Pilbara Development Commission

The impact of a Direct Maritime Freight Service for the Pilbara

Final Report

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Transport and infrastructure Council. (2018). *ATAP Guidelines (T2 Cost Benefit Analysis)*.

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Executive Summary

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 Pilbara region generated revenue of $60.2 billion in 2017 (REMPLAN) 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.

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. Inbound flows of freight 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). 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.

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 Pilbara Development Commission (PDC) propose the creation of direct maritime freight service (DMFS) into the Port of Dampier.

CGE modelling, simulating the shock of lower import freight costs, indicates that the DMFS would result in a positive economic gain to the Pilbara, increasing real GRP for the region by 1.12% in 2022. The gain is sustained throughout the forecast period, reaching 1.14% in 2030, and is largely attributable to the productivity improvement driven by the savings to inbound freight costs. CGE results also indicate a cumulative gain to national welfare (measured in household and government consumption) of $1.1 billion over the twelve-year study period (2019-2030). These results were generated based on a parallel study into the potential import cost reduction using a DMFS, compared to importing freight into Perth and transporting to the Pilbara by road. The model assumed the DMFS would attract a 20% market share of contestable freight, phased in evenly over the first four years of the study period (2019-2022). Figure 1 illustrates how the DMFS impacts real GRP over the study period.

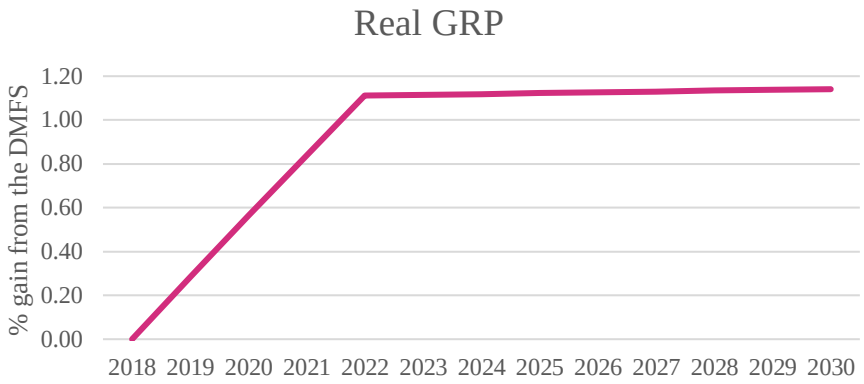

Figure 1: Real Pilbara GRP, % gain from the DMFS (CGE results)

Outside the quantified benefits to the economy from the CGE modelling, the major benefit of such a service appears to be in achieving significant import freight cost reductions for Pilbara businesses allowing them to become more competitive across Western Australia, Australia as a whole and possibly globally. These firms are likely to experience increased demand, stimulating jobs and further investment into the region. A direct maritime freight service would also offer local businesses access to a greater range of export markets across Australia and internationally.

Aside from stimulating growth in the region, removing land-based transport may offer significant benefits to stakeholders across Western Australia. Accident and road maintenance costs may be reduced while environmental benefits such as reduced greenhouse gas emissions are also realised.

1 Introduction

Arup were engaged by the Pilbara Development Commission to understand and demonstrate the direct and indirect impacts to the economies of the Pilbara, Western Australia and Australia of reducing transport costs in the Pilbara for goods using a direct and regular maritime freight service.

The scope of our engagement included using Computable General Equilibrium (CGE) modelling to quantify the potential impacts of a reduction of the cost of goods into the Pilbara at a regional, state and national level as well as a qualitative analysis into any additional relevant impacts such as environmental or safety benefits.

This report details our findings and is structured as follows:

- Background: In this section we outline the context of the project including an outline of the Pilbara region, the current inbound and outbound freight tasks and the proposed solution.
- Approach: In this section we describe our approach to the analysis including how we derived inputs to the CGE modelling as well as listing some of the potential additional economic benefits. We also include a summary of the stakeholder engagement exercise.
- Economic Benefits: This section describes the results of the CGE modelling and includes a discussion of additional economic benefits that may be achieved from a direct shipping service.
- Conclusion: We conclude on the results of our study and make recommendations for potential next steps.

2 Background

2.1 Pilbara Region

The Pilbara region is situated in the north of Western Australia, bordered in the east by the Northern Territory border and, in the west, by the Indian Ocean. The region lies approximately 1,200 km north of Perth and represents around 20% of Australia's land mass. The Pilbara is rich in natural resources with mining, mineral processing and energy the fundamental drivers of growth and development in the region. The Pilbara region generated revenue of $60.2 billion in 2017 (REMPLAN) of which $42.1 billion was derived from mining, $8.9 billion from construction and $1.9 billion from manufacturing. The majority of mineral value in the Pilbara is Iron Ore (97% of total mineral value in 2017-2018 according to the Western Australia mineral and petroleum statistics digest 2017-2018). The Pilbara was responsible for 12.3% of revenue in Western Australia.

The Pilbara region is made up of four local government authorities (Ashburton, East Pilbara, Port Hedland and Karratha) and has a population of approximately 61,000. The mining and construction industries provide the largest number of jobs, 29,000 and 11,000 respectively in 2016 (ABS Census, 2016).

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. There are a number of further port facilities managed by others including Port Walcott, Cape Preston, Onslow, Varanus Island, Barrow Island, Airlie Island and Thevenard Island. Figure 2 below displays the region's ports as well as three proposed ports (shown in green).

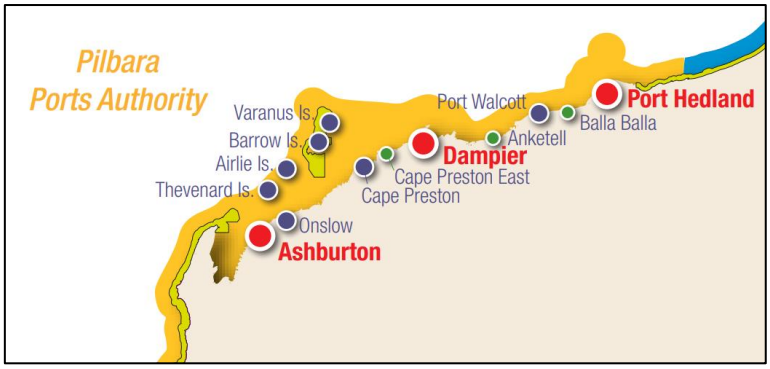

Figure 2: Pilbara Ports (Department for Transport, Western Australia)

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. Across the PPA ports there were 15,894 vessel movements over the financial year 2017-2018.

2.2 Freight Needs

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. Established ports such as Dampier and Port Hedland are adequately set up to export large quantities of bulks and have outlined expansion plans in order to facilitate growth.

Inbound flows however, consisting largely of the goods and materials required to support mining production output, are less integrated as a result of the larger variety of import goods, differences in cargo origins and destinations as well as individual contract differences between suppliers and customers.

There is a strong correlation between outbound and inbound flows in the Pilbara in which any growth in mining output drives the need for greater imports of fuel, ammonium nitrate (to be used as an explosive), equipment and general freight to support the growing industry. The inbound logistics task can be considered to consist of two relatively distinct categories:

1. Inflow to supporting the existing industry. These inbound volumes relate to the cargo required to maintain existing production as well as growth in output of existing facilities.
2. Inflow to facilitate the construction of new production facilities. These imports consist largely of construction materials, plant, new mining equipment and accommodation units required for expansion of the industry.

Generally, the import tonnages relating to construction (the second point above) are considerably greater than the tonnages required to support current operations.

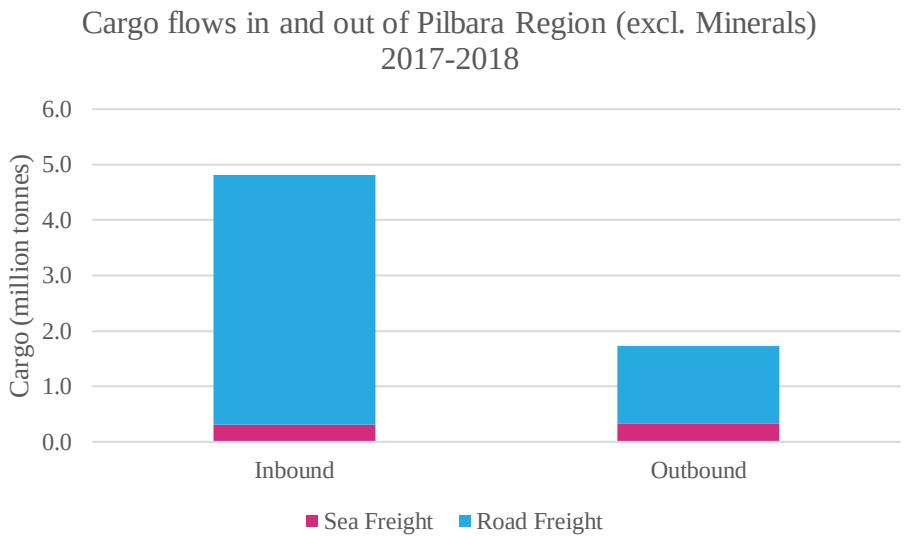

Figure 3: Cargo flows in and out of Pilbara Region (excl. Minerals) 2017-2018, Source: Sea Freight: Pilbara Port Authority (2018), Road Freight: Main Roads WA (2018), and as per advice from the Western Roads Federation

Cargo tonnages in to and out of the region are dominated by the products of mining activity. Figure 3 illustrates the cargo flows in/out of the Pilbara region when excluding mining products by the method of transportation. As can be seen, both inbound and outbound flows are mainly transported by road freight from southern WA. Inbound flows were approximately 2.8 times greater than outbound flows in the last financial year.

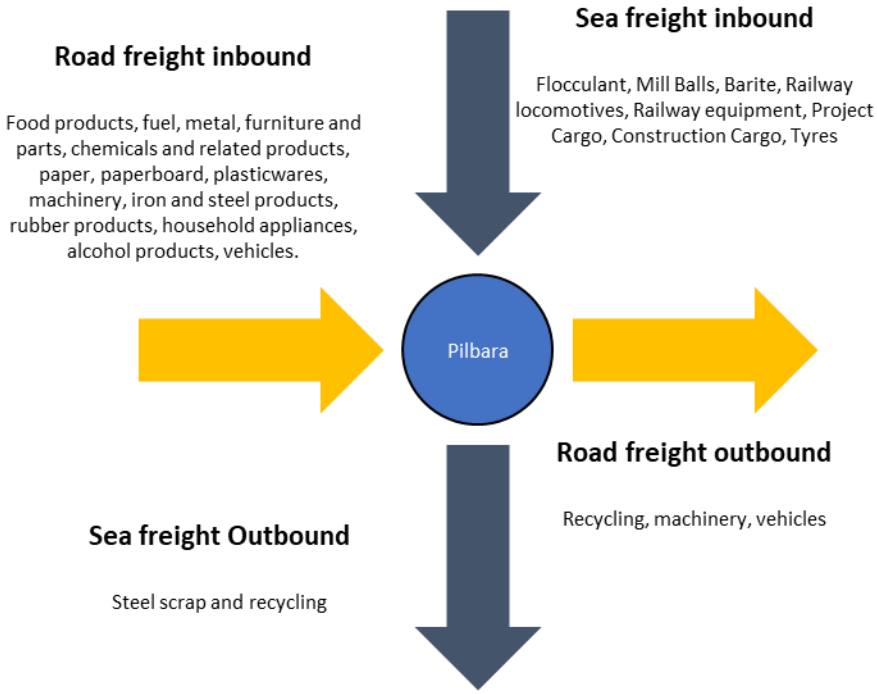

Figure 4: Product flows by method of transportation

Figure 4 displays the products being transported under each mode. Inbound road freight includes a number of finished products and includes the majority of cargo required for domestic purposes in the Pilbara.

2.3 Current Inbound Logistics

Inbound flows to the Pilbara region are imported using a combination of shipping, rail and road train transport modes. The choice of import transport mode is driven by response time and reducing inventories in addition to the nature of the cargo being transported. At present, there are two main delivery modes for importing goods to the region:

1. Goods originating in Perth (or Fremantle) are transported to the Pilbara by road train.
2. Overseas imports arrive directly at Pilbara marine ports and are either stored on-site at ports or at logistics facilities (for example rail equipment).

From the Pilbara ports, goods are transported to production facilities across the region either by rail or road. Typically, project cargo (including rail locomotives and equipment) is imported directly into the Pilbara ports whereas mining equipment, ammonium nitrate and other general freight are transported north from Perth via road train.

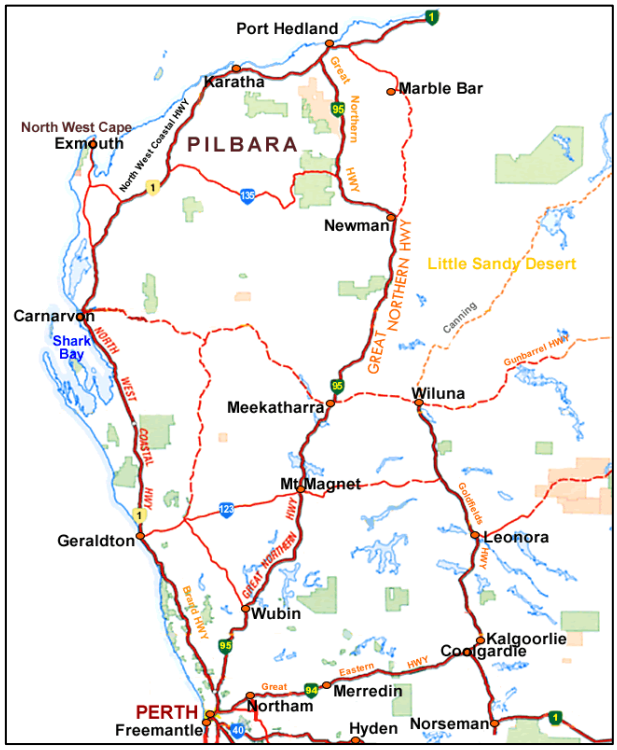

Figure 5: Western Australia Major Highways

Figure 5 displays the two major highways connecting Perth with the Pilbara region these being:

1. The North West Coastal Highway (NWCH)
2. The Great Northern Highway (GNH)

Freight destined for the Pilbara region by road use both major highways. Larger, heavy freight movements typically use the inland highway which offers shorter journey times while lighter movements may use the coastal route running through more populated areas. It is estimated that around 80% of traffic currently uses the inland Great Northern Highway (GNH) with the remaining 20% taking the coastal route.

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 over-taking opportunities. It is understood that as a result of the above impacts many non-freight vehicles are being forced to use the longer NWCH.

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. The issues of high import freight costs are discussed further throughout this report.

2.4 The Proposed Option

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 (Pilbara Development Commission) propose the creation of direct freight shipping of import cargo into the Pilbara. While this report does not make any assessment of the preferred location for a direct maritime freight service, for the purposes of adopting savings identified in the parallel Karratha Freight Study (KFS), it is assumed the service operates in the Port of Dampier. The following information was provided by the PDC to demonstrate the reasonableness of this assumption:

- Dampier has the port facilities that will support a true liner service
- Dampier has multiple shipping channels that can be used by a reduced draught general cargo ship without interfering with major bulk shipping movements and without delaying the liner cargo service
- Dampier is the oil and gas supply base hub for the Northwest – it has the only developed oil and gas supply base facilities on a large scale
- Dampier has a unique mix of shipping demand which offers a suitable blend of business interest and opportunity to develop the direct service
- Dampier is better positioned geographically for business development than other ports
- The Dampier general cargo area has direct access to the highway system and is not encumbered by the iron ore infrastructure or LNG processing. The direct road access includes Gap Ridge with modern large-scale industrial land sites suitable for customs controlled ‘cargo terminal operator’ premises for international freight
- Dampier is the Pilbara base for some very large industrials. These corporations have unique and specific logistics requirements and will be important for the business development of the service.

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. Figure 3 illustrates the current imbalance between inbound freight over land and by sea, indicating the opportunity to achieve a more balanced supply. It is hypothesised that such a shift in mode would deliver a number of benefits for the region not least a considerable reduction in inbound freight costs and the possibility of opening new export routes for businesses in the Pilbara. These benefits are detailed later in this report.

3 Approach

The purpose of this report is to assess the impacts of establishing a direct maritime freight service into the Pilbara through the Port of Dampier. The approach to conducting this assessment involved the following tasks:

- Task 1: understand the current inbound freight requirements of the region, including volumes and categories of freight currently transported to the Pilbara by road after arriving in Perth by sea
- Task 2: obtain an estimate of the cost savings from a direct maritime freight service and a reasonable proportion of inbound freight that would be able to be diverted to a direct maritime freight service
- Task 3: using the information obtained in Tasks 1 and 2 as inputs, conduct CGE modelling to assess the economic impacts of a direct maritime freight service into the Pilbara
- Task 4: conduct a high level qualitative assessment of any likely additional impacts of a direct maritime freight service into the Pilbara.

For Tasks 1 and 2, the author of the parallel Karratha Freight Study (KFS), Australian Floating Decks (AFD), has provided preliminary outputs from the KFS, which involved developing a comparison of the costs of shipping freight via a direct maritime freight service into the Pilbara with the costs of shipping freight via Perth and then transporting to the Pilbara by road.

AFD obtained estimates of freight volumes for the KFS using a bottom-up approach based on road-train movements into the Pilbara and extensive industry experience, including stakeholder consultation as part of the KFS. These volumes were consistent with volumes identified in the 2012 Hyder report, "North West Inbound Freight Movements: A consultancy to identify the potential for a partial shipping solution" (the Hyder Report). To develop the necessary inputs for CGE modelling, the total inbound road freight volume was allocated to each Local Government Area (LGA) of the Pilbara according to population and employment figures in the 2016 Census as shown in Table 1[1].

LGA	Karratha	Port Hedland	Ashburton	East Pilbara	Total
Mtpa	0.82	0.59	1.52	1.57	4.50

Table 1: Allocated inbound road freight volumes by LGA

The KFS also developed detailed costings for a direct maritime freight service into the Pilbara and provided comparisons with shipping into Perth and then transporting to the Pilbara by road. The cost savings were calculated for each LGA as shown in Table 2.

[1] Depending on the freight category, freight volumes were assigned to each LGA based on number of mining workers or overall workers (using Census 2016 Place of Work data) or population (using Census 2016 Usual Residence data).

LGA	Karratha	Port Hedland	Ashburton	East Pilbara
$/tonne	$281	$278	$213	$213

Table 2: Calculated freight cost savings by LGA

These savings were then applied as appropriate to the freight volumes allocated to each LGA above and a total annual freight cost saving for the region was calculated for the purposes of CGE modelling, after making assumptions regarding the percentage of total freight that would be diverted to the direct maritime freight service and the percentage of achievable savings that would be passed on to users of the service.

3.1 CGE Modelling

3.1.1 The Direct Maritime Freight Service Scenario

The following assumptions were made to describe the Direct Maritime Freight Service Scenario (DMFS Scenario) for the purposes of CGE modelling:

- Arup consulted further with AFD to determine a reasonable assumption for the amount of freight that could be diverted to the new direct maritime freight service. The size of the identified savings means the market share would be limited primarily by the capacity of the new service. AFD indicated that a mature service could carry 20% of the identified inbound freight task, and that it would be reasonable for the service to achieve this market share within a few years once the service's capability and savings are proved to the market. The direct maritime freight service was therefore assumed to capture market share of the total inbound freight currently transported from Perth via road according to the following schedule:

Year 1	*Year 2*	*Year 3*	*Year 4*	*Later years*
5%	10%	15%	20%	20%

Table 3: Maritime market share capture inputs

- The savings identified by AFD are based on an economic return to the service operator. Therefore, the savings would be passed on to users of the service in a reasonably competitive market. However, given the first-mover advantage likely to exist in the service's infancy, the proportion of achievable savings passed on to users of the freight service was assumed to be 75% over the study period.

- The total freight savings for the Pilbara region for Year 1 was assumed to be $39,383,487[2], based on the service carrying 5% of inbound freight and passing on 75% of the identified savings to end users.

3.2 Additional economic analysis

3.2.1 Industry perspective

As part of this study, Arup carried out a series of teleconferences to engage with a number of stakeholders in the region. The objectives of the activity were to

- confirm understanding of the current freight market;
- obtain available data on road freight and shipping costs, quantities and categories, including industry forecasts to inform our understanding of the future state; and
- obtain input from stakeholders regarding their expected impacts to local businesses of shifting inbound freight through Port of Dampier to help frame and stress test our CGE modelling and qualitative assessment of additional outcomes.

We engaged a number of local businesses in the region for comment and consultation regarding the above objectives. The companies engaged included:

- KAW Engineering
- Karratha Earthmoving
- Timik Constructions
- Ausco Modular and Transportable Buildings

Commentary from stakeholders broken down into ‘Enablers’, considerations supporting a direct freight service, and ‘Barriers’, considerations providing a barrier, are detailed below. The comments given were in-line with the wider consultation findings of the KFS and the Hyder report.

Enabler - Freight costs

Stakeholders commented that a direct freight option may be more cost effective than the road-based alternative. A number of businesses stated that costs of road freight were currently limiting their business. It was estimated that their freight costs were between $180 and $300 per tonne equating to $3,200 to $6,000 per road train.

One business quoted that freight costs amounted to between 7 and 18 percent of raw material costs and is hindering its ability to win contracts against Perth-based construction companies.

[2] Calculated by multiplying the volumes in Table 1 by the savings in Table 2 for each LGA, and then applying the 5% market share for Year 1 with 75% of the identified savings passed on.

Enabler - National contracts

Stakeholders believed that a direct freight option may allow the port to attract national contracts. One respondent noted that companies such as Bunnings did not enter the Karratha market because of high freight costs for inventory.

Enabler - Port hopping service

According to one respondent three major companies run port hopping services currently bypassing the Port of Dampier for Fremantle but two out of the three surveyed commented that they were open to stop at Dampier. This would open an export route to the east coast.

Enabler - Current freight task

Many stakeholders commented that the existing freight task justifies a direct freight option although respondents varied in their estimates of the current inbound task to Karratha. Estimates were between 35+ road trains per week to 90+ road trains per week.

Enabler – New materials

Stakeholders commented that a direct maritime freight service would enable new materials not currently being serviced at the mining dominated port. Such materials include zinc material, cars and sodium hydroxide.

Barriers

During the consultation, stakeholders also outlined some of the key barriers to the proposed direct shipping option. One issue was that of containerisation which was seen to be a potential issue for the construction industry given that a significant proportion of cargo not suitable for containerised shipping.

Respondents also noted issues related to time and regularity of services. Travel times of less than one week are required for the construction industry noting that road-based freight from Perth currently takes 2 days. Stakeholders also mentioned their concern that a service may not have sufficient regularity for some industries who require materials on demand.

3.2.2 Key assumptions

While CGE modelling has been used to quantify the net impacts of a direct freight shipping option on the Pilbara economy, there are numerous specific benefits that may be realised through the implementation of a direct shipping service. Potential benefits comprise those related to the economy (such as productivity increase), society (such as improved safety) and the environment (such as preserving clean air). Benefits may be categorised as primary, those benefits directly caused by the direct service, or secondary, those benefits that are passed on or re-distributed within the economy.

Table 4 displays some effects of improved freight transportation, starting with primary (first order) benefits and progressing to secondary benefits that flow on from the initial freight cost reductions.

First-order Benefits	Immediate cost reductions to carriers and shippers, including gains to shippers from reduced transit times and increased reliability.
Second-order Benefits	Reorganisation-effect gains from improvements in logistics. Quantity of firms' outputs changes; quality of output does not change.
Third-order Benefits	Gains from additional reorganisation effects such as improved products, new products, or some other change.
Other Effects	Increases in regional employment or increases in rate of growth of regional income.

Table 4: Effects of Improved Freight Transport and Logistic Re-organisation (US Federal Highway Administration, 2001)

Our understanding of the potential benefits offered by a direct shipping service has been informed by discussion with Pilbara stakeholders as well as existing literature detailing the benefits of freight infrastructure improvement projects. The list below incorporates elements of the TfNSW 'Principles and Guidelines for Economic Appraisal of Transport Investment and Initiatives (March 2016)' which includes a discussion of appropriate economic analysis for freight initiatives. The Australian Transport Assessment and Planning (ATAP) guidelines were also used in our economic analysis.

Economic Benefits

A direct shipping service into the Pilbara may enable a number of economic benefits to be realised. Directly related economic benefits may include:

- Reduced freight costs generating savings for Pilbara businesses and lower operating costs. These cost savings can increase product demand and sales for businesses.
- Freight travel time savings (from origin to the Pilbara) as a result of direct shipping option.
- Improved reliability of freight. Improved reliability allows firms in the Pilbara to realistically predict the amount of buffer-time in the delivery of goods. (Buffer-time is the amount of time a carrier builds into a trip to reduce the risk of being late.) A reliable buffer-time also allows firms to reduce inventories and the costs associated with storing goods.
- Increased capacity for Pilbara inbound cargo flows through the addition of port capacity.

Secondary benefits may include:

- The travel time savings, increased travel time reliability and logistic cost savings outlined above may result in productivity gains for firms in the Pilbara. These gains and associated revenue will stimulate the investment in terminal, warehouses and 'last mile' facilities, resulting in savings in

warehouse cost and inventory stock. This process is generally referred to logistic reorganisation.

- Savings in vehicle operating costs (VOCs) of road trains due to fewer vehicles on the road. VOCs would include costs related to fuel, vehicle maintenance, tyres, etc.
- Savings in infrastructure maintenance costs through reduced wear and tear on road infrastructure. This may be significant given the size and weight of trucks, particularly those operating on the GNH.
- Creation of employment at the Port of Dampier related to a new direct service. This would include both those created for adjustments to infrastructure as well as ongoing operations jobs. The assessment of this benefit should however consider the loss of trucking jobs from reduced road-based freight.
- Travel time savings for non-freight users of highways by reducing congestion and eliminating need for overtaking.
- Savings in road damage costs derived from fewer accidents on highways.
- Reduced instances of pilferage as a result of lower road-based freight tonnage.

Social benefits

Societal benefits may include those relating to improved safety:

- Reduced accidents on major highways from reduced heavy goods traffic.
- Improvements in pedestrian safety where road trains are travelling through urban areas such as Perth or towns along both the NWCH and GNH.

Environmental benefits

Reduced road-based traffic may give rise to a number of environmental externalities and intangible effects. These may include:

- Reduced vibrations at properties situated in close proximity to major highways (particularly on the NWCH) from reduced heavy good traffic.
- Reduced noise pollution from engines, air brakes, bodywork rattle, horns, etc. at properties situated in close proximity to major highways (particularly on the NWCH) from reduced heavy good traffic.
- Improved air quality through reduction in emissions of carbon monoxide, oxides of nitrogen, unburnt hydrocarbons, lead compounds and particles from a lower number of vkt (vehicle kilometres travelled).
- Reduced emissions of greenhouse gases from lower road train vehicle kilometres travelled.

Some of the benefits noted above may be quantified in either monetary or non-monetary terms assuming the availability of adequate data. Quantified values may be used in a Cost-Benefit Analysis (CBA) to evaluate the feasibility of the project.

This study however does not attempt to quantify any of the outlined benefits but qualifies them with a reasonable judgement of any potential impact. A discussion of the impacts is presented in section 4.2.

4 Economic benefits

4.1 CGE modelling

4.1.1 Approach

The CGE modelling approach included:

- Constructing a baseline projection of the Pilbara, rest of Western Australia (RoWA) and rest of Australia (RoA) economies over the period 2019-2030 to show how the economies behave when presumed to grow according to baseline forecasts (see Figure 6, below). This baseline uses growth forecasts for each region as well as information on actual, estimated and forecast LNG and iron ore mining production in the Pilbara based on publicly available information. The model includes an estimate of current GRP for the Pilbara based on Census 2016 Usual Residence data. Under the assumed growth path, this estimate of Pilbara's GRP reaches $12.365 billion in 2030.

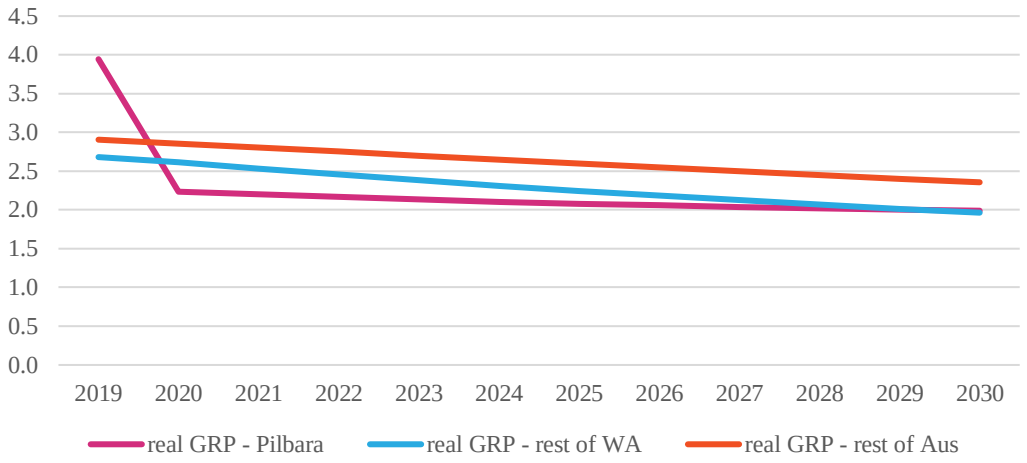

Figure 6: Baseline growth paths for the Pilbara, RoWA and RoA (Source: Centre of Policy Studies, Victoria University (CoPS))

- Applying cost savings to inbound freight based on the assumptions set out in section 3 above and comparing the following results over the study period to the baseline projection:
  - Employment, real wages and labour force participation
  - Private and public consumption, investment and GRP
  - National welfare

  All dollar values are the net present value (NPV) of the change in the associated variable over the entire simulation period 2019-2030, presuming a discount rate of 5 per cent. Note that the model does not consider the potential flow-on effects of lower freight costs stimulating new industries or projects in the Pilbara. These are considered qualitatively in section 4.2, below.

- Sensitivity analysis, including simulating a low- and high- growth scenario by adjusting the forecast growth in LNG and iron ore mining production by +/- 2.5% and +/-1% per annum, respectively, during the years 2020-2030.

4.1.2 Results

Changes to the labour market

The CGE modelling results showed only minor improvements in employment outcomes for the Pilbara under the DMFS Scenario (illustrated in Figure 7, below):

- demand for labour (employment) increases through to 2022, peaking at 0.171% more than the baseline and then tapering off to a sustained gain of around 0.1% over the baseline from 2030 onwards
- the increase in employment causes real wages to rise throughout the study period, approaching 0.4% higher than the baseline in 2030
- the rising real wage attracts workers to the Pilbara labour market, with labour supply approaching 0.08% higher than the baseline in 2030.

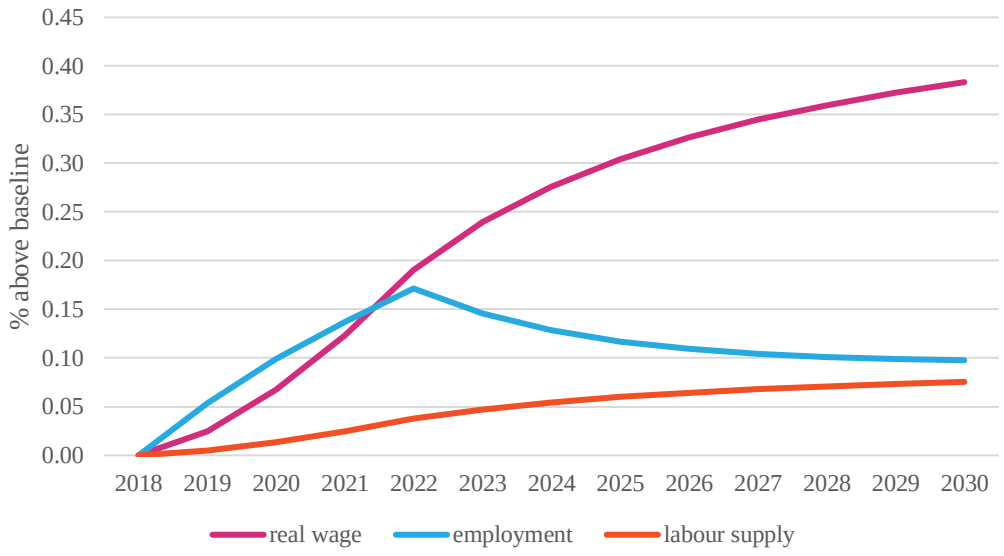

Figure 7: Labour market CGE results (Source: CoPS)

Changes to economic output

Productivity under the DMFS Scenario is illustrated in Figure 8, which shows a real increase to the output for the Pilbara region (Gross Regional Product (GRP)) phasing in over the first four years of the study period as more freight is diverted. The gain is sustained throughout the period, reaching 1.14% higher than the baseline in 2030.

The cumulative gain to Pilbara's GRP is $693 million (NPV) for the period. It is important to note that the CGE model uses an estimate of Pilbara's GRP based on Census 2016 Usual Residence data, which differs significantly from the REMPLAN figure based on Census 2016 Place of Work data and reported by the

Government of WA and the PDC[3]. Under the CGE model's assumed growth path (see Figure 6, above), Pilbara's GRP reaches $12.365 billion in 2030, compared to the REMPLAN figure for 2017 of $34 billion.

Together with gains for the rest of Australia, the boost to Pilbara's GRP contributes to a net gain of $1.035 billion to Australia's GDP over twelve years. This is primarily attributable to the productivity improvement from reduced transport costs under the DMFSS, with only minor increases in labour and capital.

Figure 8: Real GRP CGE results (Source: CoPS)

Table 5 presents the economic effects of a direct maritime freight service for the Pilbara, the rest of Western Australia (RoWA) and the rest of Australia (RoA). While consumption and investment gains are larger for RoWA and RoA, in relative terms the effects, as expected, would be more felt in the Pilbara. This is reflected in the results for real GRP, which is primarily gained in the Pilbara and relatively insignificant for the rest of the state and nationally.

	Pilbara	RoWA	RoA
Real private consumption	$75.79	$212.62	$713.23
Real investment	$106.41	$360.25	$187.76
Real public consumption	$0.34	$93.34	$235.39
Real GRP	$693.29	$180.68	$160.73

Table 5: CGE results by region ($ million)

Changes to national welfare

The change in national welfare under the DFMS Scenario is found by calculating the net present value of the changes to real household and government spending through the study period, less the increase in net foreign liabilities that accumulate. The NPV of the increase in national household consumption is $1,002.1m, while government spending increases by $328.7m. Over the period, $224.5m in net foreign liabilities accrue compared to the baseline. Accordingly,

[3] https://www.economyprofile.com.au/pilbara/industries/gross-regional-product

the reduction in transport costs under the DFMS Scenario results in a cumulative gain to national welfare of $1.106 billion (NPV) over twelve years.

Sensitivity analysis

A sensitivity analysis was conducted to see how the impact of the DMFS would change under lower and higher growth scenarios for the Pilbara. These growth scenarios were developed using lower and higher growth assumptions for iron ore and LNG outputs (see 4.1.1, above). Up to 2020, the growth rates are the same in the "low growth" and "high growth" scenarios as they are in the "central case" scenario. As a result, baseline GDP growth in the Pilbara is the same in all scenarios through to 2020, but will be higher (lower) under the "high growth" ("low growth") scenario over 2021-2030. By 2030, baseline GDP in the Pilbara is 2.34 per cent higher (2.41 per cent lower) under the "high growth" ("low growth") scenario.

Table 6 summarise the results of the CGE modelling for the Pilbara region under the low-, medium- and high-growth scenarios over the 12-year study period. The results represent the net present value of the total change over the study period, using a discount rate of 5%. These results show only minor changes to the impact of the direct maritime freight service for different growth paths for the Pilbara economy.

	Low growth	Central case	High growth
Real private consumption	$75.05	$75.79	$76.60
Real investment	$105.85	$106.41	$106.96
Real public consumption	$0.34	$0.34	$0.34
Real GRP	$689.15	$693.29	$697.42

Table 6: Sensitivity testing results ($ million)

4.1.3 Interpretation

The results of CGE modelling suggest that cost reductions resulting from a diversion of inbound freight in the Pilbara to a direct maritime freight service will result in a positive economic gain to the Pilbara, reflected in the ongoing gain to real GRP of 1.14% per annum from 2030 and a cumulative gain to national welfare of $1.1 billion (NPV) over twelve years. It is expected that, in line with the real GRP results, most of the gain to national welfare would be felt in the Pilbara. If the DMFS attracted a greater market share than 20%, and future competition saw more of the savings passed on to users of the DMFS, it is expected that economic gains would be greater.

4.2 Additional economic benefits

Primary cost benefits

The primary economic benefit of establishing a direct shipping service in the Pilbara is the reduction in freight costs to both carriers and shippers. The CGE modelling undertaken (detailed above) attempts to quantify how the 'shock' of

lower freight costs may impact other areas of the Pilbara economy including changes in regional employment or changes in the growth rate of regional income. This section discusses the additional economic benefits that may be generated through direct shipping to the region.

Two economic impacts of introducing a direct shipping service are a reduction in freight travel times and an improvement in freight transport reliability. By removing road-based transportation, businesses in the region will benefit from reduced freight times approximating the two days it currently takes for trucks to drive from Perth/Freemantle to the Pilbara. An additional time saving may be achieved for international trade that can be shipped a shorter distance to the Port of Dampier rather than down to Perth, with these time savings depending on the origin of cargo.

A direct maritime service may also reduce the variability in freight travel times by removing many sources of delay that are currently present on the land-based transportation route. Road congestion, overtaking opportunities, driver rest requirements and other factors currently causing delays to freight are largely eliminated under a direct freight option offering businesses greater certainty and allowing them to reduce the size of inventories they keep as protection against freight variability.

The above two impacts contribute to lowering freight costs for businesses in the region which, as was discussed during stakeholder consultations, is 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 may also become a catalyst for attracting new businesses to set up operations in the region. It should however be noted that the extent to which businesses may benefit from lower freight costs depends upon the extent to which carriers pass on savings. This will largely be determined by the level of carrier competition on the route which, in the early years, may be limited. In the CGE modelling described earlier, an assumption was made that 75% of import freight cost savings would be passed on to local Pilbara businesses.

In addition to local businesses such as construction firms, lower import costs would result in a reduction to the operating costs of the region's mining companies (such as Rio Tinto, BHP Billiton and FMG). By reducing the marginal cost of mining production, the economic lifetime of mines in the region may be extended.

Opening export routes

A considerable benefit of a direct shipping service at the Port of Dampier is the opening up of new export routes for local businesses. With the exclusion of mining companies (who have well developed and efficient export routes already), local businesses have poor accessibility to different markets meaning trade is largely limited to consumers in the region.

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 may be able to access new markets at considerably lower cost and travel times. During the stakeholder consultation, one respondent noted that a port hopping service may be willing to stop at the Port of Dampier which would immediately open export routes to the East coast of Australia. Potential industries benefitting from this would include agriculture and quarrying.

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 may attract new businesses to the region while stimulating growth for existing firms.

New materials

Firms attracted to the Pilbara through the opening of export routes may further benefit from the availability of new materials that were previously prohibitively expensive or impractical to import to the region. During 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 may allow firms to pursue more productive processes, increasing output and reducing operating costs.

Logistic Re-Organisation

A further benefit to consider is related to Pilbara firms making adjustments to their logistical arrangements in response to the lower shipping costs. This secondary effect relates to how local firms may react to greater demand for their products and increasing revenues.

Local businesses may use their increased wealth to invest in production and warehousing facilities leading to further reductions in logistics costs. For example, firms may use resources to invest in more advanced warehouse technology which further reduces their cost of operations. This second order effect may generate increased demand over and above that generated solely through the initial freight cost reduction.

Removing road trains

Beyond the primary benefits of lower freight costs, there are numerous benefits associated with reducing the number of road trains making the Fremantle/Perth to Pilbara journey.

Through intensive and repetitive usage, road trains can cause material damage to road surfaces. This effect appears to have the greatest impact on the GNH which handles greater OSOM (Over Size Over Mass) vehicles. As a consequence, removing road trains from both the GNH and NWCH may reduce road maintenance costs to local authorities across Western Australia. The magnitude of these cost savings is directly related to the percentage of freight diverted to the direct shipping service.

A reduction in road-train traffic on the highways is likely to result in a reduction of vehicle accidents. The benefits of reduced accidents are numerous and include both the cost savings associated with reduced road infrastructure repair as well as the clear societal and economic benefits of reducing driver injuries and fatalities. If it is assumed that the number of accidents occurring is directly proportional to the number of road trains using a highway, then accident costs should be reduced in line with the reduction in road trains.

Similarly, not only would there be safety benefits available to road users but also to pedestrians interacting with the road network. This safety benefit would be more significant in densely populated areas in and around Perth but also to road-side towns (some of them tourism hubs) along the GNH and NWCH.

The Hyder report states that in some cases, significant road train traffic (particularly on the GNG) is forcing non-freight road users to choose alternative routes. It has been reported that difficulties in overtaking road trains have been causing this impact resulting in some vehicles travelling significantly greater distances with longer time durations. Reducing the number of road trains on highways should produce the reverse effect offering travel time savings as well as safety benefits to non-freight road users.

Environmental Benefits

Most of the environmental benefits we have identified directly relate to the reduction in road trains on Western Australian highways leading to a net reduction in VKT (vehicle kilometres travelled).

This reduction in VKT leads to follow on reductions in:

- Greenhouse gas emissions (gases, for example carbon dioxide or methane, that contribute toward the greenhouse effect, a negative externality).
- Pollutants in the air (for example carbon monoxide, oxides of nitrogen, unburnt hydrocarbons, lead compounds and particles.)

There may also be environmental benefits in terms of noise pollution and vibrations at communities situated in close proximity to road train routes. Vibration impacts refer to ground borne waves (as opposed to low frequency airborne noise) and are most significant with heavy goods traffic on uneven road surfaces passing close to pedestrians or residences. While this benefit is likely to be minor as the vast majority of highways are out of urban areas, this may provide some benefit in Perth.

Noise pollution affects a greater number of people given that it can travel larger distances from the highway. The level of pollution depends mostly on the volume, age and quality of vehicles. By removing road trains from the highways, communities will benefit from a more comfortable environment with lower noise pollution or vibration impacts.

5 Conclusion

This study concludes that a direct shipping service into the Pilbara region will result in a positive economic gain to the Pilbara. The gain is sustained throughout the period, with GRP reaching 1.14% above the baseline in 2030, resulting in a gain to national welfare of $1.1 billion over twelve years. These gains are largely attributable to the productivity improvement driven by the savings to inbound freight costs.

Our sensitivity analysis tested the impact of the shipping service in differing growth scenarios for iron ore and LNG. Under the high case, GRP was 2.3% above the central case while under the low case GRP was 2.4% lower. The calculated effects of the direct shipping service in each scenario were only marginally different to the central case.

Outside the quantified benefits to the economy from the CGE modelling, several other benefits to stakeholders across Western Australia may be realised through a direct shipping service. The major benefit of such a service appears to be in achieving significant import freight cost reductions for Pilbara businesses allowing them to become more competitive across Western Australia and Australia as a whole. These firms are likely to experience increased demand, stimulating jobs and further investment into the region.

By assuming ships unloading directly into the Pilbara may be ‘back-filled’, local businesses will also have access to a much greater range of export markets across Australia and internationally. This access may facilitate additional growth for businesses in the Pilbara.

Aside from stimulating growth in the region, removing land-based transport may offer significant benefits to stakeholders across Western Australia. Accident and road maintenance costs may be reduced while environmental benefits such as reduced greenhouse gas emissions are also realised.

5.1 Further work

By stimulating growth in existing businesses as well as attracting new firms, the direct service may help to add resilience to the economy of the Pilbara by reducing dependency on mineral resources. The impact of the proposed scheme on the make-up of the Pilbara economy over the long-run has not been considered in detail in this paper. Further study on economic resilience may be beneficial.

While economic theory suggests numerous benefits may be achieved as a result of a direct freight service, an analysis of ‘real-world’ case studies both in Australia and internationally may have merit in validating the theory and understanding the limitations faced in other regions. Case studies may extend to include projects such as the Sahara Forest Projects (SFP) which demonstrates how the right conditions for large scale agriculture may be created and how a direct freight service may assist in this.

This paper does not make specific reference to the impact of a direct freight service on the mining industry. Given the proportion of GRP derived from

mining, further work to understand any potential impact could develop a more detailed picture of the benefits.