Wind Powering America’ program expected to create $60 billion in capital investment creating 80,000 new jobs.
Executive summary
Lowering the cost of business in the Pilbara, through a DMFS, generates transformational economic outcomes

Businesses from across the U.S. have been attracted to the Midwest to take advantage of cost efficient and clean energy, creating local jobs and increased regional economic activity. In Illinois, $120m of expenditure in the data centre sector stimulated $1.2bn in additional wages and salaries. Increased economic activity led to increasing tax revenues, allowing local governments to invest further in the region.

**Michigan, an R&D hub**
Michigan, USA, experienced a steep decline in its auto manufacturing industry as a consequence of the 2008-2009 recession. The lack of economic diversification in the region with a significant reliance on the automotive industry restricted Michigan’s economic growth. Since the crisis however, Michigan has seen the most improvement of any U.S. state.

In response to the crisis, Michigan slashed the costs of business in the region partly through creating a tax friendly environment. This lowering of costs stimulated $23bn in new investments and helped the state to build upon its engineering expertise to develop into a hub for advanced manufacturing, aerospace, agribusiness, energy, cybersecurity and defence technology. Michigan’s ability to leverage its existing assets to build specialised clusters has resulted in very positive economic return with the state now the 12th largest in the US by GDP.

**Unlocking new markets**
The large contribution of the resources sector in the Pilbara is well known and significant efforts are being made across the state of WA to diversify and transition the economy to one less reliant on the state’s natural resources over the medium to long term. Such economic diversification is particularly necessary within the Pilbara region and the proposed DMFS is one potential enabler for establishing alternative industries in the region. The DMFS is expected to help the growth of new markets by:

- Lowering import costs;
- Opening export opportunities; and
- Making available new materials to firms allowing more efficient operations.

Lower import costs may enable local businesses to compete with other areas of Australia in supplying goods and services to the existing industries in the region. Three sectors have been identified as potential new markets in the region:

- Plant-based agriculture
- Solar power generation
- Fishing and aquaculture

Each of the above could benefit from the DMFS by reducing start-up and ongoing cost requirements. The DMFS may support other viable new sectors in the region.

**Projects**
All potential projects in the Pilbara face differing challenges in developing viable propositions that attract sufficient investment and allow reasonable financial returns. Such challenges comprise a wide range of issues depending on the sector but, due to the remoteness of the region, often comprise an element of high cost.

On the assumption that some projects that would otherwise not be feasible are able to proceed as a result of a lowering of costs in the region, Arup carried out a high-level assessment of the economic benefit to the region in terms of the Gross Value Added (GVA) through additional employment.

Additional jobs created through the new projects were adjusted to exclude employment benefitting those outside the Pilbara or for those merely transferring jobs within the region to understand the true additionality of employment.

The assessment concluded that the new projects, in part enabled by the DMFS may result in a $1.9bn benefit to the local economy. In gross, the new projects are expected to add over 850 long-term jobs.

**Resource industry impacts**
Whilst a particular focus of the proposed DMFS is to enable the development of new industries in the region, the potential effect on the existing resources industry has been analysed. Primarily, the proposed DMFS will lower costs for natural resource extraction companies by reducing import costs. Mining and other extraction companies in the region import significant quantities of goods to support their operations. With the exception of fuel and large pieces of equipment, much of the goods imported arrive via road train from southern WA.

Importantly, a reduction in costs in the region may help to increase the economic lifetimes of existing mines, which is seen as a necessary condition to allow time for the economy of the Pilbara to develop alternative industry and sectors not reliant on non-renewable resources. This is achieved by a lowering of the cost allowing existing mines to viably explore mine extension opportunities.

**Conclusions**
The Pilbara is known for its remote location, extensive mining operations and high-cost business environment. As non-renewable resources are depleted and global decarbonisation efforts increase, the Pilbara must develop a more diverse, less reliant economy to secure its future.

The DMFS may reduce import costs to the region by up to 50% contributing to a lowering in the costs of business across the region.

In reducing costs, the DMFS may stimulate new sectors, enable marginal projects to move forwards and extend the life of existing industry allowing time for the economy to diversify.
A Direct Maritime Freight Service can ...

- Generate a reduction in import freight times of up to 70%
- Enable new projects in the Pilbara to deliver $1.9 billion in employment benefits
- Lower costs in the region stimulating new markets in ...
- Lower business costs enabling domestic import replacement opportunities
- Improve the competitiveness of local firms
- Support existing industries to remain resilient, allowing the local economy time to transition to be less resource dependent
- Open new export markets in south east Asia and beyond

Renewable Energy
Agriculture
Aquaculture
1. Introduction
1. Introduction

PDC engaged Arup to better understand the economic impacts of a direct freight service into the Pilbara.

Arup were engaged by the Pilbara Development Commission (PDC) to understand and demonstrate the direct and indirect impacts to the Pilbara economy of a direct and regular maritime freight service into and out of the region. The freight service is proposed to reduce logistics costs to businesses in the region in addition to opening potential export opportunities.

This report forms the second phase of work completed by Arup into the impact of a maritime service, following the first phase report titled ‘The impact of a direct maritime freight service for the Pilbara’ completed in February 2019. The first phase report’s focus was two-fold:

- Quantifying the macroeconomic impact on the region and Australia resulting from a Direct Maritime Freight Service (hereafter referred to as DMFS) into the Pilbara
- Discussing qualitatively the potential economic benefits from direct freight on a more micro level than gross regional product (GRP)

The first phase report’s key findings were as follows:

- A DMFS, modelled through a supply side shock in a computerised general equilibrium model, would increase real GRP for the region by 1.12% in 2020, and result in a cumulative gain to national welfare of $1.1 billion over the twelve-year study period of 2019-2030.
- Several additional economic benefits could also be expected from the DMFS, including positive impacts on road congestion, travel time length and variability, and environmental benefits from reducing reliance on road trains. New export routes, new material access, increased viability of existing local businesses and extending the useful lives of resource extraction, were also qualitatively identified and discussed in the context of additional benefits from a DMFS.
1. Introduction
The scope of this engagement focusses on four elements

This Phase Two Report will aim to build on the findings from phase one by undertaking further analysis focussed on four elements:

1. Presenting case studies where similar interventions have reduced the cost of business in a region and demonstrating the resulting impact on the regional economy.

2. Analysing the potential for the DMFS to unlock new markets and allow growth to small existing industries in the region.

3. Analysing the potential for the DMFS to enable major projects in the Pilbara to reach construction by lowering costs and improving the viability of projects.

4. Assessing the impact of a DFMS on the existing resource industry, currently the major contributor to the regional economy. This analysis will consider the potential results of reducing logistics costs on businesses operating in the Pilbara.

The DMFS is being considered as one mechanism to achieving the wider aim of reducing the costs of doing business in the Pilbara. The PDC are investigating other methods of achieving the wider goal.

While this Report focusses on the DMFS, some aspects consider the impacts of more generally reducing costs in the region.
2. Background
2. Background

The Pilbara region lies approximately 1,200 km north of Perth and represents around 20% of Australia’s land mass.

The Pilbara region

The Pilbara region is situated in the north of Western Australia, lying approximately 1,200 km north of Perth and representing around 20% of Australia’s land mass.

The economy of the Pilbara is formed primarily of the natural resources industry comprising both mining and oil and gas production. The region generated revenue of $60.2 billion in 2017 (REPLAN) of which $42.1 billion was derived from mining, $8.9 billion from construction and $1.9 billion from manufacturing. The Pilbara was responsible for 12.3% of revenue in Western Australia, and 13% of WA’s GDP (REPLAN).

The Pilbara has a large FIFO (Fly-in-Fly-out) worker population, making up around 55% of all jobs within the region in 2018 (REPLAN). This temporary workforce has, to some extent, limited growth in the local resident population in recent years although the region has developed a sophisticated services sector particularly around the major townships.

The population of the region can fluctuate significantly as a result of construction workers for major projects. Large scale developers have been known to construct purpose built villages to accommodate workers involved in such activities which upon completion are dismantled.

The Pilbara Ports Authority (PPA) operates five ports in the Pilbara region including the two major ports of Port Hedland and Dampier. These are two of the world’s largest bulk ports and export significant quantities of iron ore from the mines to destinations across the world. The Port of Dampier is also a significant exporter of Liquified Natural Gas (LNG) and provided c. 8% of world LNG exports in 2016.

During the 2017-2018 financial year, PPA ports exported 696.6m tonnes of cargo of which 94% was iron ore and 3.5% was LNG/LPG. The ports imported 2.7m tonnes over the same period, of which 86.5% was fuels and 11% was general cargo.
2. Background
Inbound flows of freight (excluding fuels) to the Pilbara region are generally imported over land via road trains from Fremantle or Perth

**Operational context**
Outbound flows from the region are largely vertically integrated processes, managed by the relevant producer companies. The mining industry has developed sufficient export capacity at ports to support the continuing growth in mining export volumes.

Inbound flows of freight (excluding fuels) to the Pilbara region are generally imported over land via road trains from Fremantle or Perth. Northbound road trains utilise two major highways from Perth to the Pilbara, the North West Coastal Highway (NWCH) and the Great Northern Highway (GNH).

The Pilbara is almost entirely reliant on supplies imported from the south resulting in a large inbound freight task to support communities. It is estimated that the region imports a minimum of 400 tonnes a day of food and drink to support the local population.\(^1\)

Due to the significant (and growing) northbound road freight from Perth to Pilbara, the GNH is suffering from a number of operational issues. Many Pilbara-based companies note that road-based freight from Fremantle is currently limiting their business with several congestion points on the road network impacting logistics efficiency. Other road operational issues include driver fatigue and related legislation, flooding impacts and insufficient over-taking opportunities.

Existing supply chains are also notable for failing to benefit from containerisation, with many smaller-businesses only receiving freight as ‘loose’ loads by road haul.

As a direct result of inefficient import trades routes, the costs to local business of importing goods is currently prohibitively high and has a direct impact on the competitiveness of businesses in the Pilbara.

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2. Background

The PDC propose the creation of a DMFS into the Port of Dampier

**Proposed intervention**

In order to address the problem of high import costs, alleviate the issues facing road-based inbound cargo to the Pilbara and support the development of a less resources dependent economy, the PDC propose the creation of a DMFS into the Port of Dampier.

The Port of Dampier has been selected as the initial port for services for a number of reasons detailed in the phase one report. However, should sufficient demand be available, additional calls at Port Hedland or Broome are possible in the future at the discretion of the service operator.

The route structure for the proposed service is to be direct between Singapore and Dampier.

Though direct freight shipping of some imports into the Pilbara exists currently, the proposed option aims to significantly reduce the tonnage of other cargo types (for example finished domestic products) being transported into the region by road and allow businesses in the region to reap the benefits of containerised seaborne trade.

Improved and more cost-effective access to containers provides greater choice to Pilbara businesses in how their freight is managed and new options for accessing cargo services.

Figure 3 illustrates the existing inbound and outbound freight flow by mode, excluding minerals.

**Forecast cost reductions**

Australian Floating Decks (AFD), who carried out a study into the Pilbara freight task on behalf of the City of Karratha in 2019, estimated that direct maritime services would reduce freight costs by up to 50% and delivery times by up to 70%.

On a per tonne basis, savings generated by the DMFS (in comparison to a route via Perth) amounted to between $200 and $300 depending on the particular destination within the Pilbara.

The DMFS is intended as one mechanism for lowering the costs of doing business in the Pilbara. The PDC are actively pursuing other, additional means of lowering costs in the region.

Figure 3: Product flows by method of transportation. Source: AFD 2019
2. Background
The high cost structure in Pilbara is a constraint to economic development and diversification

High costs of business

The costs of doing business in the Pilbara are higher than the rest of Western Australia and the majority of Australia. The high cost structure inhibits economic growth and diversification in the region, as it is often challenging to start new businesses and operate existing businesses sustainably. In order for the Pilbara to transform and improve the viability of new businesses, it is integral for the costs of operating to reduce.

The high capital and operational costs of the resource sector has driven up the overall costs of doing business in Pilbara, as inter-sector competition for labour and supplies develop. Whilst there have been substantial decreases in the level of investment and construction, along with implementation of cost cutting measures in the resources sector in recent years, the high cost structure still remains evident for businesses in the Pilbara.

Findings in the 2017 Regional Price Index, produced by the Department of Regional Development, highlight the existence of a high cost structure in Pilbara. The index found that the region had the second highest costs of any region in WA (following Kimberley) with housing the highest relative component of the basket of goods.

Townships in the Pilbara face substantially higher prices over and above those experienced in Perth. Such high cost items incurred by businesses include staff training, staff recruitment and turnover, travel, professional services and consumables. In some cases, businesses have to purchase or rent accommodation for staff, which adds a significant cost for start ups in the Pilbara. Given the relatively small market size in the Pilbara, there is considerable pressure on businesses that do manage to start-up to survive.

Business costs in Pilbara towns relative to Perth in 2015

Figure 4: Comparing costs (%) of operating a business at Pilbara towns with Perth in 2015

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2 Transitioning Regional Economies (2017), Regional Development Australia Pilbara
2. Background

Improved freight access is widely recognised as a catalyst for economic development

Economic outcomes

Beyond the primary impact of lowering costs in a region, improved freight access to an area is widely recognised as a catalyst for economic development. Such scope for economic development is particularly pronounced for regional areas where supply chains are often lengthy and inefficient. Poor quality transport and freight infrastructure constrains economies in regional areas and limits their access to markets. Such a restriction limits economic development not just for a particular region but for Australia as a whole. In the context of the Pilbara, inward freight flows are the primary constraint, limiting communities and businesses from efficient access to needs such as clothing, food, construction materials, fuel, chemicals and other household items.

According to a study by Infrastructure Partnerships Australia, supply chain costs in Australia represent around 10% of the final cost of a product, a cost which is ultimately borne by the consumer. Savings to this element, such as through investment in freight infrastructure, can have major impacts, stimulating the growth of existing industries, opening access to new markets and creating a more resilient economy. By diversifying the economy, the Pilbara can help improve the complexity of the whole Australian economy. Economic complexity is discussed further on page 15.

However, leveraging freight investments to realise transformational economic outcomes is not without challenge. Freight transport is complex involving numerous stakeholders through several layers of government, infrastructure managers and private freight operators. In order to achieve maximum benefit from any investment, all stakeholders should be involved to ensure that improvements are co-ordinated. For example, a new highway to a region has limited benefit if not co-ordinated with require local upgrades and potential land rezoning.

Economic outcomes for the Pilbara, as a result of improved freight access are discussed in detail throughout this report.

3 Infrastructure Partnerships Australia, Meeting the 2050 freight challenge, 2017
2. Background

Economic complexity drives economic development of regions and determines lasting prosperity

Economic complexity

Identifying productive capabilities provides insight into the economic development of a region. Productive capabilities refer to the combination of inputs, technologies and ideas that determine the frontiers of what an economy can produce. The diversity and complexity of existing capabilities heavily influence how growth occurs. In order to measure and compare diverse and complex productive capabilities of regions, Harvard has developed a proxy called the Economic Complexity Index (ECI), which measures capabilities by collating the following data on countries:

- Import and export of goods
- The evolution of trade over time
- Drivers of economic growth
- Emerging industries

Australia’s ECI

Australia has an ECI of negative 0.43, ranking at 93, with developing countries such as Kenya, Uganda, Namibia and Kazakhstan placed above it in terms of economic complexity. This implies that Australia has low diversity and sophistication in the products that it can produce. As shown by Figure 5, Australia relies heavily on exporting iron ore, coal and petroleum gases. As Harvard present that lasting economic prosperity is linked to productive knowledge as proxied by the ECI, the lack of productive capabilities in Australia pose a problem for Australia’s future economic development.

Assessment of Western Australia’s economic complexity

As the Western Australian economy currently relies heavily on the mining sector, there is a strong need to diversify the region and increase its productive capabilities. The Regional Development Trust of Western Australia and the Department of Primary Industries and Regional Development has commenced an engagement with Harvard to:

- Establish the evidence base to build pathways to economic diversification;
- Identify new sectors that will drive economic growth; and
- Build new thinking, policy design and capable implementation to accelerate economic growth and more inclusive job creation in Western Australia.

Figure 5: Australia’s exports in 2017, Source: The Atlas of Economic Complexity, Harvard University
3. Case studies – Lowering the cost of doing business
3. Case studies – Lowering the cost of doing business

Case studies demonstrating the impact of lowering business costs have been identified

Introduction

Arup has sought to identify case studies that demonstrate how a reduction in operating costs for businesses in a region can result in transformational economic outcomes.

To ensure relevance to this study, the type of intervention implemented (by which lower operating costs are achieved) has been focussed on private investments, public investments, tax incentives and government subsidies.

For the type of cost reduction (see figure 6 opposite), the focus has been on where transport costs have been reduced. Transport infrastructure investments by public or private sector bodies have the potential to open up access to a region and significantly reduce costs of living and doing business.

In identifying case studies, a top-down and bottom-up approach has been utilised, as regional economic development does not generally arise from just one intervention. Instead, it consists of different types of intervention being implemented over a long period of time to connect people, firms and places more closely and generate agglomeration economies or clusters, which increase productivity.

Evolution of regional economies

The identified case studies demonstrate how regional economies have evolved through a range of interventions being implemented. Successful regional economies stem from innovation and a region’s ability to upgrade its productivity capacity. There needs to be a focus on the efficiency in which knowledge is generated, diffused and used to increase a region’s competitiveness. The prosperity of regions lies in the ability to leverage its existing industries, geography and climate to create specialised economies that differ from other regions and offer comparative advantage to local economies.

Growth vs Prosperity

It is important to note that growth and prosperity are not the equivalent. Growth is desirable only if the standard of living of citizens increase. High growth often leads to a rising cost of living that erodes prosperity through degrading natural resources and physical infrastructure that support quality of life.

Figure 6: Case study identification methodology
3. Case studies – Lowering the cost of doing business

Inland rail will unlock economic development in Parkes through reduced freight costs and access to markets

Case study 1 – Inland rail, enabling regional economic development

Parkes economic profile

Parkes is located in central New South Wales, and is uniquely positioned at the intersection of the East West rail line, the North South Newell Highway and soon, the new $10 billion Melbourne to Brisbane Inland Rail. Parkes shire has a population of approximately 15,000 with agriculture, mining, health care and construction the dominant industries in the region. The Parkes shire economic output by sector is displayed in Figure 7 (opposite, bottom). Parkes’ central location enables it to play a role in the way freight is moved around eastern Australia. The town provides major logistics, manufacturing, warehousing, agricultural value-adding services and, more recently distribution opportunities.

Intervention

Inland Rail is the largest freight rail project in Australia and is expected to provide $16 billion in economic benefits in addition to allowing safety and environmental benefits by taking more than 200,000 trucks off the road.

The $10 billion Inland Rail project will comprise construction of a 1,700 kilometre Melbourne to Brisbane freight rail line along Australia’s east-coast - bypassing the congested Sydney network and the north coast line via Australia’s four richest farming regions in Victoria, New South Wales and Queensland.

The Parkes to Narromine (P2N) section of the project is the most advanced section in NSW and should reduce transport and shipping costs by:

- Replacing or upgrading approximately 107 kilometres of existing sleepers and track, as well as culverts and bridges;
- Realigning the track to minimise tight curves;
- Raising the level of the rail formation (the supportive foundations of the track); and
- Improving level crossings, signalling and communications, services and utilities within the corridor.

Relevance

The town of Parkes currently relies on its dominant industries, mining and construction. The Inland Rail project is expected to stimulate economic development and diversification in the region through a reduction in transport and business costs drawing a number of parallels with the proposed DMFS in the Pilbara.

Figure 7: Parkes Shire Output by Industry Sector 2017/18

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4Parkes Shire Council, $8.4 billion to deliver Inland Rail, 2017. 5Australian Rail Track Corporation (ARTC), The Case for Inland Rail, 2019. 6Australian Rail Track Corporation (ARTC), The Case for Inland Rail, 2019. 7WSP, Parkes to Narromine’s First Big Step to Unlocking Regional Potential, 2019.
3. Case studies – Lowering the cost of doing business

Inland rail will unlock economic development in Parkes through reduced freight costs and access to markets

Case study 1 – Inland rail, enabling regional economic development (cont.)

Impacts of intervention

Inland Rail will drive significant investment in NSW’s Central West with an expected 490 additional jobs created in the region during the construction phase, an estimated 150 new jobs in agriculture, manufacturing and mining sectors post production and an economic impact of $216m over 60 years.

Farmers and other landholders in Parkes are expected to share the broader economic benefits of construction by supplying suitable materials direct from borrow pits and quarries as well as rock, gravel and soil. Inland Rail’s construction phase and capacity to lower transport costs is expected to provide Parkes with an increase in employment and regional economic development.

The completion of Inland Rail will allow Parkes to become a multi-modal national transport hub, with the ability to transport and process freight between Brisbane, Sydney, Melbourne and Adelaide within 24 hours. Parkes will have better access to emerging Asian markets, improved connection to key Australian ports and additional regional markets in Queensland and Victoria. Parkes’ major export sectors, mining, agriculture, forestry and fishing are expected to experience increased demand through reduced transport, freight and shipping costs. Such demand increase will contribute to local economic growth within established industry sectors, increasing production supply and employment levels accordingly.

Inland Rail should allow economic development in Parkes by attracting investment from a range of markets. The project is likely to attract nearby agricultural products into local storage and supply chains, as well as build on the networks of existing interstate intermodal freight terminals to establish Parkes as an efficient national distribution hub.

Though not yet in a construction phase, local businesses have already started to benefit from Inland Rail. Local firm, Regional Business Supplies, has become the main furniture supplier for Inlink, the contractor appointed to construct the Parkes to Narromine section of the rail line.

Pacific National recently commenced work on a $35 million terminal development in the Parkes National Logistics Hub. The investment highlights the capability of Inland rail to enable diversification and growth in the local economy.

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8 Parkes Shire Council, $8.4 billion to deliver Inland Rail, 2017, 9 Parkes Shire Council, Pacific National Commits Initial $25 Million to Parkes Logistics Terminal, 2018
3. Case studies – Lowering the costs of doing business

Private and public investment in infrastructure have lowered business costs and improved economic growth for the Toowoomba region.

**Case study 2 - Infrastructure investment in Toowoomba**

**Toowoomba regional profile**

Toowoomba is located 125km west of Queensland’s capital city of Brisbane and is home to 166,000 residents. Exports to domestic and international markets generated $6.3 billion to the regional economy in 2017/18 and are a strategic driver of economic growth. Toowoomba region’s largest net export industries include mining, manufacturing and agriculture. Toowoomba is a significant freight hub for road, rail and air given its strategic location along the Melbourne-Brisbane freight route with value being added through trade and distribution. This is shown in figure 9 (opposite, top).

**Intervention**

Private and government investment in infrastructure projects to improve connectivity has resulted in lower business costs, growing GRP and increased employment in the Toowoomba region. Major completed or proposed city and region shaping infrastructure projects include:

1. **Road: Toowoomba Second Range Crossing (Public Investment)**

The $1.6 billion TSRC is a region shaping project jointly funded by federal and state governments. The 41km route is set to drive growth in the region’s transport and logistics capabilities by linking Brisbane, the Darling Downs and the Surat Basin on the road freight network.

2. **Rail: Inland Rail (Public Investment)**

Australia’s largest freight rail project, Inland Rail is a $10.4 billion freight and logistics network beginning in Melbourne and connecting regional centres including Toowoomba up to Brisbane over a 1,700 kilometre stretch.

3. **Air: Wellcamp Airport (Private Investment)**

Wellcamp airport opened in 2014. Connecting Toowoomba to Australia and the rest of the world, the airport currently runs 80 weekly services via Qantas, Airnorth and Regional Express. It also operates a weekly cargo flight to Hong Kong via Cathay Pacific.

**Lowering cost of business**

Investments in transport infrastructure achieved lower business costs through increased operational efficiency and reduced transport costs. The trade industry benefits from the reduction in travel times and the reliability of trading routes across their networks.

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10. WSP, Why Toowoomba is becoming a thriving regional centre, 2018
11. Economy.id, Data based on ABS and NIEIR, 2018
12. Economy.id, Data based on ABS and NIEIR, 2018
13. Economy.id, Data based on ABS and NIEIR, 2018

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**Relevance**

Toowoomba shares several similarities with the Pilbara region. Both are rural areas heavily reliant on the mining industry and aim to diversify economically to achieve sustainable growth. Toowoomba has successfully lowered business costs and encouraged economic competitiveness through transport investment, making it an appropriate comparator for the Pilbara.
3. Case studies – Lowering the costs of doing business

Operational efficiency and lower transport costs encourage economic growth, a diversified employment base and access to international markets.

Case study 2 - Infrastructure investment in Toowoomba (cont.)

Lowering cost of business (cont.)

For example, the Toowoomba Second Rate Crossing (TSRC) route is designed to increase freight efficiency and significantly improve driver safety and community amenity by removing heavy vehicles from Toowoomba’s CBD. This supported the cost competitiveness of Toowoomba’s key exporting agriculture and food product manufacturing industries. The TSRC route delivers travel time savings of 40 minutes.

The Toowoomba Wellcamp airport facilitates air cargo and trade via air routes, allowing businesses to capitalise on high speed transport when moving their goods and services. Diversification in travel methods and improved efficiency in current transport networks reduces the overall cost of business.

Regional impact of interventions

In 2017/18, the region’s economy reached $10.8 billion, making it one of the key employment and economic centres in Queensland\textsuperscript{14}. It was the third year in a row that Toowoomba region’s GRP grew by over 4\%\textsuperscript{15}.

The unemployment rate was at 5.0\% as at June 2018, below the rate for regional Queensland which currently sits at 6 per cent and below the rest of Australia at 5.4\%\textsuperscript{16}. Figure 12 (opposite, bottom) demonstrates Toowoomba’s improvement in economic diversification, in which Toowoomba had the fifth most diverse economy in Queensland in 2016.

Between 2008 and 2018, Toowoomba grew GRP at a faster rate than Queensland as a whole, this is shown in figure 11 (opposite, top). The Regional Australia Institute projected Toowoomba’s GRP growth at 3.5\% (CAGR) for the period 2013-2030\textsuperscript{17}. This was above the national average of 2.7\%, and higher than the region’s growth rate of 2.6\% for the period 2001-2013. Toowoomba had the fourth highest growth rate projection of all regional Australian cities\textsuperscript{18}.

The Asian air freight link has allowed Toowoomba to access international markets. Additionally, established industries including tourism, manufacturing, energy and mining have been able to capitalise from the new trade routes. Established industries including mining comprise a large portion of exports and assist in economic expansion.

\textsuperscript{14}Economy:id, Data based on ABS and NIEIR, 2018
\textsuperscript{15}Australian Bureau of Statistics, 2018.
\textsuperscript{16}Economy:id, Data based on ABS and NIEIR, 2018
\textsuperscript{17}Regional Australia Institute, Investing in national growth, 2018
\textsuperscript{18}AWSP, Why Toowoomba is becoming a thriving national centre, 2018
3. Case studies – Lowering the costs of doing business
Quality transport infrastructure enables the unlocking of new markets

Case Study 3: Albury, a regional hub with significant logistics advantage

Albury is located just north of the Victorian border, about 310km north-east of Melbourne and 570km south-west of Sydney. Albury has developed its main asset of a strategic location between Sydney and Melbourne to create a hub easily accessible by air, road and rail.

The region’s strategic location along with high quality infrastructure has meant that a number of major freight routes run through the region. This has created a competitive advantage for the transport and logistics sector, in turn acting as an enabler for other industries such as manufacturing and agriculture. From 2006 to 2018, the Gross Regional Product for Albury steadily increased from $4.3bn to $6.9bn.20

The region has benefited from public and private investments into infrastructure within Albury. According to Albury City and Woodonga Council, the strategic location combined with quality transport infrastructure provides access to 75% of Australia’s population within 24 hours. The combination of public and private investments into infrastructure has been essential in transforming the accessibility of the region and lowering the cost of transporting products in and out of Albury.

Key transport infrastructure facilitating the region:

1. Rail (Private and public investment)
   Regular freight services from Albury to Melbourne and Brisbane are provided by the Ettamogah Rail Hub, located 10km from the Albury CBD in the Nexus Industrial Estate. The Ettamogah Rail Hub is privately owned and operated, and serves as a major rail interconnector in Albury. The Ettamogah Rail Hub has also secured $7.6 million from NSW to increase its siding capacity to make it more efficient. The NSW Government has funding $9.9bn into the Nexus Industrial Estate, where the Ettamogah Rail hub is located. The industrial precinct will support large industrial development and further grow the region’s manufacturing, transport and logistics hub.

2. Road (Public Investment)
   The Hume Freeway enables transport in a single run to Sydney, Melbourne, Canberra and Adelaide. The major road link provides a significant logistics advantage for Albury.

3. Air (Public Investment)
   The Albury Airport is owned and operated by the local council, Albury City. The airport is located 5km from Albury CBD and has daily connections Sydney, Melbourne and Brisbane. The major regional airport provides accessibility and a significant access corridor to the region.

Relevance
Albury highlights how efficient transport connections can enable regional growth and unlock new sector opportunities. Given the large distances between centres prevalent in Western Australia, additional freight access provides channels between industry clusters. Connecting clusters may increase interactions for innovation, productivity improvements and unlock new markets.

20 Economy, id – Data based on ABS and NIEIR
3. Case studies – Lowering the costs of doing business
Private investment in renewable energy has encouraged growth and attracted investment in Midwest America.

**Case Study 4: Renewable Energy Investment in Midwest America**

Midwestern United States is one of four census regions of the United States Census Bureau. It occupies the northern central part of the United States shown in figure 14. Due to the particularly rich farming land prevalent throughout the region, agriculture is a dominant economy in the Midwest, accounting for billions of dollars’ worth of exports and thousands of jobs. Consequently, much of the Midwest faces risk of over dependency on one industry, drawing parallels with the Pilbara’s current reliance on the resources sector. Effective investments have however reduced the cost of doing business and transformed the Midwest region.

**Intervention lowering cost of business**

Private investment in renewable energy has encouraged economic growth and attracted investment. Renewable energy investments have resulted in more favourable energy prices than fossil fuels and conventional energy sources, lowering the cost of businesses for local farmers and rural communities.

- A report from the NRDC show private investment in renewable energy target areas of the Midwest has led to the region gaining 2.2GW of new wind capacity in 2017.
- Within the Midwest, rural landowners in Iowa, Illinois and Kansas receive more than $10 million annually from wind leases (US Department of Energy). Farmers and ranchers in North Dakota, Minnesota, and Indiana receive between $5 million and $10 million.
- Rural areas are also experiencing new growth in solar energy. Co-ops have taken advantage of community solar programs to expand solar access. Community solar programs allow participants to buy a share of a solar project and benefit from the electricity generated.
- Wind energy projects have provided a new source of tax revenues for local governments which may be invested into school districts and economic development projects. For example, in Colfax, Illinois, a town of 1,000 people, new wind projects increased the property tax base from $61 million in 2006 to $102 million in 2008. The new revenue allowed local schools to fund new projects and pay down debts.

**Relevance**

Effective investments reducing the cost of doing business have transformed the Midwest region. This, combined with a historical dependence on one sector, has made it a useful case study when considering the desire to lower costs and promote economic diversity in the Pilbara. This case study provides an excellent example of how investment in one sector has flow on benefits in others. In this case, renewable energy investments have led to flow-on investment in data centers.

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3. Case studies – Lowering the costs of doing business

Low cost renewable energy attracted investment and allowed the development of additional markets

Case Study 4: Renewable Energy Investment in Midwest America (cont.)

Regional impact of intervention

Wind projects have been catalysts for further investment and assisted in unlocking additional markets. Businesses from across the United States have been attracted to the Midwest to take advantage of cost efficient and clean energy creating local jobs and increased regional economic activity. The new industries help increase tax revenues allowing additional infrastructure improvements. For example, businesses have invested in data centres across the rural Midwest due to their capacity to run on clean energy. In Illinois, construction expenditure of new data centers was $120m in 2017, creating statewide employment in the data center industry for 10,000 people and generating $1.2 billion in associated wages and salaries.23

Solar energy projects are also enabling other economic benefits. For example, the Farmers Electric Cooperative in Kalona, Iowa, generates 15 percent of its power from solar energy and distributes 2.5 kilowatts (kW) per member.24 The cooperative has encouraged smart financial investments in the area.

Achieving the goals of the U.S. Department of Energy’s ‘Wind Powering America’ program during the next 20 years is expected to create $60 billion in capital investment in rural America, providing $1.2 billion in new income for farmers and rural landowners and creating 80,000 new jobs.25

This case study demonstrates how lowering the costs of doing business in a region, in this case through reducing energy costs, has the capacity to stimulate increased investment in a region and allow the development of new sectors. Increased economic activity led to increasing tax revenues, allowing local governments to invest further in the region.

23 Magnum Economics, Potential Impact of Data Center Incentive in Illinois, 2018
24 NRDC, Renewable Energy Brings Economic Boost to Rural Communities, 2018
3. Case studies – Lowering the costs of doing business

Industry clusters drive regional economic success through competitiveness and innovation output

Case Study 5: Michigan (USA) – from bankruptcy to attracting private investments and becoming an R&D hub

Michigan experienced a steep decline in its auto manufacturing industry as a consequence of the 2008-2009 recession, followed by bankruptcy and federal bailouts of General Motors and Chrysler. This led to the loss of over 800,000 jobs resulting in the unemployment rate peaking in 2009 at 14.6%.

The lack of economic diversification in the region with a significant reliance on the automotive industry restricted Michigan’s economic growth. Since the crisis however, Michigan has seen the most improvement of any US state. Today, Michigan’s auto industry is powered by technology and innovation.

Michigan has the highest concentration of engineers in the nation and has built upon its automotive experience to unlock additional industries such as advanced energy storage, solar power, wind turbine manufacturing, advanced materials and defence. Michigan has transformed into an advanced manufacturing innovation and technology cluster through government incentives and private investment.

Key interventions implemented

1. Tax incentives

Michigan provides a business friendly tax environment which encourages companies to base their operations in Michigan. Michigan’s competitiveness is due in part to its simple and efficient tax structure of 6% corporate income tax and 4.25% personal flat income tax.

The state has eliminated property tax which significantly reduces costs for companies that have large capital investments in equipment. This encourages companies that carry a large amount of PPE, especially those in the advanced manufacturing, defence, agribusiness and cybersecurity, to base their operations in Michigan. The elimination of property tax has contributed to Michigan in becoming an advanced manufacturing and technology cluster, as increasing number of companies move their business into Michigan. As a result, interconnected companies, linked by commonalities and complementarities, experience more competition, placing additional pressure for innovation and efficiency. The development of a ‘second generation’ cluster in Michigan has been the driving force behind regional innovation and rising productivity.


Relevance

Michigan was able to leverage its existing industry to create new specialised industries. Consideration needs to be given to how Pilbara can build upon its current composition, as new activities often emerge out of existing economies.

Figure 15: GDP for Michigan, Source: US Bureau of Economic Analysis, GDP by State.

Figure 16: Unemployment Rate in Michigan, Source: US Bureau of Labor Statistics.
3. Case studies – Lowering the costs of doing business
Industry clusters drive regional economic success through competitiveness and innovation output

**Case Study 5: Michigan (USA) – from bankruptcy to attracting private investments and becoming an R&D hub (cont.)**

2. Private investment

The recovery of automotive production and presence of other advanced technological industries has been the role of foreign direct investment. The auto supply chain attracts many foreign suppliers from China, Japan and India to Michigan. According to the Michigan-China Innovation Centre, Chinese investment in Michigan has amounted to $3 billion as at 2017 – around 300 Chinese companies have set up in Michigan. In order to encourage further investment and maintain strong relationships with China, the Michigan-China Innovation Centre has been established. The Centre seeks to identify goods and services that China requires, in which the Michigan industries have the capacity to produce and export these items to China.

*What attracts foreign investment to Michigan?*

- The business friendly tax environment incentivises foreign investors to base their operations in Michigan.
- The presence of US automobile and advanced manufacturing companies in the state, along with headquarters for many suppliers, creates a cluster for knowledge sharing, which assists investors in R&D and purchasing decisions.

*Impacts of interventions*

The favourable business climate in Michigan has prompted more than $23 billion in new investments. Michigan has the highest concentration of electrical and machinal engineers and is the national leader in advanced manufacturing R&D. Automotive history has positioned Michigan as a natural laboratory for advanced manufacturing, aerospace, agribusiness, energy, cybersecurity and defence technology. Michigan’s ability to leverage its existing assets to build specialised clusters has resulted in:

- The unemployment rate reducing from 14.6% in 2009 to 4.2% in 2018.\(^{28}\)
- From 2009 to 2018, the GDP for Michigan has grown from $366bn to $528bn, an increase of 44%.\(^{29}\)
- Michigan has become the twelfth-largest state economy in the US by GDP.

Cutting business costs, in this case through a low tax environment has stimulated growth in additional markets linked to and building on the existing automotive capability in the State.


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26th September 2019

**Figure 17:** Michigan Employment by Sector (%) as at May 2019

Michigan Employment by Sector (%) as at May 2019
4. Unlocking new markets
4. Unlocking new markets
A direct maritime service enables the development of new markets in the Pilbara

Introduction

At present, the economies of both the Pilbara and the state of WA are dominated by the mining sector.

The Pilbara region generated revenue of $60.2 billion in 2017 (REMLPLAN) of which $42.1 billion was derived from mining, $8.9 billion from construction and $1.9 billion from manufacturing. In 2016, mining jobs accounted for around half of all employment in the Pilbara.

At the state level, mining activities contributed to 32% of state GVA (Gross Value Added) in 2018. The next largest contributor in WA was the construction industry at 8% of GVA.

The large contribution of the resources sector is however well understood and significant efforts are being made across the state to diversify and transition the economy to one less reliant on the state’s natural resources over the medium to long term.

Such economic diversification is particularly necessary within the Pilbara region and the proposed DMFS is one potential enabler for establishing alternative industries in the region.

Direct maritime services in and out of the Pilbara, those being from Asia as well as the Australian east coast, is likely to enable new markets to develop, or small existing markets to grow principally through three mechanisms.

Opening new export markets

A direct shipping service for non-mineral cargoes not only provides freight import benefits but also a potentially efficient means for businesses to access export markets across Australia and South East Asia. With the potential for exporting containerised cargo directly from the region, businesses can access new markets at considerably lower cost and travel times. Containerised cargo may also enable the shipping of refrigerated cargoes.

Specifically, exporting can be achieved by ‘backloading’ vessels delivering goods to the Pilbara which is typically necessary for an operator to run a profitable service. Developing industries producing sufficient output so as to allow the backfill of container ships will be a key component of economic development in the Pilbara.

By facilitating cost-effective access to a wider range of international and domestic markets for companies based in the Pilbara, a direct shipping option investment is likely to attract new businesses to the region while stimulating growth for existing firms.
4. Unlocking new markets
A direct maritime service opens export opportunities, reduces operating costs and creates the availability of new input materials.

Lowering freight costs

Two economic impacts of introducing a direct shipping service are a reduction in freight travel times and an improvement in freight transport reliability.

Existing freight supply chains result in imports from Asia taking between 20 and 31 days depending on whether the cargo enters Australia through Perth or Melbourne. A previous study by Australian Floating Decks indicates that this maybe reduced to 9 days under a direct freight scenario. Such a reduction in freight times results in considerable cost savings.

The above impacts contribute to lowering freight costs for businesses in the region which are said to be currently limiting the ability of companies to win contracts and compete with Perth-based firms.

These cost savings can therefore be used to increase the demand for the products and services of local businesses resulting ultimately in increased revenues.

While benefitting existing companies in the region, lower import costs could also become a catalyst for attracting new businesses to set up operations in the region.

Availability of new materials

Firms attracted to the Pilbara through the opening of export routes can further benefit from the availability of new materials that were previously prohibitively expensive or impractical to import to the region.

During previous consultation, stakeholders noted that materials such as zinc and sodium hydroxide may be viably imported through a direct maritime freight option.

The availability of new materials can allow firms to pursue more productive processes, increasing output and reducing operating costs. Greater material availability can also contribute to creating the conditions necessary for new industries to develop.

New markets

As a result of the three key benefits listed above several potential new markets or existing but developing markets in the region have been identified:

- Plant-based agriculture
- Solar power generation
- Fishing and aquaculture

The following pages provide further detail on the potential impact on each of the above new markets.
4. Unlocking new markets

New markets are unlocked principally through three mechanisms:

- **Lowers import costs**
  - Improves viability of renewable energy projects
  - Reduces import costs of seed and fertilizer
  - Reduces import costs of aquaculture equipment
  - Increases competitiveness of manufacturing
  - Enables import replacement opportunities
  - Creates efficient, reliable connection with international markets
  - Enables chilled export capability directly to international markets
- **Opens export opportunities**
  - Enables direct export of agricultural products to markets in Asia
  - Facilitates export of aquaculture products
  - Enables chilled export capability directly to international markets
- **Opens opportunities with new materials**
  - Enables new manufacturing processes
  - Allows firms to be more productive and reduce operating costs
4. Unlocking new markets
A direct connection to Asia unlocks agricultural potential in the Pilbara providing access to significant new markets.

**Agriculture**

*Introduction*

The Pilbara is characterised by its large area and long distance from markets, a very high degree of solar radiation, low average rainfall, a very high incidence of cyclones and associated wet seasons, and highly variable rainfall.

Consequently, extensive pastoralism has been the dominant agricultural industry in the region in the past. Plant-based agriculture has been limited to providing supplementary fodder to livestock or working animals and has historically been confined to small areas. The first case of irrigated farming in the Pilbara was in 2009.

At present, there are no commercial growers producing crop for human-consumption.

However, high value agriculture and cropping, along with aquaculture, algae, biofuels and co-products have been identified as avenues for development in the region.

These opportunities are seen in relation to changing climates, increased water security challenges and market opportunities in Asia for safe, high-quality food. Large amounts of sunlight and relatively fertile soils, in combination with potential links to Asia to service global food markets creates the basis for business opportunities.

In addition to international markets, local production would relieve pressure on regional food supply based on the current reliance of fresh produce items, most of which is being trucked in from Perth at significant cost.

At present, the sector is still in its infancy with significant barriers to achieving long-term viable businesses growing food for human consumption. The high energy costs involved with irrigating the land and cooling greenhouse environments for indoor crop was commented as a key challenge.
4. Unlocking new markets
Previous studies have identified high potential agricultural products for the region.

Agriculture

**Plant-based**

In 2015, a study by Coriolis titled ‘Growing the north’, was completed analysing what agricultural products could be produced in the Pilbara, where target markets are and what agricultural products they demand.

This study identified 22 high potential markets as shown in figure 19 opposite. Agricultural demand from these target markets was then evaluated against the growing capabilities of the north of WA (taking into account climatic conditions) to identify a list of 18 market opportunities.

Some of the best of these 18 agricultural product opportunities, suitable for growth in the Pilbara were:

- Cassava
- Sesame Seeds
- Tobacco
- Cotton

The Pilbara was deemed to be most suited to field grown crops rather than perennial tree products.

**Challenges**

A number of challenges exist for growing agricultural products in the north of WA. These include, but are not limited to:

- relatively high wages (due to competition with mining);
- capital intensity of large scale irrigation;
- remoteness of growing locations;
- perishable products that may spoil in transit;
- low value/high volume products are not viable due to logistics costs;
- supply chains being incomplete.

Figure 19: Potential target markets for new agricultural products, Source: Growing the North, Coriolis, 2015.
4. Unlocking new markets
A direct service would allow far more effective export of products to markets in Asia.

Agriculture

**DMFS impact**

A DMFS will help to minimise some of the above challenges and make new agricultural export business more viable.

Principally, a direct service would allow far more effective export of products to markets in Asia with significantly reduced freight times. With the potential introduction of refrigerated containers, products requiring cold storage can also be feasibly exported with considerably lower logistics costs. Comments from stakeholders indicated that research was being carried out into the feasibility of stone fruit and table grapes in upland areas of the region. Such products would benefit from cold container export.

By reducing freight export costs, a direct service allows agricultural products of lower value and higher volume to be produced more viably. Previously such products from the region had prohibitively high transport costs.

From a supply perspective, reduced freight costs enables growers to import key production inputs such as fertiliser, pesticides and seed at lower cost. Lower costs could improve profit margins and allow reinvestment in operations to increase the scale of operations in the region.

Anecdotal evidence from stakeholders in the agricultural sector suggested that reasonably large quantities of fertilizer are required for the intensity of production required to make projects viable. While some fertilizer may be sourced from nitrate plants in the region (mostly near the Port of Dampier), it is understood that significant volumes would be required to be imported to the region. The cost of this importing would be reduced with a DMFS.

While a direct maritime service can support the opening of new agricultural industry in the region, other policy measures such as reducing the burden of required approvals for farming and land development are likely to be required as additional support for the new sector.

Other issues requiring attention include the limited availability of reasonably priced and adequately skilled labour and the need for significant post-harvest capital intensive equipment for some crops.
4. Unlocking new markets
Modelling by SFP indicates that agricultural developments are viable though currently offer modest returns.

Agriculture

The Sahara Forest Project

In May 2018, the 'Sahara Forest Project' (SFP) carried out a study to explore opportunities in the Pilbara for large scale facilities for vegetable production in arid areas, integrated with revegetation of surrounding lands driven by renewables. This is a specific methodology for high intensity farming developed in arid areas of the Middle East and Africa.

A broad analysis was conducted to evaluate local, regional and international market and value chain opportunities, as well as obtaining pricing for all CAPEX and OPEX elements for various facility alternatives.

The study comprised extensive stakeholder engagement and, business development efforts were also an important part of assessing the feasibility of establishing The Sahara Forest Project in Karratha.

SFP carried out financial modelling on two scenarios, a small-scale SHP facility and a large-scale SHP facility:

Small scale facility
- The small scale facility modelled comprised of 2 ha of green-housing and 1.5 ha of PV.
- Capital investment was estimated at $16.4m with opex rising from $1.9m to $4.1m by 2039.
- Under this scenario, SFP calculated an NPV of $2.4m with a discount rate of 6.8% and an IRR of 8%.

Large scale facility
- The large scale facility comprised 20 ha of green housing and 15 ha of PV.
- Capital investment was estimated at $156m with opex rising from $11.8m to $37.1m by 2039.
- Under this scenario, SFP calculated an NPV of $35.3m with a discount rate of 9.5% and an IRR of 12%.

The modelling undertaken, which was specific to SFP agricultural methods, demonstrated that plant-based agriculture was viable in the Pilbara region albeit, under the current logistics, offering modest returns.

The DMFS, proposed in this project, should increase the returns of SFP projects by enabling a reduction in operating and capital costs as well as the increasing market demand by facilitating access to new international markets.

It is expected that the DMFS would enable more attractive returns for investors in plant-based agriculture of which SFP-style agricultural facilities are one potential option. Other, unique, agricultural projects are likely to become more viable in a lower-cost operating environment, stimulating domestic and foreign investment in the region.
4. Unlocking new markets

The Pilbara has some of the highest levels of solar radiation in the world.

Renewable energy

Introduction

The Pilbara has some of the highest levels of solar radiation in the world and has been identified as one of the best locations for large-scale solar photovoltaic generation. At present, solar power development focus has been on off-grid technologies that can support larger industry (such as mining operations) and community energy loads, though new projects are now being proposed aiming to connect major energy users to one another.

The Asian Renewables Energy Hub is a large proposed energy project in the Pilbara that seeks to enable up to 15 GW of wind and solar generation primarily for use in producing green hydrogen for export markets with the remaining power to be used by local communities. Later stages of the project may comprise the construction of a subsea interconnector to Indonesia. This project is detailed further later in this report.

In 2011, Horizon Power completed construction on two power stations in the inland Pilbara towns of Marble Bar and Nullagine which combine solar technology with back up diesel generation. The technology applied provided the highest solar penetration possible, with 65% of the day-time load of the towns met by solar energy.

Challenges in development

Developing solar farms in the Pilbara presents a series of unique challenges, differing from those prevalent in eastern states. Of particular note is difficulty in securing land access where strong relationships with Traditional Owners of the land are critical to project success. Consultation with Traditional Owners will be required through project development where land access is required. In some cases, this may include potential compensation and/or economic and social indicators (such as access to employment).

Strong relationships are also required with major energy users in order to understand demand flows and secure off-take agreements. Anecdotal evidence has suggested that small to medium sized mining operations without dedicated in-house energy teams are more open to external solar power developers.

Further challenges include the high costs in the Pilbara relating to both transportation and staff as well as the limited availability of appropriately skilled workers in a sparsely populated region.

Costs

Costs for developing solar farms include those for physical components such as modules, inverters, structural components, electrical components and transmission lines and other costs including the following:

- EPC overhead including SGandA, warehousing, shipping and logistics
- Direct labour installation costs
- Developer overhead
- Contingency
- Profit
- Burden costs

Based on Arup international project experience, typical solar projects in remote areas incur total capital costs ranging from 1.2 to 1.7 AUD per Watt (peak).

The total cost of solar power generation is typically driven by the cost of components as opposed to other infrastructure developments which may incur far greater labour costs. However, a small workforce coupled with high competition for labour in the Pilbara may increase installation labour costs beyond those typically seen in the PV industry.

EPC overhead costs, which include the cost of shipping, warehousing and logistics, can cost between 8 and 13% of equipment value. This figure may be pushed higher where a remote location lacks good import options, as is the case for many locations in the Pilbara.

DFMS impact

By directly reducing the transportation costs associated with moving equipment from manufacturers to PV sites in the Pilbara, the DFMS will help reduce total capital expenditure and increase project viability in the region.

Industry contacts indicated that many components of solar farms used in Australia, including a number of PV module types, are manufactured in South-East Asia. It is therefore expected
4. Unlocking new markets
Reducing the costs of import goods improves the viability of solar projects in the region

**Renewable energy**

*DFMS impact (cont.)*

that, with a direct freight connection to Asia, import costs for the components of solar farms could be significantly reduced, assuming they make use of the containerised shipping service.

*Flow on impacts*

While the DMFS should enable more viable project development of solar farms, flow-on effects from shipping components directly into the Pilbara may also be significant. Components arriving at ports are often not in the form required for installation, creating an opportunity for new local industry to assimilate at port locations to support the growing PV industry and provide value add services.

Employment flow on impacts are not well understood for the renewable industry but could enable clusters to develop and agglomeration benefits (benefits that arise from firms and people being located close to one another) to be realised.

As was observed in the Midwest America case study earlier in this report, the U.S. Department of Energy’s ‘Wind Powering America’ program during the next 20 years is expected to create $60 billion in capital investment in rural America, providing $1.2 billion in new income for farmers and rural landowners and creating 80,000 new jobs. The reason for such attractive results are the flow on benefits associated with investing in wind power. Not only is the direct investment in wind-farms creating wind farm construction jobs, but also stimulates the establishment of new companies to support the growing industry. New firms such as those manufacturing turbine components, developing foundation designs or providing specialised transportation services are established as a flow on impact of the direct investment made.

In Australia, jobs in large-scale solar farms tripled over the 2017-2018 financial year, overtaking the hydro sector for the first time. As of financial year-end June 2019, jobs in renewable energy reached over 20,000. With renewable energy generation and energy storage falling drastically in costs over recent years, significant future investment as a cost-efficient method of reaching global decarbonisation goals is expected. Such a boom in the Australian renewable energy sector will stimulate new supporting businesses, some of which may feasibly establish operations within the Pilbara.
4. Unlocking new markets
PV capital costs are primarily driven by the costs of physical components

Key cost drivers of solar farms

Figure 20: Typical costs of developing Utility-scale PV. Source: National Renewable Energy Laboratory, October 2018.
4. Unlocking new markets
Lower costs of doing business improves the viability of the aquaculture industry in the Pilbara

Aquaculture

Introduction
The potential for the aquaculture industry to be a component in the achievement of economic diversity in Australia’s northern regions has been recognised by the Commonwealth Government in its associated Green Paper – Developing Northern Australia. The paper highlights how beyond new opportunities in mining and resources, there are prospects for expanding agricultural industries, including aquaculture, to add to the diversity for rural communities across Australia.

Opportunities
At a regional level, the PDC has also identified aquaculture as one element of achieving greater economic diversity within the Pilbara. In the Pilbara Regional Investment Blueprint: Summary Document, the PDC demonstrates amidst changing climates and increased water security challenges, the natural advantages of the Pilbara in food production will be promoted.

The overarching biological attributes of the Pilbara region is considered suitable for the production of a range of algal, finfish, crustacean, seaweed culture and mollusc species. These attributes include:
- A pristine marine environment which includes an abundance of sunlight and coastal land
- Significant groundwater resources
- Large areas of relatively unpopulated land.

Challenges
However, a PDC report on the technical and economic viability of aquaculture in the Pilbara region highlighted several hurdles to overcome for offshore aquaculture in the region. Details of these challenges include:
- Potential aquaculture sites may require significant up-front capital investment with long payback periods.
- Aquaculture operations will potentially incur higher ongoing operating costs (for example high energy costs) in view of the location of the region.
- Adverse environmental conditions including cyclones and naturally occurring cadmium and other heavy metals render a higher technical risk for establishing a viable commercial scale aquaculture industry
- Such environmental conditions are likely to be an impediment to marketing any product (particularly edible oysters) when there are established existing markets without such risk factors.

![Value of Australian Fishery Exports by Destination](image)

Figure 21: Value of Australian Aquaculture Exports by Destination, Source: Australian Bureau of Agricultural and Resource Economics and Sciences 2018
4. Unlocking new markets
Lower costs of doing business improves the viability of the aquaculture industry in the Pilbara

Aquaculture

Challenges (cont.)

Changes in pond water quality through localised flooding and high ambient temperatures limit the viability of effective aquaculture farming.

Technically and economically viable marine based aquaculture in the Pilbara-Gascoyne region at this time is considered challenging for a typical investor; however, for investors with pre-existing infrastructure and expertise in place, aquaculture can be viable.

Small to medium scale, land based aquaculture ventures could be considered viable, noting such projects have the potential to deliver significant dividends to the local community.

DMFS impact

A direct maritime service will help to minimise some of the above challenges and make new aquaculture export businesses more economically viable whilst attracting increased investment from private investors.

From an import perspective, a DMFS will help local aquaculture farmers and producers’ access equipment required for aquaculture including handling and grading equipment, pumps, seine reels and aeration devices at lower costs. This will encourage operational savings and lower business costs, allowing the aquaculture industry to grow without being inhibited by the current high operational costs localised in the Pilbara region.

The increased rate of freight shipping and import due to the lower costs will encourage operational efficiency and increase the rate of aquaculture production. Consequently, returns on aquaculture investment can be incurred in shorter payback periods, encouraging investment to the Pilbara aquaculture industry. Figure 22 (opposite, bottom) demonstrates the value of aquaculture and edible fishery production in Australia.

Depending on shipping times and storage requirements, aquaculture farming in the Pilbara should access greater export opportunities to international and nationwide markets as a result of reduced logistics costs. Locally farmed algal, finfish, crustacean, seaweed culture and mollusc species may be exported to meet the international demand for aquaculture.

Aquaculture supply is expected to be over 60% of the world’s seafood consumption by 2030.30

30FAO, Prospects for Fisheries and Aquaculture, 2013
4. Unlocking new markets
The replacement of domestically imported goods with those locally manufactured may be achieved by enabling cost-efficient operations in the Pilbara

Domestic import replacement

Introduction

The existing major sectors in the Pilbara, primarily the oil and gas and mining industries, are supplied with equipment and other manufactured goods arriving from three sources: the Pilbara, elsewhere in Australia or internationally. Resources companies make decisions on where to procure such goods according to several factors including quality and existing relationships but, often more significantly, cost. Cost, in this context, refers not solely to the price of a product, but the total cost of purchasing a product and transporting it to where it is required.

‘Import replacement’ refers to the opportunity to replace the manufactured goods being imported by the major industries in the Pilbara with equivalent products made locally. Resource companies are private entities, with major interests in delivering profit to shareholders and consequently seek to enable as efficient operations as possible. As a result, for import replacement to occur competitive market conditions, it must offer a viable cost efficient alternative.

A lowering of costs in the region, in part as a result of the DMFS, may enable manufacturing that, in the future, could become competitive with that of elsewhere in Australia. The same principle holds true for other procurement including construction and professional services. Import replacement, presents a potentially large opportunity for businesses in the Pilbara. Whilst unlikely in the short-term, the longer term results of regional cost reduction could enable the development of new businesses directly supplying the resources sector.

Significant imports

A gap analysis using REMPLAN data identified a number of potential opportunities for import replacement in the Pilbara. The analysis assessed the value of goods and services being imported from elsewhere in Australia by four large industries in the Pilbara as follows:

- Iron ore mining imported $5.6bn from the rest of Australia
- Heavy and civil engineering construction $1.87bn from the rest of Australia
- Oil and gas imported $1.51bn from the rest of Australia
- Non-ferrous ore mining imported $0.93bn from the rest of Australia

Across the four industries, imports from elsewhere in Australia amount to almost $10bn annually. These imports are the goods and services used exclusively in the operations of companies in the four sectors. It is important to note that these figures do not comprise international imports such as goods from south-east Asian countries with significantly lower production costs.

The majority of domestically imported products and services are likely either not available in the Pilbara or cannot be produced at lower enough cost to incentivise companies to switch to locally produced options.

Gap analysis

The gap analysis undertaken does not seek to determine which import replacement opportunities are the most viable nor recommend which opportunities are most sensitive to a reduction in operation costs but merely highlights the largest domestic imports under four key industries in the Pilbara.

The results of the analysis are displayed overleaf. Each chart displays the top 6 imports to each sector by the difference between domestic imports and local purchases.

Results

Across all four industries, services such as finance and insurance displayed a large difference between those bought locally and those imported domestically. Such a result is expected given the more services-orientated economies of Australia’s cities.

Outside of services, a significant difference was apparent between construction being procured locally and imported domestically. Similarly, a large difference was found for specialised and other machinery and equipment manufacturing. In the iron ore sector, $198m of this manufacturing is imported domestically while only $16m is bought locally.

Some of the large differences identified represent import replacement opportunities.
4. Unlocking new markets
Import replacement may be achievable by enabling cost-efficient manufacturing in the Pilbara
5. Enabling feasible projects
5. Enabling feasible projects
High development and operating costs are often stumbling blocks for projects under consideration in the Pilbara

Introduction

There are a wide-range of projects at various stages of development across a number of sectors in the Pilbara. Projects range from very large renewable energy developments, to offshore LNG platforms, to smaller agricultural developments. Some are at early stages while some are well developed proposals. The top 10 projects by investment value are detailed in Table 2 overleaf.

All potential projects face differing challenges in developing viable propositions that attract sufficient investment and allow reasonable financial returns. Such challenges comprise a wide range of issues depending on the sector however, due to the remoteness of the region, often challenges comprise an element of high cost.

In the case of solar farms, where photovoltaic panels are not manufactured in the Pilbara, transport costs form reasonable proportions of any investment. Further, labour required to install panels can be of particularly high cost. While just two examples, such cost issues have often been the cause of limited investment and stumbling blocks for otherwise viable projects.

For infrastructure projects, those being projects with stable and predictable long-term returns, minimum required IRR’s (internal rate of return) for private investors tend to be 10 – 12% while other projects, with less stable income streams, require sometimes significantly greater returns. Both capital investments as well as ongoing operating costs have large impacts on achieved IRR’s and thus private investment in projects.

This section of this report seeks to analyse the extent to which lowering the costs of business in the region may enable more projects to reach completion. Lowering costs of business in the region can be achieved from several measures, one of which is a reduction in imported freight costs generated by a DMFS.
5. Enabling feasible projects
The top 10 projects under consideration by value in the region amount to c. $70bn of capital investment

Top 10 projects under consideration in the Pilbara, by investment value

<table>
<thead>
<tr>
<th>Project name</th>
<th>Description</th>
<th>Industry</th>
<th>Location</th>
<th>Estimated total investment value ($m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Woodside Burrup Hub Project</td>
<td>A combination of multiple projects to create the Burrup Hub vision of the Burrup Peninsular. This includes developments of the Scarborough and browse off-shore gas fields, a second train at Pluto LNG and an interconnector between Pluto and Karratha Gas Plant</td>
<td>Oil and Gas Extraction</td>
<td>City of Karratha</td>
<td>52,000</td>
</tr>
<tr>
<td>The Asian Renewable Energy Hub</td>
<td>CTW and partners are seeking to develop low cost renewable energy for the Pilbara and South East Asia.</td>
<td>Electricity, Gas, Water and Waste Services</td>
<td>Town of Port Hedland</td>
<td>22,000</td>
</tr>
<tr>
<td>West Pilbara Iron Ore Project (WPIOP)</td>
<td>The Australian Premium Iron Joint Venture is proposing to develop the West Pilbara Iron Ore Project. Stage 1 of the project is based on the production of 40Mtpa of direct shipping iron ore from deposits, including Red Hill and Mt Stuart deposits, located 35-80km south west of Pannawonica. The ore is proposed to be transported by a 240km heavy haul railway for export via the proposed multi-user port at Anketell.</td>
<td>Infrastructure</td>
<td>Shire of Ashburton</td>
<td>6,800</td>
</tr>
<tr>
<td>Balla Balla Investment Group (BBIG)</td>
<td>Develop integrated port and rail infrastructure system in Pilbara. BBI Group (BBIG) is proposing the Balla Balla Infrastructure project (BBIP), a mine, rail and port development, which when constructed will comprise an integrated port and rail infrastructure system.</td>
<td>Infrastructure</td>
<td>City of Karratha</td>
<td>6,000</td>
</tr>
<tr>
<td>Downstream Processing Chemical Production Facility</td>
<td>WesCEF, along with Joint Venture partners are considering a 1.8Mtpa methanol plant on Site E of the Burrup Strategic Industrial Area (SIA) on Murujuga (the Burrup Peninsular).</td>
<td>Manufacturing</td>
<td>City of Karratha</td>
<td>2,000</td>
</tr>
<tr>
<td>Pyxis and Pluto North Hookup</td>
<td>Woodside is proposing to develop both the Pyxis and Pluto North infill wells through an approximately 25-kilometre subsea tieback to the Pluto platform.</td>
<td>Oil and Gas Extraction</td>
<td>City of Karratha</td>
<td>500</td>
</tr>
<tr>
<td>LD Brine SOP Project</td>
<td>Reward Minerals Limited proposes to extract potassium-rich brines from sediments of the Lake Disappointment playa and to use solar evaporation of the brine to produce potassium sulfate (potash), a compound used mainly as an agricultural fertiliser.</td>
<td>Manufacturing</td>
<td>Shire of East Pilbara</td>
<td>451</td>
</tr>
<tr>
<td>Marillana Project</td>
<td>Brockman Mining Joint venture to develop new mine. MRL to build, own and operate the rail and port infrastructure for life of mine.</td>
<td>Mining</td>
<td>Shire of Ashburton</td>
<td>435</td>
</tr>
<tr>
<td>Mardie Salt and Potash Project</td>
<td>Building a new Salt and Potash business supported by Iron Ore cash flow.</td>
<td>Mining</td>
<td>City of Karratha</td>
<td>425</td>
</tr>
<tr>
<td>Beyondie Sulphate of Potash Project</td>
<td>Development of the Beyondie Sulphate Of Potash Project with the aim of producing Sulphate of Potash (SOP)</td>
<td>Mining</td>
<td>Shire of East Pilbara</td>
<td>284</td>
</tr>
</tbody>
</table>

Table 1: Top 10 projects under consideration in the Pilbara, by investment value. Source: PDC
5. Enabling feasible projects
The proposed DMFS increases the viability of projects in the region

Major projects in the Pilbara

The PDC maintains a list of completed, under-construction, committed and under-consideration projects in the region across all sectors. Table 1 (previous page) displays the top 10 projects by investment value under consideration as at August 2019. Note that this list does not include projects at very early stages such as those in the pre-feasibility stage.

The Asian Renewable Energy Hub is a very large project seeking to develop wind and solar farms in the Pilbara to generate up to 15GW of energy. While some energy will be consumed domestically, the majority is proposed to be used to produce green hydrogen products for export to Asian markets.

Other large projects under consideration include a number of new mining opportunities in iron ore and potash as well as new exploration in Oil and Gas.

In addition to these very large projects, under consideration smaller projects include opportunities in:
- Hydrated magnesium carbonate production
- Irrigated agriculture
- Aquaculture
- Hydrogen production
- Fertilizer production

Objective

Arup carried out a high-level assessment of the economic benefit to the region in terms of the Gross Value Added (GVA) through additional employment. The additional employment is generated by the proposed completion of several major projects currently under-consideration.

The assessment is intended to estimate employment-related benefits to the region.

Reference and intervention cases

Determining the specific hurdles for each project under consideration in the Pilbara, in particular whether high costs are the biggest challenge in reaching completion, requires a detailed and intimate knowledge of each project. At this stage, Arup is not able to determine precisely which projects may become feasible as a result of lowering the cost of doing business in the Pilbara. Such a determination would likely require access to confidential information and even with such data, would be difficult to make. It is understood however, that a number of proposed projects, which are impacted by the high cost environment, would become more viable through the lowering of costs achieved by the DMFS.

All projects designated as ‘under-consideration’ are yet to reach the FID (Final Investment Decision) stage with the true viability of each not completely understood by developers. As a result, many such projects may not reach the internal investment hurdles required and not be progressed. It is proposed that the DMFS would allow more projects to reach a ‘proceed’ FID.

For the purposes of this assessment, the Reference Case, that is the projects that would go ahead regardless of the DMFS, is assumed to include only major projects with a total investment value of greater than $400 million. This is referred to as ‘deadweight’.

The Intervention Case, that is the case where the DMFS results in additional projects above the reference case, is assumed to include all the under-consideration projects in the region with an investment value of under $400 million.

From the above definitions, the net additional impact of the DMFS is the sum of the projects under $400 million in value. This result is achieved using the equation in figure 27 below.
5. Enabling feasible projects

Arup has estimated the additional GVA as a result of new employment from major projects.

### Methodology

**Step 1: PDC project list**
- Identify proposed projects that are under consideration in the Pilbara.

**Step 2: Remove large unaffected projects**
- Remove large projects (> $400m) such as Woodside Browse and the Asian Renewables hub that are unlikely to be made more viable as a result of the DMFS (Reference Case).
- Retain projects less than $400m in value that are assumed to be impacted by the DMFS and lower costs (Intervention Case).

**Step 3: Determine total investment for each project**
- Determine total capital investment for each project using industry sources and information in the public domain.

**Step 4: Determine number of jobs during construction and operations**
- Utilise expected job numbers from sources in the public domain or, where not available, utilise Arup benchmarks to estimate gross job numbers.

**Step 5: Calculate net job creation**
- Apply best practice additionality guidance (from the UK) to determine genuinely additional jobs by removing substitution, leakage and displacement factors.
- Use the Pilbara region as the target area to remove benefits realised in other areas.

**Step 6: Estimate Gross Value Added by job creation**
- Determine the GVA per job by sector and apply to number of additional jobs by project.
- Sum GVA for all projects to determine economic benefit from job creation.

Figure 28: Methodology for estimating employment impacts as a result of enabling new projects.
5. Enabling feasible projects

Arup investigated the employment impacts of new projects in the region

Methodology (cont.)

Deadweight
As discussed above, deadweight refers to the projects that are considered to progress to completion independently of the DFMS. For the purposes of this assessment, all projects above $400 million in total investment value are considered to be deadweight. These projects include the following:

- Woodside Burrup Hub Project
- The Asian Renewable Energy Hub
- West Pilbara Iron Ore Project (WPIOP)
- Balla Balla Investment project
- Downstream Processing Chemical Production Facility
- Pyxis and Pluto North Hookup
- LD Brine SOP Project
- Marillana Project
- Mardie Salt and Potash Project

We assume that the above projects would benefit from the DFMS however, it would not be the critical push factor to enable them to reach completion.

The above projects are contained within the Reference Case.

Estimating construction and operations jobs from new projects
The expected number of construction and production jobs for new projects in the Intervention Case have been sourced from the public domain. Where information was not available, benchmarking based on previous projects has been applied to the investment value of each project to estimate number of jobs required during both construction and operations. Sector specific benchmarks have been utilised to ensure that estimates are relevant to the project in question.

Additionality assessment
The number of jobs calculated above are referred to as the gross direct effects comprising all the jobs created by projects in the intervention case. However, it is necessary to apply several factors to the gross number of jobs to calculate the net job creation for the intervention case. The net job creation comprises the truly additional jobs within the target area by assessing leakage, displacement, substitution and multiplier factors. These terms are describe in further detail later.

Target area
The target area has been selected as the Pilbara region. For the purposes of this assessment, impacts outside of the region have been removed.

Time period and discounting
Given the long-term impact of major projects in the Pilbara, employment effects have been quantified over a 30-year appraisal period. Gross Value Added (GVA) from employment has been discounted over the appraisal period using a discount rate of 7% in line with WA State Government guidance. This reflects the fact that future impacts are worth less than current impacts.

Construction start date and duration
All of the projects being assessed have unclear construction start dates and limited information was available publicly regarding expected construction durations. For the purposes of this assessment, all projects were assumed to begin construction in 2021.

Durations for construction were estimated based on previously observed timescales on similar projects.
5. Enabling feasible projects

Arup investigated the employment impacts of new projects in the region

Methodology (cont.)

Leakage

A leakage factor has been applied to the calculated gross jobs. Leakage refers to impacts benefiting those outside of the target area (as described above) and is used to make allowance for distributional effects.

As has been discussed previously, FIFO (Fly-in, Fly-out) workers are common in the Pilbara where employees from largely metropolitan areas are flown into the region for projects in both the construction and operational phases. As a result of this practice, employment leakage has been high with significant benefits being achieved outside of the target area.

As result of this, leakage factors have been selected for construction and operation jobs of 67% and 55% respectively. These percentages reflect the percentage of workers that fly out of the region with benefits ‘leaked’ from the regional economy.

Displacement

Displacement arises where an intervention takes market share or labour, land or capital from other existing local firms or organisations. For example, an intervention may help a business expand operations but such an expansion may reduce market share of other businesses in the region.

It is considered that new projects may compete, to some degree, with existing projects for employment and thus there may be some displacement effects. However, limited reduction in employment elsewhere in the target area is expected. Based on this, a displacement factor of 25% has been selected for both operations and construction.

Substitution

Substitution effects arise where a firm substitutes one activity for a similar one as a result of an intervention. In the context of this assessment, substitution is expected to be low as new projects are, by definition new and are thus unable to substitute existing activities. A substitution factor of 10% has been applied for operations and construction.

Multiplier

Multiplier effects occur where the results of an intervention generate additional impacts for firms along the supply chain. In this case, new projects may generate new jobs in the region which would result in new jobs at firms supplying the new projects, the ‘multiplier’ effect. However, this assessment seeks only to quantify the direct employment impacts of new projects rather than those flowing through the regional economy and a multiplier factor of 1.0 has been selected accordingly.

In the Arup Phase 1 findings for this project, CGE modelling was undertaken to understand the regional economic impact of the intervention. This analysis takes into account the multiplier effect.

Calculating Gross Value Added (GVA)

The Gross Value Added (GVA) by additional employment from new projects has been achieved by calculating a GVA per job figure for each industry and multiplying this by the net job creation.

ABS (Australian Bureau of Statistics) data for the gross value added by sector for 2018 in Western Australian was attained. This was divided by the number of full-time employees in each sector in 2018 to give a GVA per job figure by sector.

For the construction phase of the projects, GVA per job has been assumed to be the GVA per annum per worker for the construction sector in WA. However, for employment generated during the operations phase, the relevant GVA for the sector that the project is in has been adopted.
5. Enabling feasible projects
The employment benefit from enabling new projects in the Pilbara is estimated at $1.05bn

Results

The Net Present Value (NPV) of Gross Value Added (GVA) from job creation amounts to $1.86bn consisting of $61m (3%) from additional construction jobs and $1.8bn (97%) from additional production/operations jobs.

The estimated $1.86bn of employment benefit is the result of additional jobs being created in the Pilbara from projects in the intervention case proceeding.

Before discounting, the net GVA from job creation amounts to $5,014m, consisting of $72m (1%) derived from net additional construction jobs and $4,968m (99%) from net additional production/operations jobs.

An estimated 856 new construction jobs are created from enabling the projects, while 871 new jobs are created annually over the life of the projects. Given that a large number of FIFO workers are expected, there is significant employment leakage which results in benefits not being fully realised in the target area of Pilbara. As a result, the net additional jobs created, where benefits directly flow to the Pilbara region, are significantly less than gross job creation.

It has been assumed that construction for projects in the intervention case commence in 2021 with 144 net additional construction jobs being created between 2021 to 2022. A net 147 additional jobs are projected in the operations phase.
5. Enabling feasible projects
Consideration should be given to the underlying reasons for a project not reaching completion

Other considerations

Limitations
As stated above, the precise reasons for individual projects proceeding or not proceeding are generally not available in the public domain. An assumption has been made that the high cost of doing in the business in the Pilbara limits projects under-consideration to proceed to completion.

Anecdotal evidence from developers in the region, for example a solar developer, suggested that high costs and in particular high import costs have a material impact on the viability of their projects and limit the number of projects able to proceed.

Other limitations include the following:

- Given the limited data available to calculate benchmarks for specific industries, the benchmarks applied to projects that have limited information available may overstate or understate the expected number of construction and production/operations job created.
- Projects have been assumed to commence construction in year 2021. Based on prior project experience and desktop review, it has been assumed that the construction phase is 1-2 years depending on the investment value.
- The net GVA amount assumes that the projects will remain in the operations phase until 2049.
- During the production phase, it is assumed that the net additional jobs year on year does not change.

Other impacts on projects
In addition to enabling projects to become viable, the DMFS will allow the extension of existing project lifetimes in the region. When originally conceived, projects may have had proposed revenue-producing lifetimes of a certain number of years with viable returns beyond this period not considered possible. However, the DMFS may enable projects to extend lifetimes by reducing the marginal costs of production and allowing viable returns to continue to be made over a longer period than originally forecast.

In order to extend the life of many projects, significant capital expenditure may be required. Such expenditure will only be made by investors if viable returns are forecast. The DMFS and consequential cost reduction in the region may facilitate major life-extending capital investments to be made.

Figure 31: Accumulated NPV of net GVA created from construction and production/operations jobs from 2019 to 2049
6. Resource industry impacts
6. Resource industry impacts
Extending mine lifetimes will allow time for investment in new industries in the region

Introduction

Whilst a particular focus of the proposed DMFS, as has been detailed throughout this report, is to enable the development of new industries in the region, it is important to present the potential impact on the region’s major economy, the resources sector.

The mining industry exported some $38.2 billion of mining products during 2018, adding $25.8 billion to the Pilbara economy. Imports of the sector to the Pilbara economy amounted to $9.8 billion in 2018.

The mining sector has well developed logistics with rail infrastructure and dedicated port facilities enabling efficient export activities. However, from an import perspective, goods that support operations, such as food for the workforce, is less efficient and often relies on expensive road train operations from southern WA. An opportunity exists to increase the efficiency of the mining sector’s supply chain and thereby reduce input costs.

This section of the report examines the impact of (1) the DMFS and (2) a general lowering of the costs of business in the Pilbara on mining in the region. Arup has not had direct access to mining companies in this study and thus the results shown are based on international examples and anecdotal evidence from industry experts.
6. Resource industry impacts
Extending mine lifetimes will allow time for investment in new industries in the region

Anticipated impacts

Cost reduction
Primarily, the proposed DMFS will lower costs for iron ore mining companies by reducing import costs. Mining and other extraction companies in the region import significant quantities of goods to support their operations. With the exception of fuel and large pieces of equipment, much of the goods imported arrive via road train from southern WA. By replacing this transportation method with a DMFS, as found in the Arup phase one report, import costs are reduced by up to 50%. This reduction is expected to have an impact on the production volumes of mines in addition to the economically viable lifetime of operations.

In a report by PwC, *Tempting Times 2018*, the key cost drivers for the mining industry are detailed. While the precise breakdown of costs vary from operation to operation, PWC presented the six generalised components of total mine operating costs in order of expense as follows:

- Raw material and consumables (33%)
- Employee expenses and external services (32%)
- Government royalties paid/payable (14%)
- Freight and transport (10%)
- Other operating costs (9%)
- Exploration and evaluation (2%)

Most notably, reducing import costs through the DMFS is likely to reduce freight and transport costs, though no impact is expected on the direct costs of exporting extracted material itself. Freight and transport related savings will be limited to import of goods to support operations. As the DMFS is proposed as an enabler for more general lowering of business costs in the region, savings would also be expected to the cost categories ‘raw material and consumables’ and ‘other operating costs’ noted above. Generally speaking, cost savings as a result of the DMFS would be to fixed costs that would not vary with mine output. Variable costs such as drilling, loading and mucking are likely to be only moderately affected by the lower cost environment.

Impacts of cost savings
From a high-level perspective, a reduction in the operating costs of a mine, assuming production output and raw material prices remain constant, will result in increased profitability. Such profitability enables additional investment in expansions, new technology or other business needs, further improving operational efficiency and providing resilience in the case of a fall in global material prices.

Importantly, a reduction in costs in the region will help to increase the economic lifetimes of existing mines, which is seen as a necessary condition to allow time for the economy of the Pilbara develop alternative industry and sectors not reliant on non-renewable resources.

Towards the end of a mine’s originally proposed economic lifetime, typically 20 years, a number of options are available to management including: agreeing to close and decommission the mine or to invest in exploring deeper and extending the economic life of the mine. The decision of which option to follow is typically decided by the minimum IRR of the mining company. If additional exploration and mine extension is calculated to exceed the required internal rate, then the activity will likely go ahead. Whether or not the hurdle rate is achieved is dependent on a number of factors including the capital cost of the extension and the corresponding operating costs. The lowering of costs provided by the DMFS may enable marginal mining extensions to reach threshold IRR’s and thus go forward.

While not a specific aim of the DMFS, extending mine lifetimes will allow continued employment in the region and crucially time for investment in new industries.
6. Resource industry impacts
Argyle diamonds reduced costs in order to extend mine life in the early 2000’s

**Argyle Diamonds**

The Argyle diamond mine is in the remote East Kimberley region of Western Australia. The mine has been operating since 1983 and has produced more than 800 million carats of rough diamonds.

The mine, owned by Rio Tinto, was originally considered to have a twenty year life with closure expected in the early 2000’s. Limited additional exploration was completed during the operation of the mine in the 80’s and 90’s and accordingly no significant additional mine life was achieved. However, investigations into mining below the open pit were carried out in the late 90’s and early 00’s to ascertain the viability of extending the mine life. It is understood that the viability of the extension was in doubt due to high costs and a significant decommissioning liability. With its existing cost structure, the extension would not have met the required rate of return of Rio Tinto at the time.

Argyle were able to reduce their operating costs, partly through agreeing a reduction in their royalty rate from 7.5% to 5%, which meant that the proposed mine extension exceeded the threshold rate of return. The extension, given the go-ahead in 2005, allowed the mine to continue operations until present day. The economic benefit of the mine extension was considerable, ensuring the continuation of employment for a large workforce in addition to benefits to the wider Kimberley region. At the time the mine was the largest single contributor to the local economy.

This example highlights how a reduction in operating costs may allow a mine to viably extend its life leading to economic benefits for the region. In the case of the Pilbara, the cost reduction mechanism is through the DMFS rather than royalty reduction and aimed to allow the economy time to develop alternative industries.
6. Resource industry impacts

Previous cost reductions in mining have led to improved resilience to price changes and more viable mine extensions.

**Rio Tinto, driverless trucks**

In 2008, Rio Tinto introduced fully automated, driverless haulage trucks across iron ore mines in Western Australia. The increased operational efficiency reduced load and haul operating costs by up to 13% and generated an improvement of 14% in productivity.\(^{31}\)

In 2017, its autonomous fleet moved around one quarter of all material moved out of Rio Tinto’s Pilbara mine sites, with the vehicles running for 700 hours longer than conventional trucks over the course of the year.

While the upfront capital costs were large, camp costs and labour costs (including associated FIFO travel costs) have been reduced through the innovative fleet with significant savings being made over the long term. This cost reduction mechanism has allowed Rio Tinto to remain resilient against changes in raw material pricing, particularly between 2011 and 2015 in addition to improving the viability of future mining extensions.

**Mining productivity**

There are a number of measures for the productivity of mines but the MineLens Productivity Index, developed by McKinsey, measures the physical output of a mine against employment at the site, the value of assets at the site and non-labour costs. This index showed a global fall in mining productivity between 2004 and 2013 of -3.5% per year driven by escalating capital and operating expenditures.

Globally, McKinsey found that the mining productivity decline has been largely driven by increases in capital expenditure and non-labour expenses. Consequently, significant productivity improvements are available in reducing non-labour operating costs. This may be achieved in a variety of ways but, in the case of the Pilbara, could be in part achieved by reducing the costs of freight imports. Should Pilbara mines successfully improve productivity (moving to the green quadrant in the figure 32, below), they will be more resilient to price shocks and be better prepared to extend their operations.

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\(^{31}\)Mine 2018, Tempting Times, PwC, 2018, \(^{32}\)McKinsey, Productivity in Mining Operations: Reversing the downward Trend, 2018
7. Conclusions
7. Conclusions
Lowering the cost of business in the Pilbara, through a DMFS, helps generate transformational economic outcomes

The DMFS, a catalyst for development

The Pilbara is known for its remote location, extensive mining operations and high-cost business environment. Historically, the region has relied upon its abundance of natural resources for prosperity and future development. As non-renewable resources are depleted and global decarbonisation efforts increase, the Pilbara must develop a more diverse, less reliant economy to secure its future.

Currently, the Pilbara is an expensive place to do business with one of the highest consumer price indexes in the country. High prices combined with a relatively small local market presents a barrier to new business entry and limits the ability for existing businesses to compete with Perth-based alternatives.

One reason for such high costs are long, inefficient supply chains in which goods make a multi-day journey on road trains using increasingly constrained highways. High transport costs are pushed onto businesses and consumers limiting growth. Through the DMFS, transport costs will be reduced by up to 50% and delivery times by up to 70%. This reduction, in a region where nearly all goods are imported is expected to contribute to a lowering of business costs in the region. This results in several transformational economic outcomes.

Lower costs are expected to unlock opportunities in new sectors such as plant-based agriculture, solar power and aquaculture where projects may, for the first time, become financially viable. In existing industries, marginal capital investment projects should reach positive final investment decisions with reduced costs enabling threshold hurdle rates to be met.

While reducing import costs, the DMFS also opens export access to international markets for companies based in the Pilbara. With the potential for exporting containerised cargo directly from the region, businesses should be able to access new markets at considerably lower cost and travel times.

Diversifying the economy of the Pilbara is a long-term objective and will only be achieved through a gradual process. The DMFS may help facilitate this gradual transition indirectly by enabling the extension of existing mining operations to allow the economy time to develop. Through the creation of a lower cost environment, mine extensions may become more feasible.

While the DMFS is seen as one mechanism for lowering costs and increasing economic diversity, the region will need a combination of additional policy measures and capital investments to reach its long-term goal of reduced reliance on natural resources.
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