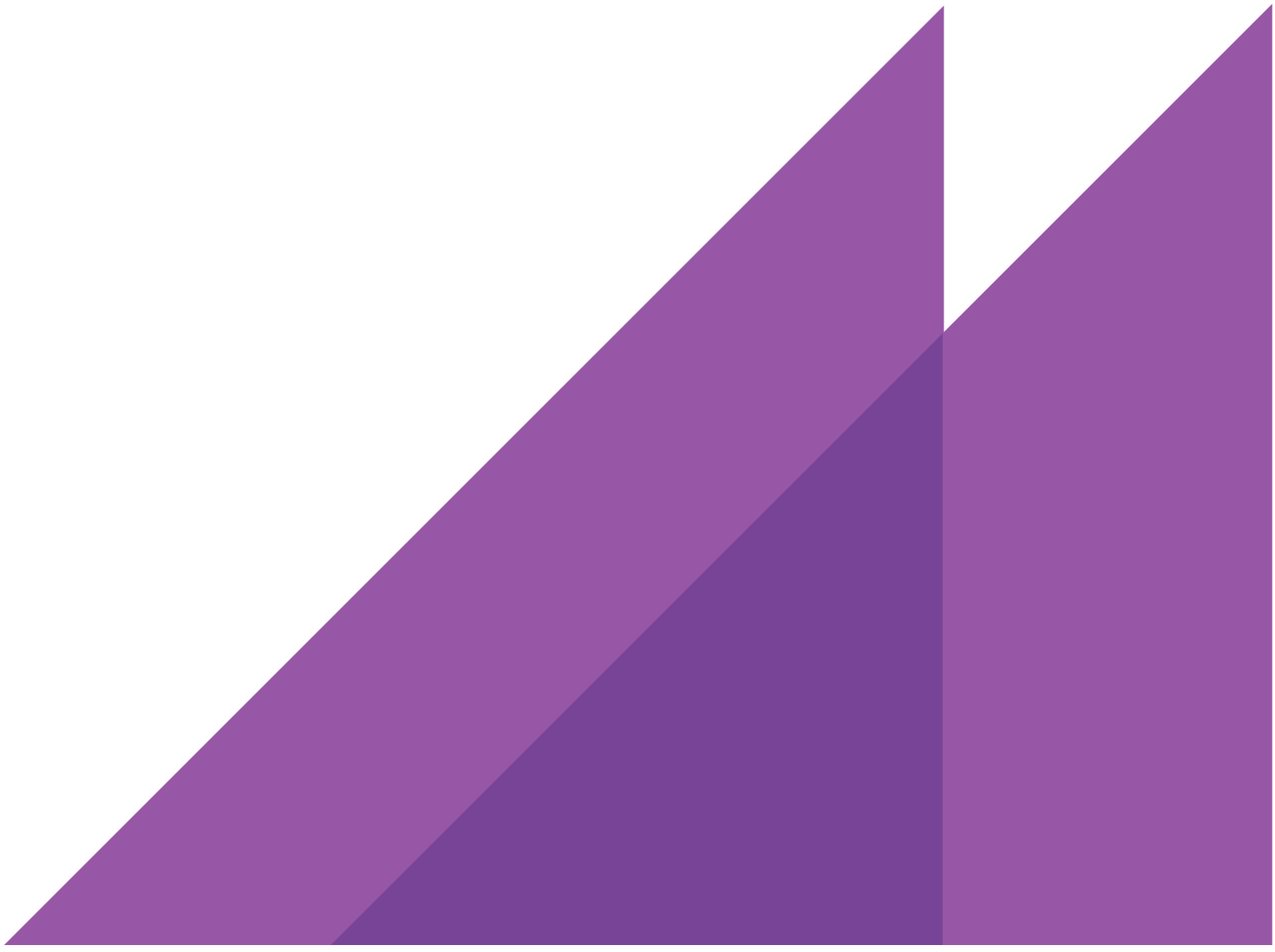
REPORT TO
THE PORT HEDLAND INDUSTRIES COUNCIL AND PILBARA PORTS AUTHORITY

JUNE 2020

THE ECONOMIC SIGNIFICANCE OF THE PORT OF PORT HEDLAND

CONFIDENTIAL



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EXECUTIVE SUMMARY

Report Overview

The Port of Port Hedland is one of Australia's most significant pieces of economic infrastructure. Located in the resources-rich Pilbara region, the Port of Port Hedland is the crucial link in the supply chain for resource companies in moving their key communities to their markets around the world.

In 2017, ACIL Allen Consulting ('ACIL Allen') completed a report, *An Economic Study of the Port Hedland Port*, for the Port Hedland Industries Council ('PHIC'). In order to estimate the economic value of the Port, ACIL Allen has combined the income, expenditure and employment of the Port of Port Hedland and associated entities that utilise the Port for trade into a single group called the Port Hedland Port Supply Chain. This allowed ACIL Allen to present the results of this study as a single contribution/impact, and importantly protect the confidentiality of information provided by the Port and its users.

The report found that the Port of Port Hedland and the trade that is facilitated through the Port contributed $30 billion in economic output to the Australian economy in 2015-16, or 1.9 per cent of GDP. This level of economic contribution supported a total of 86,240 FTE jobs, of which 86 per cent were the result of the flow on impacts of the activities of the Port Hedland Port Supply Chain across the Australian economy.

Since the completion of the 2017 report, there has been a number of significant developments that have influenced activity in and around the Port, and the economic value that is generated through the Port, such as the development of new resources and higher commodity prices. The 2017 study also focussed on the iron ore industry, reflecting the requirements of the PHIC at the time.

In 2019, the PHIC, in conjunction with the Pilbara Ports Authority (PPA) engaged ACIL Allen to provide an updated assessment of the economic significance of the Port of Port Hedland and the trade that is facilitated through the Port to the local, State and National economies.

In order to build a more comprehensive assessment of the economic significance of the Port of Port Hedland, the **PHIC enlisted the support of its key members — the Pilbara Ports Authority, BHP, FMG, and Roy Hill — and port users Atlas Iron, Rio Tinto (Dampier Salt), Sandfire Resources, Pilbara Minerals, and Mineral Resources**. In order to protect commercially sensitive information relating to the operations of each stakeholder, the results of this study are presented in aggregate as the **Port Hedland Port Supply Chain**.

In order to estimate the economic contribution of the Port of Port Hedland and the economic activity facilitated through the Port, ACIL Allen has adopted the same methodology as was used for the 2017 study, using up-to-date information from a broader range of companies.

Using ACIL Allen's Input-Output models of the town of Port Hedland, the Pilbara Region, Western Australia, and Australia, the economic value of the Port Hedland Port Supply Chain was determined in

each region on the basis of its contribution to output (Gross Domestic Product, Gross State Product, Gross Regional/Town Product), welfare (wages and salaries earned), employment (Full Time Equivalent (FTE) basis) and taxation and royalty payments made by the Port Hedland Port Supply Chain to the Commonwealth, the WA Government and the Town of Port Hedland.

To **project the future activity through the Port, ACIL Allen will use forward guidance from participating PHIC member companies** to estimate the economic impact of the increased production and trade through the Port over the 10 years to 2029-30 using ACIL Allen's in-house computable general equilibrium model, *Tasman Global*.

The results of the economic impact assessment will be presented in terms of the direct and indirect impacts of the Port Hedland Port Supply Chain in terms of output, income, employment and taxation payments. to the town of Port Hedland, the Pilbara Region, Western Australia, and Australian economies over the 10 years to 2029-30.

Economic Contribution of Port Hedland Port and the Trade through the Port, 2018-19

The economic contribution that the Port of Port Hedland and the trade through the Port made to the town of Port Hedland, the Pilbara Region and the Western Australian and Australian economies in 2018-19 has been estimated using ACIL Allen's Input-Output modelling framework. The economic contribution has been measured in terms of the direct and indirect contribution to output (Gross Product), incomes (wages and salaries earned), employment (FTE basis) and taxation and royalty payments made to the Commonwealth, the WA Government and the Town of Porth Hedland (by key heads of taxation).

The economic contribution of the Port of Port Hedland and the trade that is facilitated through the Port is significant, generating tens of billions of dollars to the national, state and local economies each year, supporting thousands of jobs both directly and indirectly throughout all sectors of the economy, and providing billions of dollars each year to the Commonwealth, WA Government and Town of Port Hedland in the form of tax and royalty payments.

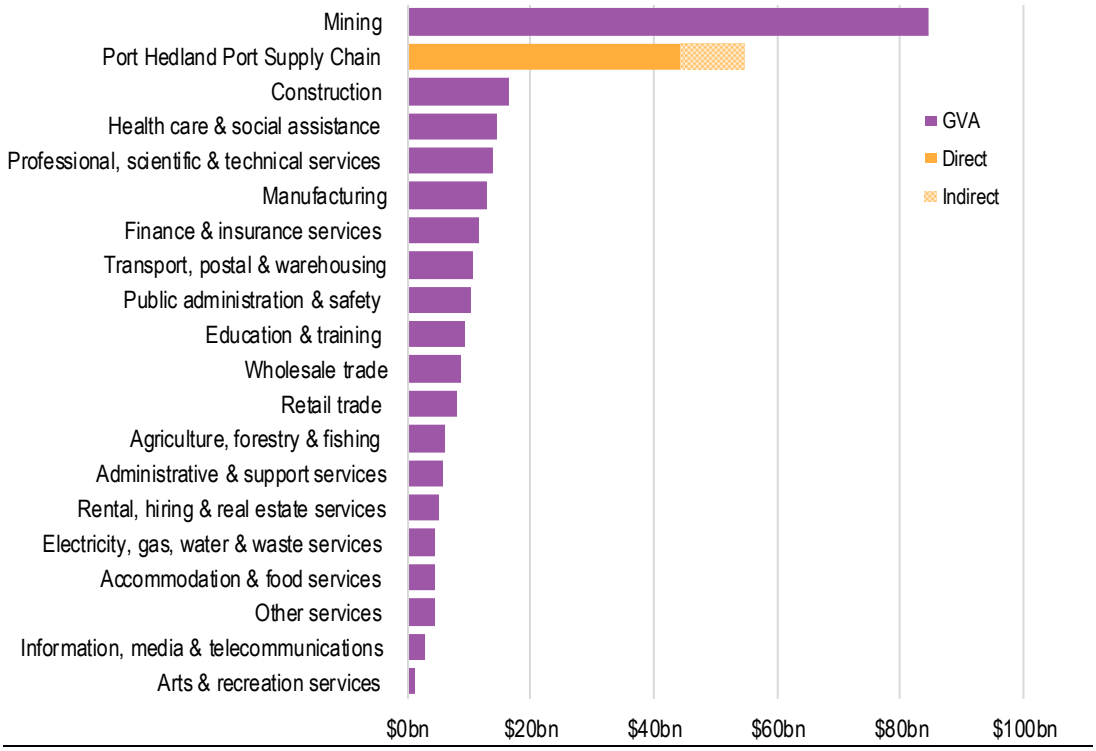
For the town of **Port Hedland** and its residents, ACIL Allen estimated that the Port Hedland Port Supply Chain helped inject $1.1 billion to the Town's economy in 2018-19, which helped support almost 3,600 full time jobs, and almost half a billion in wages and salaries to resident workers.

Across the **Pilbara Region**, it is estimated that the Port Hedland Port Supply Chain generated $42.8 billion to GRP in 2018-19, accounting for 47 per cent of the Region's economy. The Port Hedland Port Supply Chain further supported 10,178 direct and indirect FTE jobs across the Pilbara Region in 2018-19, which equates to approximately 29 per cent of total employment in the Region.

For **Western Australia**, the Port of Port Hedland and the trade that is facilitated through the Port is a significant driver of the WA economy. ACIL Allen estimates that the Port Hedland Port Supply Chain contributed $44.5 billion to the Western Australian economy in 2018-19 – directly accounting for over 17 per cent of the State's GSP.

The significant contribution that the Port Hedland Port Supply Chain directly makes to the WA economy compares favourably against other industries. The Port Hedland Port Supply Chain generated significantly higher levels of output than another other WA industry in 2018-19 (other than Mining) – almost four times the Gross Value Added of the Manufacturing Industry, five times the output of the Education and Training Industry and seven times the output from the Agriculture Industry in 2018-19.

FIGURE ES 1 GROSS VALUE ADDED BY INDUSTRY IN WESTERN AUSTRALIA – COMPARISONS TO THE PORT HEDLAND PORT SUPPLY CHAIN, 2018-19



SOURCE:

ACIL Allen estimates that its total contribution to the WA economy reached $54.7 billion in 2018-19– accounting for more than 20 per cent of WA's GSP. The level of activity generated supported some 75,302 direct and indirect FTE jobs within the supply chain and more broadly across Western Australia. Based on Western Australia's average full time workforce of 924,200 in 2018-19, ACIL Allen estimates that one in every 12 workers jobs across Western Australia were either directly or indirectly supported by the Port of Port Hedland and the trade that is facilitated through the Port.

Reflecting the significant levels of employment, ACIL Allen estimates that the Port Hedland Port Supply Chain supported the payment of some $9.1 billion in wages and salaries to workers across Western Australia in 2018-19.

While the majority of the economic and employment benefits accruing from the Port Hedland Port Supply Chain were realised in Western Australia in 2018-19, there were still sizeable benefits realised in other parts of Australia.

ACIL Allen estimates that across **Australia**, the Port Hedland Port Supply Chain boosted Australia's GDP by $64.1 billion in 2018-19. Based on Australia's GDP of $1.9 trillion in 2018-19, the Port Hedland Port Supply Chain contributed either directly or indirectly some 3.4 per cent to the national economy.

From an employment perspective, there were significant job opportunities created outside of Western Australia as a result of the Port Hedland Port Supply Chain. ACIL Allen estimates that there were 133,349 direct and indirect FTE jobs created from the activities of the Port Hedland Port Supply Chain across Australia in 2018-19, of which 58,046 FTE jobs were created outside of Western Australia.

Of the $14.2 billion in wages and salaries paid by businesses across Australia either directly or indirectly as a result of the Port Hedland Port Supply Chain in 2018-19, some $3.9 billion was paid in wages and salaries to workers not directly working in the Port Hedland Port Supply Chain and living outside of Western Australia – highlighting the significant role that the Port and the trade that is facilitated through the Port contributes to the nation's prosperity.

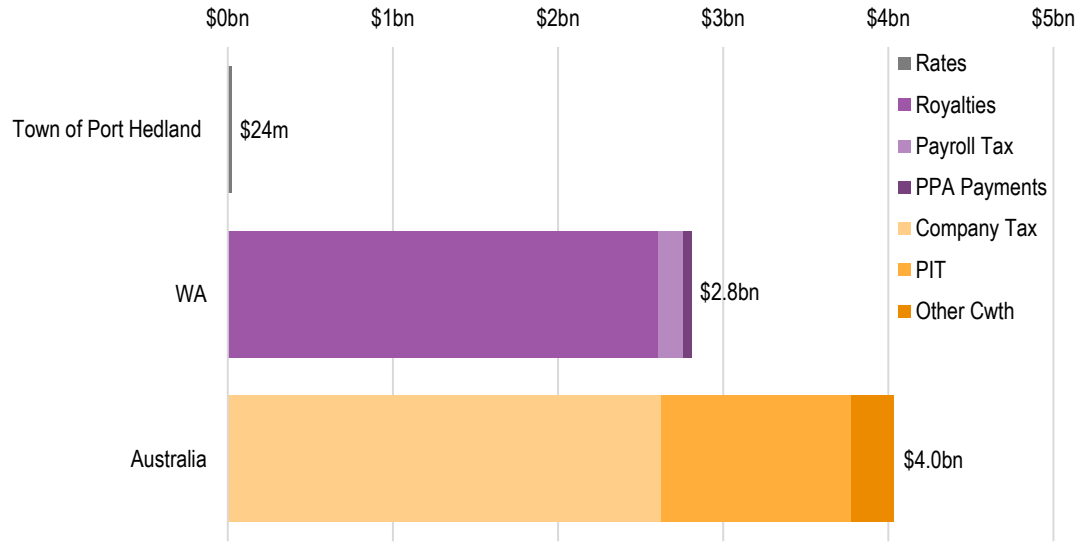
FIGURE ES 2 ECONOMIC CONTRIBUTION OF THE PORT HEDLAND PORT SUPPLY CHAIN IN AUSTRALIA, 2018-19

SOURCE: ACIL ALLEN CONSULTING

One of the other primary means by which the economic contribution of the Port Hedland Port Supply Chain can be measured is through the **taxes and royalties that are paid to the Commonwealth, the WA Government and the Town of Port Hedland.**

In total, ACIL Allen estimates that the Port Hedland Port Supply Chain directly paid $2.8 billion in taxation receipts to the Western Australia Government in 2018-19. The majority of these payments were in the form of resource royalties ($2.6 billion), with payroll tax paid by businesses across the supply chain ($147 million) and dividend and tax equivalent payments (by the PPA) ($54 million) making up a smaller proportion. To put this into perspective, this is equivalent to approximately 10 per cent of the General Government sector revenue in 2018-19, and is three times larger than the State's land tax revenue in any one year.

FIGURE ES 3 TAXATION PAYMENTS TO COMMONWEALTH, WESTERN AUSTRALIAN GOVERNMENT AND TOWN OF PORT HEDLAND, 2018-19



SOURCE: ACIL ALLEN CONSULTING

In relation to Commonwealth taxation payments to the Commonwealth, ACIL Allen estimates that the Port Hedland Port Supply Chain paid $4.0 billion to the Commonwealth Government in 2018-19, primarily as a result of company income tax ($2.6 billion) and personal income taxation ($1.1 billion)

as a result of the direct employment on projects. This is equivalent to five times the Commonwealth's annual contribution to State Government infrastructure projects.

Economic Impact of Port Hedland Port and the Trade through the Port, 2019-20 to 2028-29

The incremental economic impact of the Port of Port Hedland and the trade through the Port to the Pilbara Region and the Western Australian and Australian economies over the 10 years to 2028-29 has been estimated using ACIL Allen's CGE Model, *Tasman Global*. The results are the incremental over and above the economic contribution of the Port of Port Hedland and the trade through the Port, which for the purposes of this study can be considered the economic baseline. The results are measured in terms of the direct and indirect impact to output (Gross Product), incomes (wages and salaries earned by individuals and profits generated by businesses), employment (FTE basis) and taxation and royalty payments made to Commonwealth and Western Australian Governments (by key heads of taxation).

ACIL Allen estimates that the potential **Gross Regional, State and Domestic Product** increase associated with the Port Hedland Port Supply Chain's additional activities over the next decade is a cumulative $26.2 billion above the baseline contribution of $64.1 billion in 2018-19. The incremental impact follows the forward guidance on production levels from across the Port Hedland Port Supply Chain, with an average annual impact of $2.6 billion across the national economy.

The potential increase in real output over the next ten years is concentrated primarily in the Pilbara region ($27.3 billion), with a further $3.1 billion in output is realised in the Rest of Western Australia as a result of the purchases of supplies and services required to facilitate the mining and port operations in the Pilbara. ACIL Allen estimates that output in the Rest of Australia would potentially fall by an average $423 million per annum as the modelled appreciation in the Australian Dollar impacts on the competitiveness of other export industries across the Rest of Australia.

In the Pilbara region, the average potential annual increase in the region's output is equivalent to approximately 3 per cent of the Pilbara economy's GRP in 2017-18.

Real income measures how the returns associated with an increase in production, expenditure and employment flow through to increased wealth and purchasing power by households, businesses and Government. Given this it is the preferred measure of the economic impact of forward guidance of the Port Hedland Port Supply Chain on the welfare of each region and society as a whole.

ACIL Allen estimates that the potential **real income** increase associated with the Port Hedland Port Supply Chain is a cumulative $32.1 billion over the ten years through to 2028-29. The distribution of real income reflects the fact that the returns associated with future profits, taxation, wages and salaries are more in line with the employment patterns of the Port Hedland Port Supply Chain, ownership structures of supply chain participants, and taxing powers of the Commonwealth and State Governments.

The potential increase in real income over the next ten years is spread evenly across the Pilbara ($14.9 billion) and the Rest of Western Australia ($14.4 billion). However, the potential increase in real income across the Rest of Australia ($2.9 billion) is significantly lower. This reflects the offsetting impacts of future company income tax receipts and exchange rate effects on non-mining sectors.

From an **employment** perspective, ACIL Allen estimates that the potential increase in employment associated with the Port Hedland Port Supply Chain will average a net 5,307 FTE jobs per annum over the ten years through to 2028-29, over and above the current 133,349 FTE jobs supported in 2018-19 economic baseline.

Additional employment ranges from a high of 8,243 FTE jobs in 2019-20, falling to 3,694 FTE jobs in 2028-29. The pattern of employment reflects the strong focus on capital expansions across the Port Hedland Port Supply Chain in the early years of the study, which is an important development given the expected impact of restrictions associated with Covid-19 on the Australian economy. By the end of the forward guidance period, the capital expenditure profile of participants is more in line with maintenance of production as opposed to new projects and expansions.

The majority of the potential impact on jobs occurs in the Rest of Western Australia (potential increase of 5,587 FTE jobs on average per annum), while a potential increase of 1,072 FTE jobs on average per annum occurs in the Pilbara region. The potential impact on the Pilbara region is most pronounced, with the number of FTE jobs added per annum equivalent to 3 per cent of its current workforce.

Total employment across the Rest of Australia is projected to be slightly negative across the forward guidance period, averaging a reduction of 1,352 FTE jobs across the ten year period. This reflects the role of exchange rate effects reducing the output of some trade-exposed sectors outside of Western Australia, but also reflects changes in real wages in Western Australia relative to the Rest of Australia which results in higher population flows from the Eastern States to Western Australia.

ACIL Allen estimates that the potential increase in **real taxation and royalty receipts** associated with the Port Hedland Port Supply Chain is a cumulative $21 billion over the ten years through to 2028-29, or an additional $2.1 billion per annum over and above the baseline contribution of $6.8 billion in 2018-19.

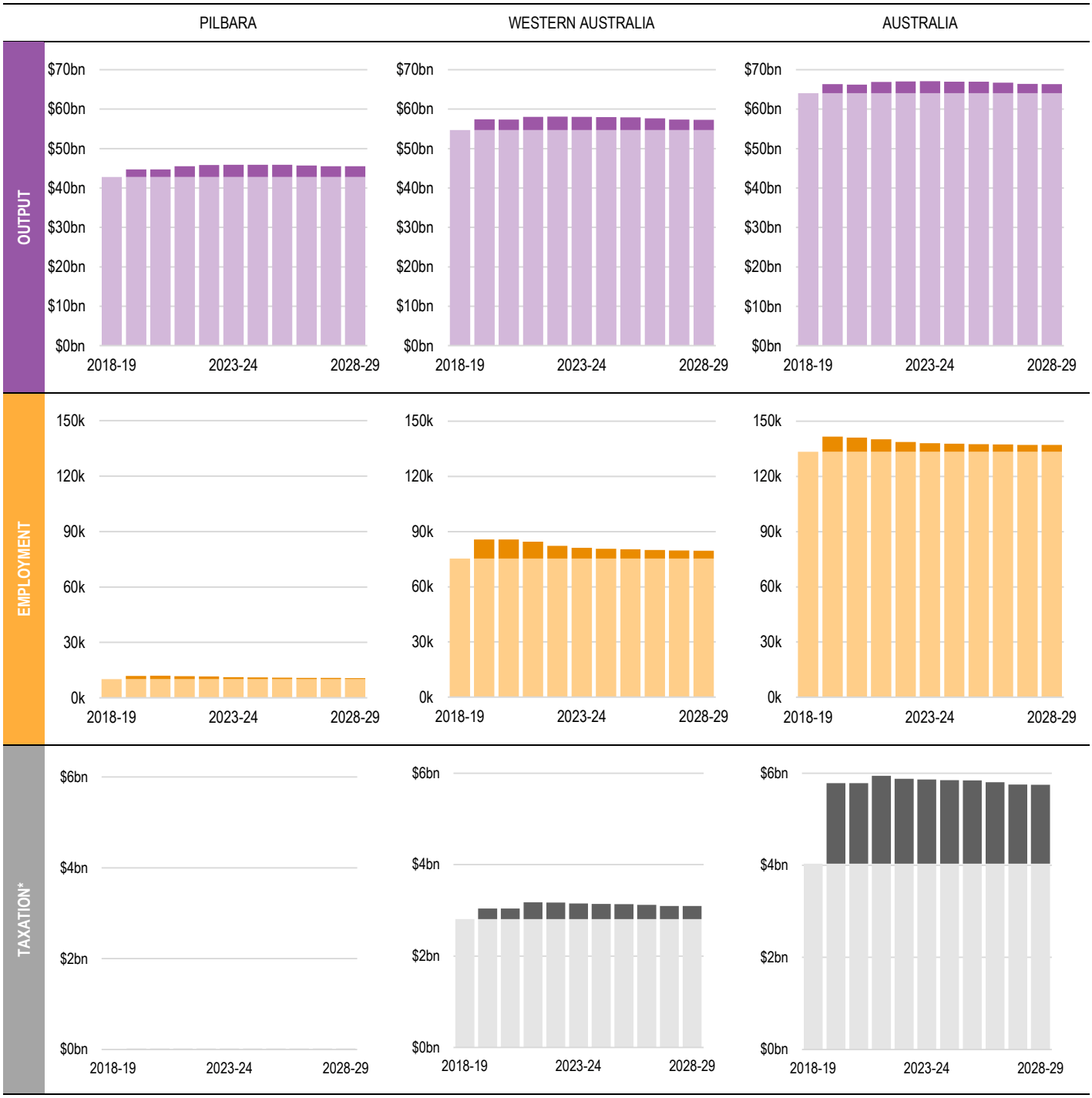
The majority of the potential impact on taxation receipts (on average 49 per cent annually) is attributed to Australian company taxation receipts, which are forecasted to average over $1 billion annually over ten years.

The remaining potential impact on taxation receipts is attributed to:

- Western Australia Royalty receipts, which are potentially $2.3 billion higher over ten years;
- Western Australia Payroll tax receipts, which are potentially $789 million higher over ten years;
- Personal income taxes, which are potentially $6 billion higher over ten years; and
- Other taxes, which are potentially $1.7 billion higher over ten years.

The economic impacts discussed above are incremental to the contribution of the Port Hedland Port Supply Chain in 2018-19, insofar as they reflect how the forward guidance provided by each participant in the supply chain can be expected to impact on the local, State and national economies over the next ten years. The figures below highlight the total economic contribution of the Port Hedland Port Supply Chain from 2018-19 (baseline year) and over the forward projections to 2028-29.

FIGURE ES 4 TOTAL FORECAST ECONOMIC CONTRIBUTION OF PORT HEDLAND PORT SUPPLY CHAIN ON PILBARA, WESTERN AUSTRALIA AND AUSTRALIAN ECONOMY(2018-19 TO 2028-29)



* There was $24 million in local government rates paid to the Town of Port Hedland in 2018-19.

SOURCE: ACIL ALLEN CONSULTING

1 INTRODUCTION AND CONTEXT

1.1 About this Engagement

The Port of Port Hedland is one of Australia's most significant pieces of economic infrastructure. Located in the resources-rich Pilbara region, the Port of Port Hedland is the crucial link in the supply chain for resource companies in moving their key communities to their markets around the world.

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1.2 Overview of Approach

In order to estimate the economic contribution of the Port of Port Hedland and the economic activity facilitated through the Port, ACIL Allen has adopted the same methodology as was used for the 2017 study, using up-to-date information from a broader range of companies.

Using ACIL Allen's Input-Output models of the town of Port Hedland, the Pilbara Region, Western Australia, and Australia, the economic value of the Port Hedland Port Supply Chain was determined in each region on the basis of its contribution to output (Gross Domestic Product, Gross State Product, Gross Regional/Town Product), welfare (wages and salaries earned), employment (Full Time Equivalent (FTE) basis) and taxation and royalty payments made by the Port Hedland Port Supply Chain to both the Commonwealth and Western Australian Governments.

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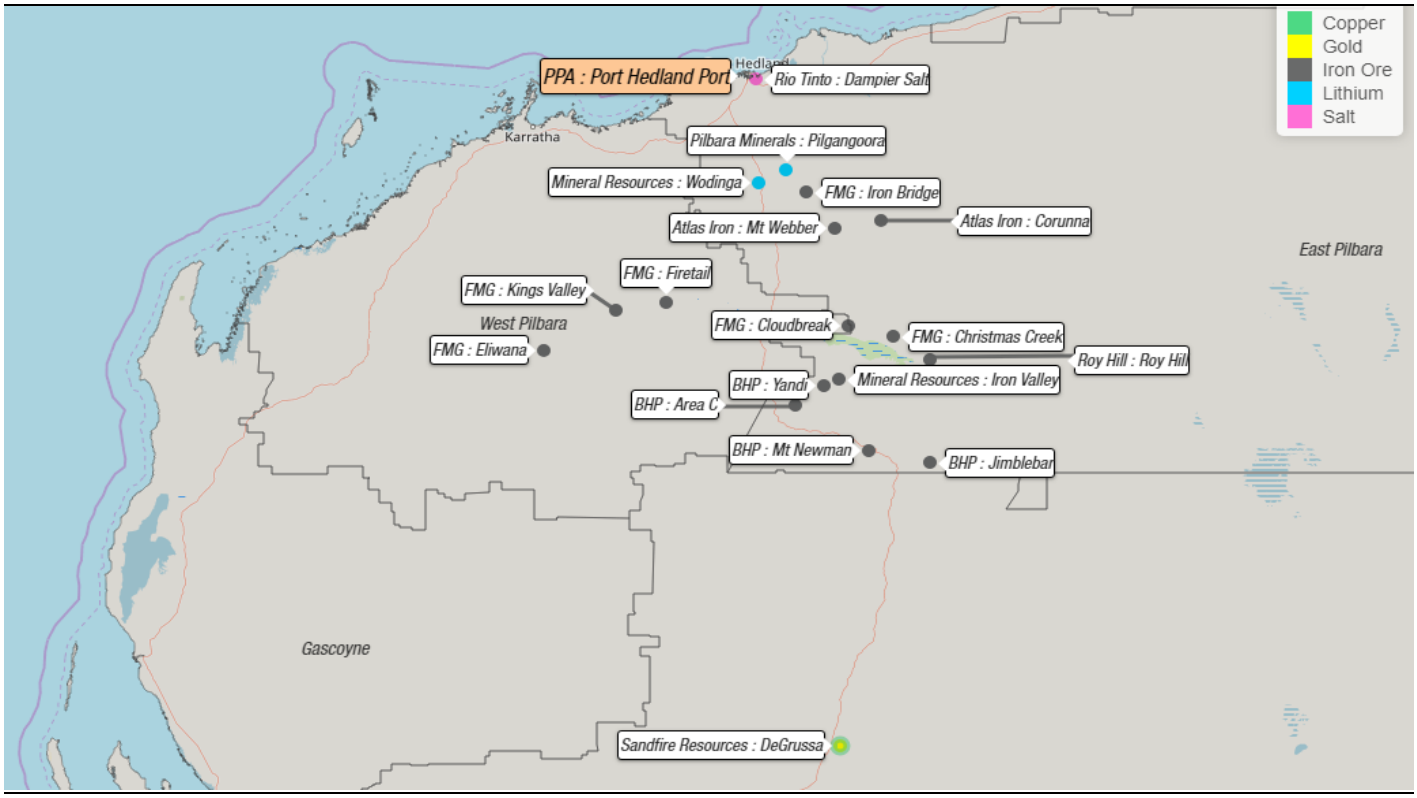
1.2.1 Port Hedland Port Supply Chain

There are nine member companies of the Port Hedland Industries Council that together represent the Port Hedland Port Supply Chain for this study. A brief description of each company/agency and their operations in the Pilbara region is provided below, with the location of the mining operations for each of these member companies presented in **Figure 1.1**.

FIGURE 1.1 PORT HEDLAND PORT SUPPLY CHAIN



SOURCE: ACIL ALLEN CONSULTING

Pilbara Ports Authority

Pilbara Ports Authority (PPA) operates as a Western Australian Government Trading Enterprise.and was established on 1 July 2014, following the amalgamation of the former port authorities of Dampier and Port Hedland.

When first established, Port Hedland Port was originally used for trade in livestock, gold, wool pearl shell, tin, copper and manganese. In 1966, the port was upgraded to enable the bulk transportation of iron ore.

While Port Hedland Port continues to serve the trading of a range of pastoral and mining products, successive expansions have seen it grow to become the world's largest iron ore export port.

BHP

BHP are headquartered in Melbourne, Australia and employ a global workforce of 72,00 staff in 90 countries.

BHP's operations in the Pilbara are organised around an integrated system of four processing hubs and five mines (Mt Newman, Yandi, Jimblebar, Mt Goldsworthy and POSMAC) connected by more than 1,000 kilometres of rail infrastructure and port facilities - collectively referred to as Western Australia Iron Ore (WAIO).

BHP is currently investing in expanded capacity through the South Flank project which is projected to produce 80 million tonnes of iron ore per annum and will replace BHP's ageing Yandi mine.

Fortescue Metals Group

Fortescue Metals Group (FMG) is a Western Australian company, founded in 2003 and headquartered in Perth. FMG own and operate an integrated supply chain including two mine hubs comprising four operating mines (Kings Valley, Firetail, Cloudbreak and Christmas Creek), two mines under development (Iron Bridge and Eliwana), a five-birth port in Port Hedland, towage infrastructure, heavy haul railway, tug fleet and eight ore carriers.

FMG is currently investing in expanded capacity through the Eliwana Mine and Rail Project and the Iron Bridge Magnetite Project. FMG is currently the fourth-largest seaborne iron ore producer and the lowest cost supplier of iron ore into China.

Roy Hill

Roy Hill is a Western Australian company, majority owned by Hancock Prospecting Pty Ltd. which was founded in 1955.

The Roy Hill mine commenced operations in 2014 with an initial life of 17 years and is expected to operate until 2043 (with extensions). Over the initial mine life, Roy Hill is estimated to produce an annual average of 72 Mtpa of wet ore. The mine is supported by a 344km single line, heavy haul railway and a two berth iron ore port facility at Port Hedland.

Rio Tinto

Rio Tinto are headquartered in London, England and employ 47,500 staff on 60 projects in 35 countries.

Rio Tinto have significant iron ore mining operations in the Pilbara region of WA. However, for this study, we are only including the company's Port Hedland salt mine – one of three salt mines operated by the company in the Pilbara– as it is their only mining operation that utilises the Port Hedland Port.

Rio Tinto operate the Port Hedland salt mine as part of a joint venture called Dampier Salt. Dampier Salt have two further salt mines in the region (Dampier and Lake MacLeod). Dampier Salt is the world's largest exporter of seaborne salt, with capacity to produce approximately 10.3 Mtpa.

Atlas Iron

Atlas Iron is a Western Australian company headquartered in Perth and founded in 2004. The company initially commenced iron ore production at Pardoo in 2008.

Since 2014, Atlas Iron has operated the Mt Webber mine in the Pilbara. The company is also investing in two expansion projects in the Pilbara; Corunna Downs and McPhee Creek.

Pilbara Minerals

Pilbara Minerals is a Western Australian company headquartered in Perth and founded in 2005.

Pilbara Minerals began production and shipping of spodumene concentrate in 2018 at the Pilgangoora Lithium-Tantalum Project – one the largest hard-rock lithium-tantalum deposits in the world. Pilbara Minerals are continuing to invest in the project by expanding the processing capacity from 2Mtpa to 5Mtpa

Mineral Resources

Mineral Resources is a Western Australian company headquartered in Perth and founded in 1993. The company mine lithium and iron ore in the Pilbara region.

Wodinga is one of the largest hard rock lithium deposits in the world. In 2019, Mineral Resources temporarily ceased operations at the site while in the process of expanding the project to produce 750,000 tpa of spodumene concentrate over a 30+ year mine life.

The Kumina Iron Ore project was acquired in .2018 and following further exploration and planning, is expected to commence operations in 2021

Sandfire Resources

Sandfire Resources is a Western Australian company with global operations and was founded in 2004. The company's current operations in the Pilbara region include the DeGrussa and Monty copper-gold mines which are staffed by 450 employees. The mine includes key operational infrastructure such as a concentrator, tailings storage facility, power station, paste plant, as well as supporting accommodation, transportation and telecommunication infrastructure.

1.3 Report Structure

This report has been structured into five key sections and an **Executive Summary**.

- **Chapter 1: Introduction and Context** – provides an overview of the objectives of this report and the approach to quantifying the economic importance of the Port of Port Hedland and the trade that moves through the Port. This section also introduces the PHIC members that have agreed to participate in this study, with their contribution aggregated into a single body termed the "Port Hedland Port Supply Chain".
- **Chapter 2: Economic Overview** –provides important economic context supporting this study, including an overview of the recent trends in the Pilbara region across a number of key economic indicators, and a profile of the recent trends in the Port Hedland Port and the global trends and prospects of the commodities that are traded through the Port.
- **Chapter 3: Modelling Methodology and Assumptions** - provides an overview of the modelling methodology and data that has been collated from PHIC member companies to estimate the economic impact of the Port of Port Hedland and the trade through the Port to the town of Port Hedland, the Pilbara Region and the Wester Australian and Australian economies.
- **Chapter 4: Economic Contribution of Port Hedland Port and the Trade through the Port, 2018-19** – The results presented in this section articulate the economic contribution that the Port of Port Hedland and the trade through the Port made to the town of Port Hedland, the Pilbara Region and the Western Australian and Australian economies in 2018-19, using ACIL Allen's Input-Output modelling framework. The economic contribution has been measured in terms of the direct and indirect contribution to output (Gross Product), incomes (wages and salaries earned), employment

(FTE basis) and taxation and royalty payments made to the Commonwealth, WA Government and the Town of Port Hedland (by key heads of taxation).

— **Chapter 5: Economic Impact of Port Hedland Port and the Trade through the Port, 2019-20 to 2028-29** – The section presents the incremental economic impact of the Port of Port Hedland and the trade through the Port to the Pilbara Region and the Western Australian and Australian economies over the 10 years to 2028-29 using ACIL Allen's CGE Model, *Tasman Global*. The results are the incremental over and above the economic contribution of the Port of Port Hedland and the trade through the Port that was presented in the previous section. The results are measured in terms of the direct and indirect impact to output (Gross Product), incomes (wages and salaries earned by individuals and profits generated by businesses), employment (FTE basis) and taxation and royalty payments made to Commonwealth and Western Australian Governments (by key heads of taxation).

1.4 Glossary of terms and abbreviations

The following terms and acronyms are used in this report.

TABLE 1.1 SUMMARY OF TERMS USED

Term used	Meaning
Compensation of employees	The total remuneration, in cash or in kind, payable by an enterprise to an employee in return for work done by the employee during the accounting period. It is further classified into two sub-components: wages and salaries; and employers' social contributions. Compensation of employees is not payable in respect of unpaid work undertaken voluntarily, including the work done by members of a household within an unincorporated enterprise owned by the same household. Compensation of employees excludes any taxes payable by the employer on the wage and salary bill (e.g. payroll tax).
Economic footprint	A measure of the total economic activity in the production of new goods and services.
Employment	Economic footprint is a broader measure of the economy in that it includes the final value of goods and services produced (GDP/GSP/GRP), as well as the value of the intermediate consumption within the region to produce the goods and services, and imports from outside the region.
Exchange rate	The number of full time equivalent job years created as a result of a project or expenditure in the economy, which includes direct and indirect (flow-on) employment.
Exports	The exchange rate is expressed as the AUD/USD exchange rate unless otherwise stated and is denoted as $ or A$ throughout the document.
Gross Operating Surplus	Gross Operating Surplus (GOS) is an economic measure of the income earned by the capital employed by a project or economy. It is typically calculated as a residual factor of total income earned by a project less expenditure on intermediate inputs and wages paid. It is different to accounting profit as it includes a number of the deductions and other outflows a company would typically remove from the measure of its profitability; it also includes all taxes payable to governments
Gross product or real economic output	Gross product is a measure of the output generated by an economy over a period of time (typically a year). It represents the total dollar value of all finalised goods and services produced over a specific time period and is considered as a measure of the size of the economy. At a national level, it is referred to as Gross Domestic Product (GDP); at the state level, Gross State Product (GSP); while at a regional level, Gross Regional Product (GRP).
Input-Output Tables	Input-Output (I-O) tables capture the direct and indirect effects of expenditure by capturing, for each industry, the industries it purchases inputs from and also the industries it sells its outputs to. For example, the I-O model for Western Australia captures purchases from and sales to industries located in Western Australia, as well as imports from outside of Western Australia.

Term used	Meaning
Job years	Real employment is measured in job years. A job year is employment of one full time equivalent (FTE) person for one year. Alternatively in can be expressed as one 0.5 FTE person for two years.
Net present value (NPV)	The value of a future stream of income (or expenses) converted into current terms by an assumed annual discount rate. The underlying premise is that receiving, say, $100 in 10 years is not 'worth' the same (i.e. is less desirable) than receiving $100 today. For the purposes of this study, NPV calculations have been made based on a discount rate of 4 per cent and 7 per cent.
Port Hedland Port Supply Chain	For the purposes of this study, ACIL Allen has combined the income, expenditure and employment of the Port Hedland Port and associated entities that utilise the Port for trade into a single group we have called the Port Hedland Port Supply Chain. This allows us to present the results of this study as a single contribution/impact, and protects the confidentiality of information provided by the Port and its users.
Purchasing Power Parity (PPP)	Purchasing Power Parity (PPP) represents the theoretical value of a nation state's economic output adjusted for currency effects and the purchasing power of a standard unit of exchange. It ultimately reflects the underlying competitiveness of a country's economy.
Real and nominal dollars	Nominal dollars are dollars that are expressed in the actual dollars that are spent or earned in each year, including inflation effects. Real dollars have been adjusted to exclude any inflationary effects and therefore allow better comparison of economic impacts in different years. Over time, price inflation erodes the purchasing power of a dollar thereby making the comparison of a dollar of income in 2063 with a dollar of income in 2016 invalid. Adjusting nominal dollars into real dollars overcomes this problem.
Real income	A measure of the welfare of residents in an economy through their ability to purchase goods and services and to accumulate wealth. Although changes in real economic output are useful measures for estimating how much the output of the economy may change due to a change in policy, changes in real income are also important as they provide an indication of the change in economic welfare of the residents of a region through their ability to purchase goods and services. Real income measures the income available for final consumption and saving after adjusting for inflation. An increase in real income means that there has been a rise in the capacity for consumption as well as a rise in the ability to accumulate wealth in the form of financial and other assets. The change in real income from a development is a measure of the change in the economic welfare of residents within an economy.
State Final Demand / domestic economy	A measure of the value of goods and services in an economy. The aggregate obtained by summing government final consumption expenditure, household final consumption expenditure, private gross fixed capital formation and the gross fixed capital formation of public corporations and general government. It is conceptually equivalent to the Australia level aggregate domestic final demand.
Working age population	All usual residents of Australia aged 15 years and over except members of the permanent defence forces, certain diplomatic personnel of overseas governments customarily excluded from census and estimated population counts, overseas residents in Australia, and members of non-Australian defence forces (and their dependants) stationed in Australia.

TABLE 1.2 SUMMARY OF ACRONYMS

Acronym	Meaning
ABS	Australian Bureau of Statistics
AUD/ A$ or $	Australian dollars (default unless otherwise specified)
CAPEX	Capital expenditure
CGE	Computable General Equilibrium (model)
CO2	Carbon dioxide
CPI	Consumer Price Index
FIFO	Fly in-fly out work practice
FOB (shipping)	Free on Board
FTE	Full Time Equivalent
FY	Financial year
GDP	Gross Domestic Product
GRP	Gross Regional Product
GSP	Gross State Product
GST	Goods and Services Tax
GVA	Gross Value Added
LGA	Local Government Area
MT	Million tonnes
MTPA	Million tonnes per annum
NPV	Net Present Value
OPEX	Operational expenditure
PAYE	Pay as you earn income tax
PPP	Purchasing Power Parity
USD or US$	United States dollars
WPI	Wage Price Index

2 ECONOMIC CONTEXT

This section provides important economic context supporting this study, including an overview of the recent trends in the Pilbara region across a number of key economic indicators, and a profile of the recent trends in the Port Hedland Port and the global trends and prospects of the commodities that are traded through the Port.

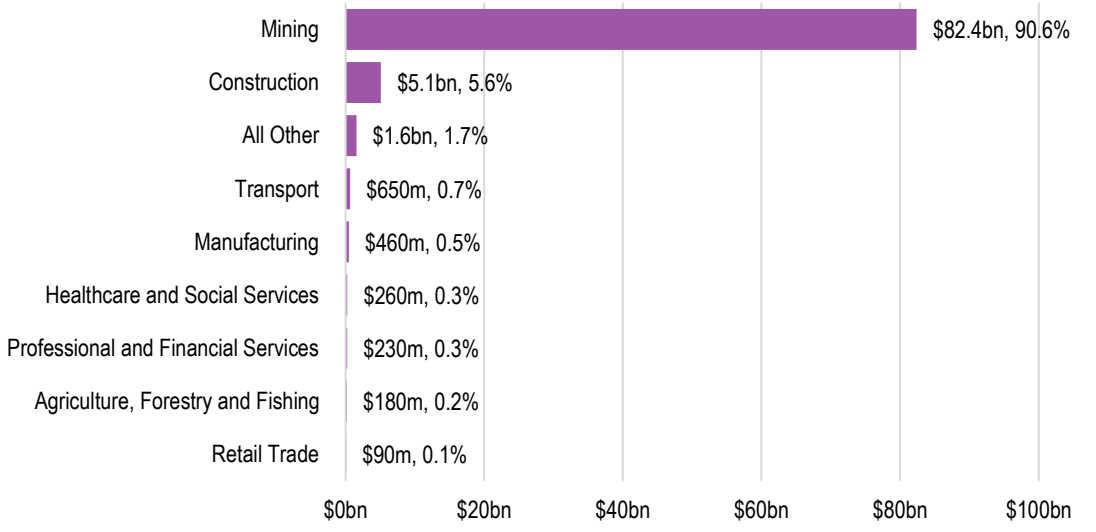
2.1 Economic Structure of the Pilbara Region

The Pilbara region is Western Australia's mineral and energy heartland, responsible for generating a significant proportion of the State's economic activity, wealth and prosperity.

The Pilbara region is Western Australia's mineral and energy heartland, responsible for generating a significant proportion of the State's economic activity, wealth and prosperity. In 2017-18, the Pilbara Region generated $90.9 billion in output, accounting for around 36 per cent of Western Australia's economy.

The Gross Regional Product (GRP) of the Pilbara Region in 2017-18 was $90.9 billion, accounting for around 36 per cent of Western Australia's economy. Of this total, it is estimated that the Mining Industry accounted for the vast majority of activity in the Region, accounting for almost 91 per cent of total economic activity (**Figure 2.1**).

FIGURE 2.1 PILBARA REGION – GROSS VALUE ADDED BY INDUSTRY, 2017-18



SOURCE: ACIL ALLEN CONSULTING

Of the other sectors, Construction was the Pilbara Region's largest, accounting for approximately 5.6 per cent ($5.1 billion) of Gross Value Added (GVA). Excluding the 'All Other' category (1.7 per

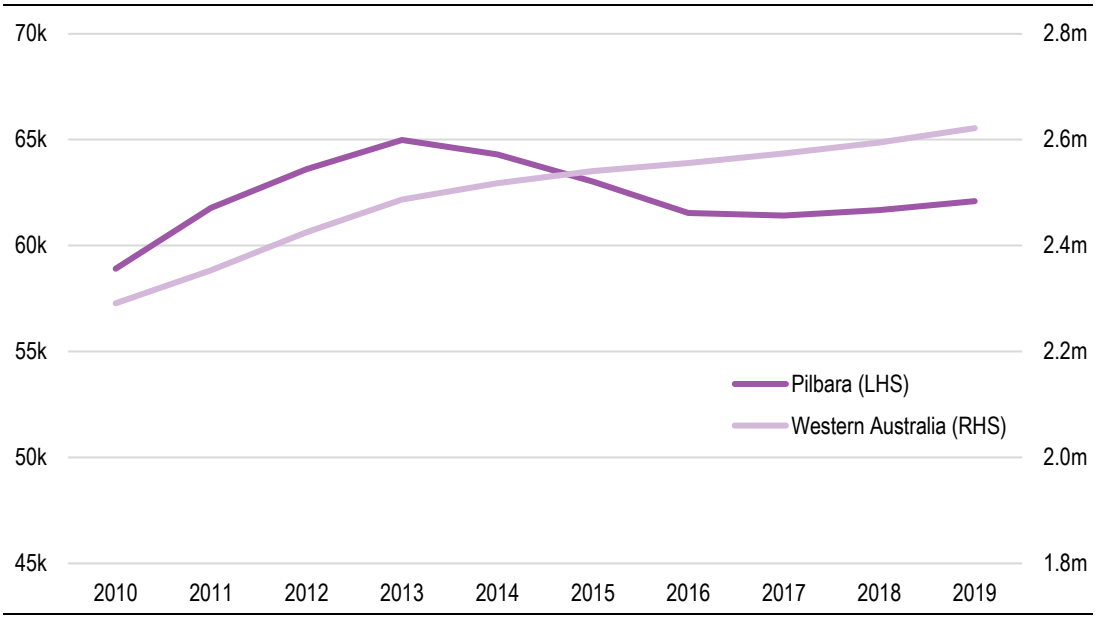
cent), Transport was the Pilbara's third largest industry, accounting for approximately 0.7 per cent ($650 million) of the Pilbara's total GVA.

While the Pilbara is Western Australia's most significant economic region, its population is relatively small compared to its economic might. As presented in **Figure 2.2**, the population of the Pilbara region reached a peak of 64,978 in 2013 after growing by an average annual rate of 3.9 per cent over the preceding five years. In 2019, the population of the Pilbara was 62,093, a decline of 4.4 per cent since the peak in 2013. The largest LGA in the Pilbara is Karratha (22,716), followed by Port Hedland (15,144), Ashburton (13,305) and East Pilbara (10,928).

The population of Western Australia has enjoyed steady growth since 2010 – increasing by an annual average of 1.6 per cent. Population growth over the last five years has slowed however with an annual average of 0.8 per cent.

To serve the needs of industry, the Pilbara region has a large fly-in fly-out (FIFO) worker population, which to some extent has limited growth in the local resident population. It has also meant that the population of the Pilbara region can fluctuate significantly as a result of construction workers for major projects residing in Port Hedland and Karratha for short periods of time.

FIGURE 2.2 POPULATION PROFILE, 2010-2019

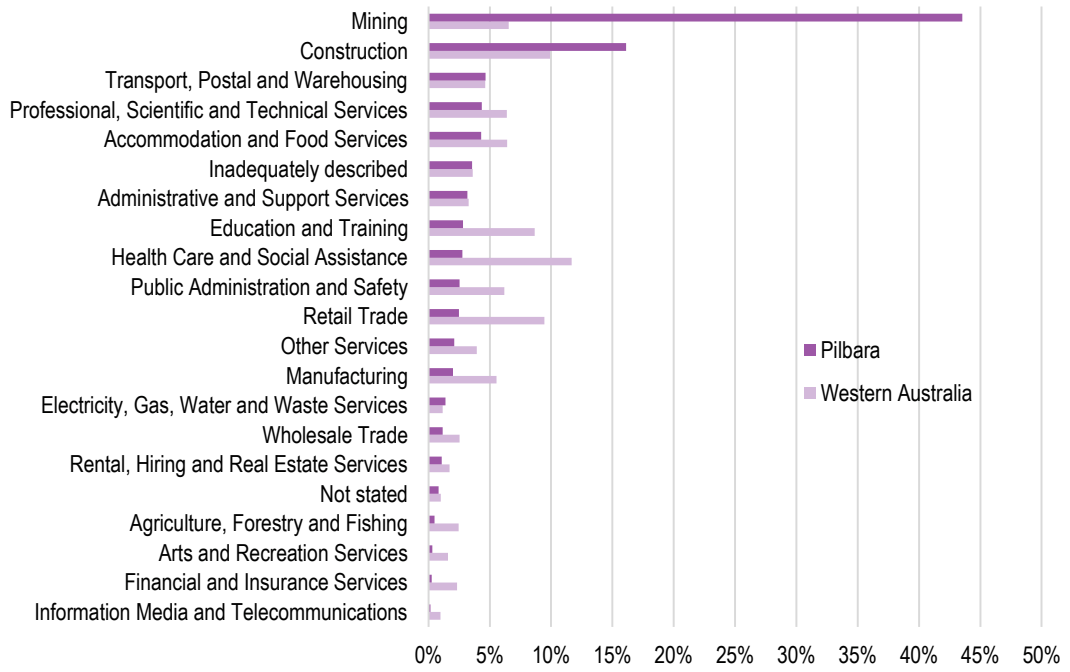


SOURCE: AUSTRALIAN BUREAU OF STATISTICS (2019) 3218.0 REGIONAL POPULATION GROWTH

As would be expected, the Mining Industry (which includes the oil and gas sector) employs approximately 43.5 per cent of the Pilbara's workforce, making it by far the largest industry, followed by Construction (16.1 per cent) and Transport, Postal and Warehousing (4.7 per cent).

By comparison, employment across Western Australia is more evenly distributed with the top five employing industries accounting for almost half of all jobs (**Figure 2.3**). Health Care and Social Assistance, the largest employing industry across Western Australia, accounted for approximately 11.7 per cent of all jobs in the state in the 2016 Census. Across Western Australia, Mining accounts for approximately 6.6 per cent of all jobs, a significantly smaller of the workforce than that recorded in the Pilbara region.

FIGURE 2.3 EMPLOYMENT BY INDUSTRY, SHARE OF TOTAL EMPLOYMENT, WESTERN AUSTRALIA AND PILBARA REGION, 2016 CENSUS

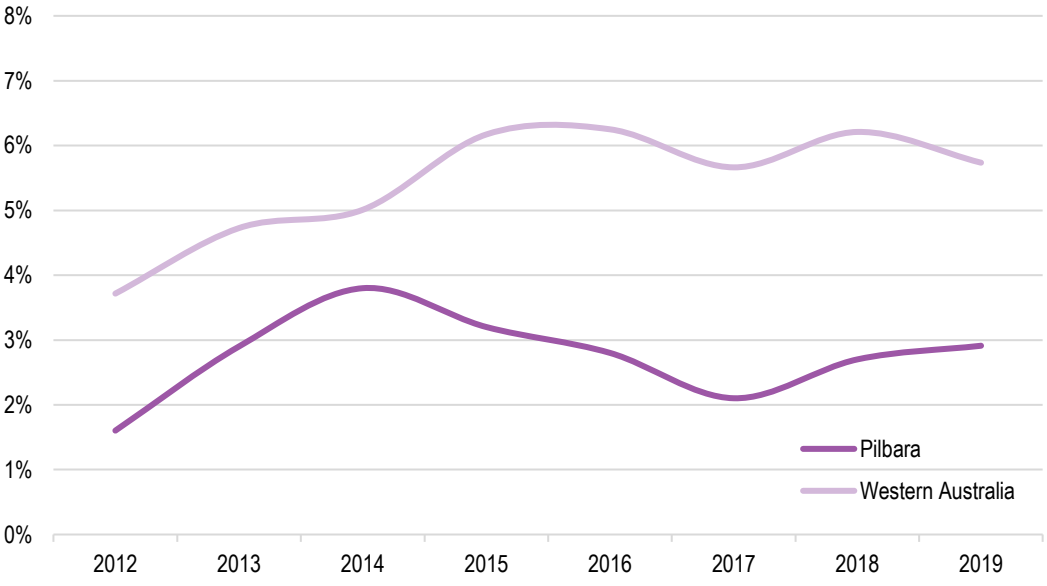


SOURCE: AUSTRALIAN BUREAU OF STATISTICS, CENSUS DATA, 2016

People residing in regional WA are heavily influenced by their job prospects, which in the case of the Pilbara Region, has been very positive for a number of years now, as is reflected by the very low levels of unemployment.

As is generally the case, people residing in regional WA are heavily influenced by their job prospects, which in the case of the Pilbara Region, has been very positive for a number of years now, as is reflected by the very low levels of unemployment. The unemployment rate in the Pilbara region has averaged 2.8 per cent since 2012, peaking at a still low rate of 3.8 per cent in 2014 and a recording a low of just 1.6 per cent in 2012 (**Figure 2.4**).

FIGURE 2.4 UNEMPLOYMENT RATE, 2012-2019



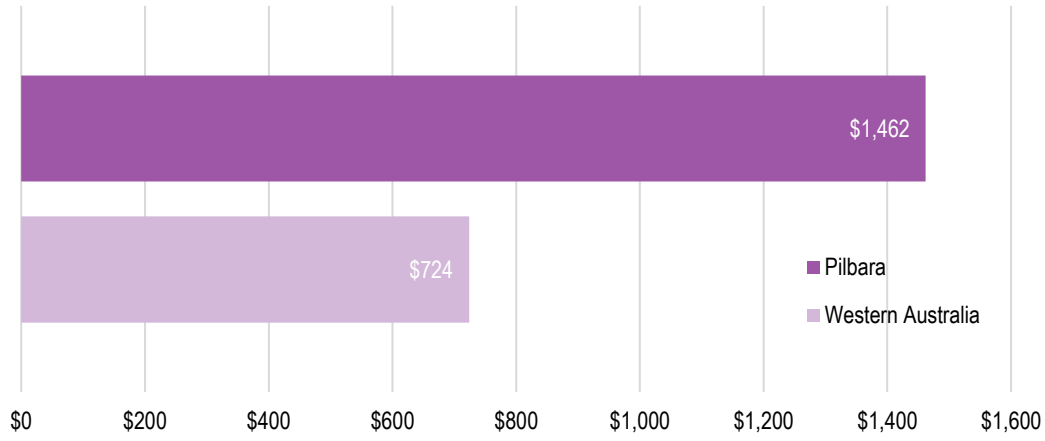
SOURCE: AUSTRALIAN GOVERNMENT (2019), DEPARTMENT OF EMPLOYMENT, SKILLS, SMALL AND FAMILY BUSINESS, LGA DATA TABLES – SMALL AREA LABOUT MARKETS – JUNE QUARTER 2019, REMPLAN

This compares favourably to Western Australia over the same period, with the unemployment rate averaging 5.4 per cent, reaching a high of 6.3 per cent in 2016 and a low of 3.7 per cent in 2012.

According to the 2016 Census, the median personal income for Pilbara residents was $1,462 – more than twice the median income across Western Australia (**Figure 2.5**).

In the Pilbara region, 42 per cent of households had a gross weekly income in excess of $3,000, compared to just 19 per cent across Western Australia. A contributing factor to higher median personal weekly incomes in the Pilbara region is that 72 per cent of the Pilbara's labour force were in full-time employment, compared to 57 per cent across Western Australia at the time of reporting.

FIGURE 2.5 MEDIAN PERSONAL WEEKLY INCOME, 2016



SOURCE: AUSTRALIAN BUREAU OF STATISTICS – 2016 CENSUS QUICKSTATS

The volatility of the mining and oil and gas sectors in the Pilbara region, particularly in relation to short-term labour force requirements, has had flow-on effects on the performance of the local residential property market.

In expectation of renewed investment activity in coming years through the construction of major projects, the local government sector has advocated for a boost in housing stock in order to keep rent and home ownership affordable, particularly for small business owners and non-resource sector workers in the Pilbara region.

In Port Hedland during the December 2019 quarter, REIWA members reported 60 transactions at a median sale price of $230,000. This was a 2.7 per cent decrease on the median sale price recorded during the previous quarter and a 20 per cent fall in sales activity. REIWA members reported a total of 79 houses leased during the December 2019 quarter, a decrease of 38.8 per cent on the previous quarter. The overall median weekly rent in Port Hedland was $450 per week, an increase of $50 on the previous quarter.

In Karratha during the December 2019 quarter, REIWA members reported 74 transactions at a median sale price of $390,000. This was a 6.8 per cent increase on the median sale price recorded during the previous quarter and a 8.6 per cent fall in sales activity. REIWA members reported a total of 113 houses leased during the December 2019 quarter, an increase of 8.7 per cent on the previous quarter. The overall median weekly rent in Karratha was $620 per week, an increase of $128 on the previous quarter.

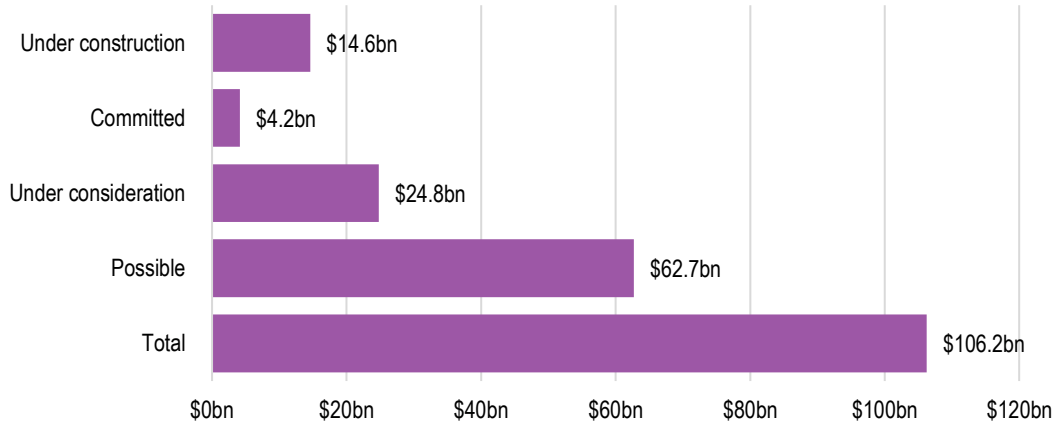
2.1.1 Investment Outlook

The availability of high-quality economic infrastructure is vital to the realisation of continued economic growth and the long-term sustainability of supporting a growing population. In turn, as the Pilbara region diversifies its industry profile, investment in key economic infrastructure such as energy, water, waste, digital communications and transport will be required. Major projects in the Pilbara region are presented with a range of challenges impacting their ability to attract sufficient investment and allow

reasonable financial returns. High cost items incurred by businesses in the Pilbara region include staff training, staff recruitment and turnover, travel, professional services and consumables.

As of April 2020, there is close to $106.2 billion of investment in the pipeline for major projects in the Pilbara region. Of this total, approximately $14.6 billon in major projects are currently in various phases of construction, with a further $4.2 billion likely to commence construction in the near future. The value of projects that are at an advanced stage of consideration across the Pilbara region is estimated to total a further $24.8 billion, with the remaining $62.7 billion in major projects considered longer term propositions for the State (**Figure 2.6**).

FIGURE 2.6 MAJOR PROJECTS BY STATUS IN PILBARA REGION (APRIL 2020)



SOURCE: ACIL ALLEN CONSULTING

TABLE 2.1 MAJOR PROJECTS IN THE PILBARA REGION (>$1BN)

Project	Company	Industry	Status	Value
Browse Upstream Development	Woodside	Mining	Possible	$30bn
Scarborough Upstream Development	Woodside	Mining	Under consideration	$15.8bn
Gorgon LNG Plant Fourth Train	Chevron Australia	Mining	Possible	$10bn
West Pilbara Iron Ore Project	Aurizon/Baosteel	Mining	Possible	$7.4bn
Anketell Port	Pilbara Ports Authority	Transport & Storage	Possible	$7bn
Flinders Iron Ore Port and Rail Project	Flinders Mines/Todd Corporation	Mining	Possible	$6bn
South Flank Iron Ore Development	BHP	Mining	Under construction	$4.9bn
Burrup Peninsula Urea Project	Perdaman Fertilisers and Chemicals	Manufacturing	Under consideration	$4.5bn
Iron Bridge Iron Ore Development	Fortescue Metals Group	Mining	Under construction	$3.7bn
Koodaideri Iron Ore Development	Rio Tinto	Mining	Under construction	$3.5bn
Eliwana Iron Ore Development	Fortescue Metals Group	Mining	Under construction	$1.7bn
Burrup Methanol Plant	Wesfarmers	Manufacturing	Under consideration	$1.4bn
Robe Valley Mesa B, C & H	Rio Tinto	Mining	Committed	$1.3bn
Western Turner Syncline Phase 2	Rio Tinto	Mining	Committed	$1bn

SOURCE: ACIL ALLEN CONSULTING

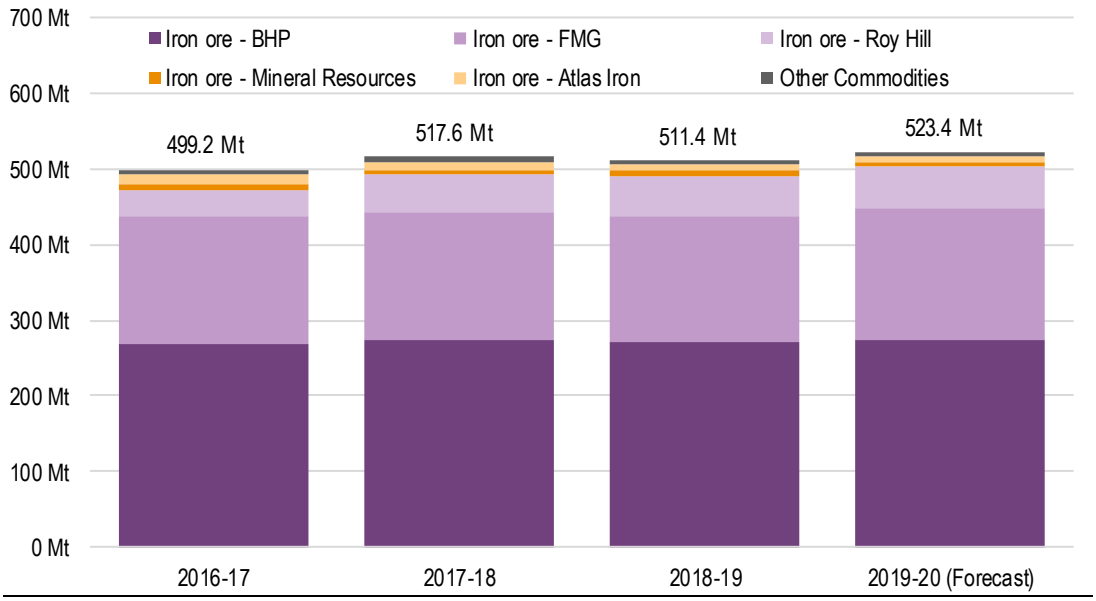
2.2 Port Hedland Port Overview

If the Pilbara region represents the most significant and prospective economic region in the State and the Nation, then its most critical piece of economic infrastructure is the Port of Port Hedland.

If the Pilbara region represents the most significant and prospective economic region in the State and the Nation, then its most critical piece of economic infrastructure is the Port of Port Hedland.

The Port Hedland Port is operated by the Pilbara Ports Authority (PPA) and has grown to become the world's largest bulk export terminal, handling over 511 million tonnes of trade and 6,147 vessel movements[1] in 2018-19. **Iron ore** is the primary commodity traded through the port. Other commodities include **manganese, salt, lithium** (exported as spodumene concentrate) and **copper** concentrate. As shown in **Figure 2.7**, total trade volumes for Port Hedland Port are forecasted to reach over 523 million tonnes in 2019-20, with iron ore equating to 99.1 per cent of total trade in volume terms.

FIGURE 2.7 TRADE VOLUMES – PORT HEDLAND PORT



Note: Other includes manganese, spodumene concentrate, copper concentrate and salt. Excludes general cargo/containers and cattle.

SOURCE: PILBARA PORTS AUTHORITY

Loading and unloading is undertaken at each of the Port's 19 berths – 4 of which are public and 15 which are privately owned and operated. Of the private births, eight are owned and operated by BHP, five by Fortescue Metals Group and two by Roy Hill.

An overview of each of the berths is presented below in **Table 2.2**.

TABLE 2.2 OVERVIEW OF BERTHS AT PORT HEDLAND PORT

Berth Operator	Berth Name	Maximum Vessel Displacement (tonnes)	Maximum Vessel Length (metres)
Pilbara Port Authority	PPA No. 1 Berth – PH1	40,000	225
	PPA No. 2 Berth– PH2	40,000	130
	PPA No. 3 Berth – PH3	55,000	225
	Utah Point Multi-user Facility – PH4	100,000	260
BHP	Nelson Point NPA	150,000	300
	Nelson Point NPB	150,000	300
	Nelson Point NPC	150,000	325

[1] Pilbara Ports Authority

Berth Operator	Berth Name	Maximum Vessel Displacement (tonnes)	Maximum Vessel Length (metres)
	Nelson Point NPD	150,000	325
	Finucane Island –FIA	150,000	325
	Finucane Island –FIB	150,000	325
	Finucane Island –FIC	150,000	300
	Finucane Island –FID	150,000	312
Fortescue Metals Group	Anderson Point Berths - AP1	149,900	340
	Anderson Point Berths – AP2	149,900	340
	Anderson Point Berths – AP3	149,900	340
	Anderson Point Berths – AP4	149,900	330
	Anderson Point Berths – AP5	149,900	300
Roy Hill	SP1 Berth	149,900	330
	SP2 Berth	149,900	330

SOURCE: PILBARA PORTS AUTHORITY, 2020 PORT HANDBOOK PORT OF PORT HEDLAND

2.3 Commodity Analysis

As detailed above, the Port of Port Hedland provides the critical link in the supply chain to a number of key exporters which together generate billions to Australia's economy. A brief analysis of the key commodities exported through the Port of Port Hedland which will support this study is presented below.

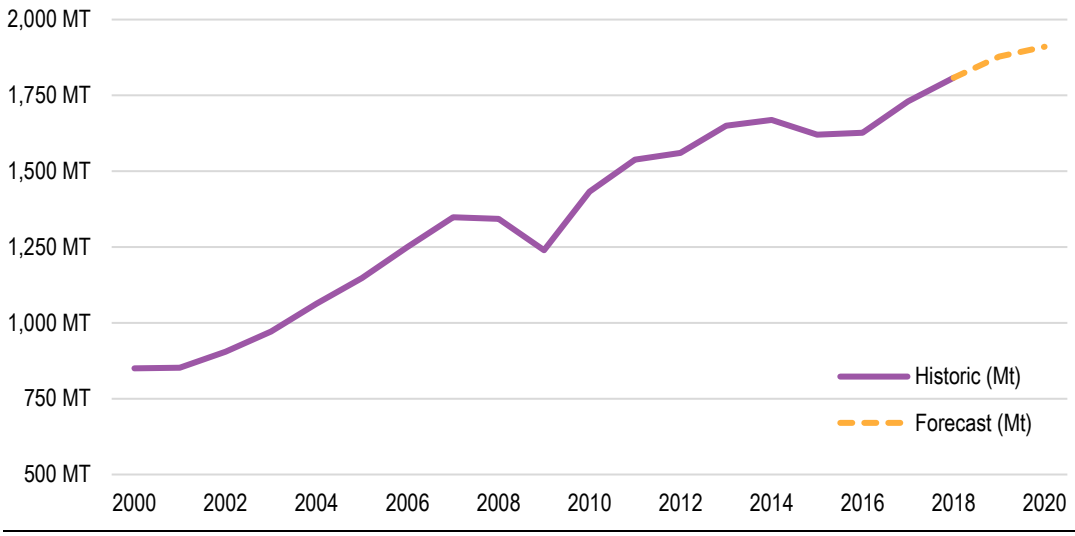
2.3.1 Iron ore

Iron ore is one of the most important commodities in the global economy. Iron ore is extracted via open cut mining, where rock is blasted, dug up and transported to crushing and screening plants where it is then further processed to increase the iron content by removing impurities[2].

The global demand for iron ore has increased by an annual average of 2.9 per cent since 2012, reaching 1,712 million tonnes in 2018[3] (**Figure 2.8**). China is the number one destination for Australia's iron ore exports and accounted for 81 per cent of Western Australia's iron ore exports in 2018. Japan accounted for 8 per cent and South Korea for 6 per cent[4]. Demand is estimated to have increased by 3.9 per cent in 2019 and is forecast to grow by 1.7 per cent in 2020[5]. The slower growth in projected demand for 2020 had been attributed to uncertainty from the ongoing US-China trade tensions, leading to a reduction in activity in the construction and automotive industry in China. In more recent times, the uncertainty relating to COVID-19 on the global economy has had a profound impact on the global outlook.

[2] Ibid.
[3] World Steel Association (2019), World steel in figures 2019.
[4] WA Government, Department of mines, industry regulation and safety. Major Commodities 2018-19
[5] World Steel Association (2019), World Steel Short Range Outlook, October 2019

FIGURE 2.8 GLOBAL STEEL DEMAND (MILLION TONNES)

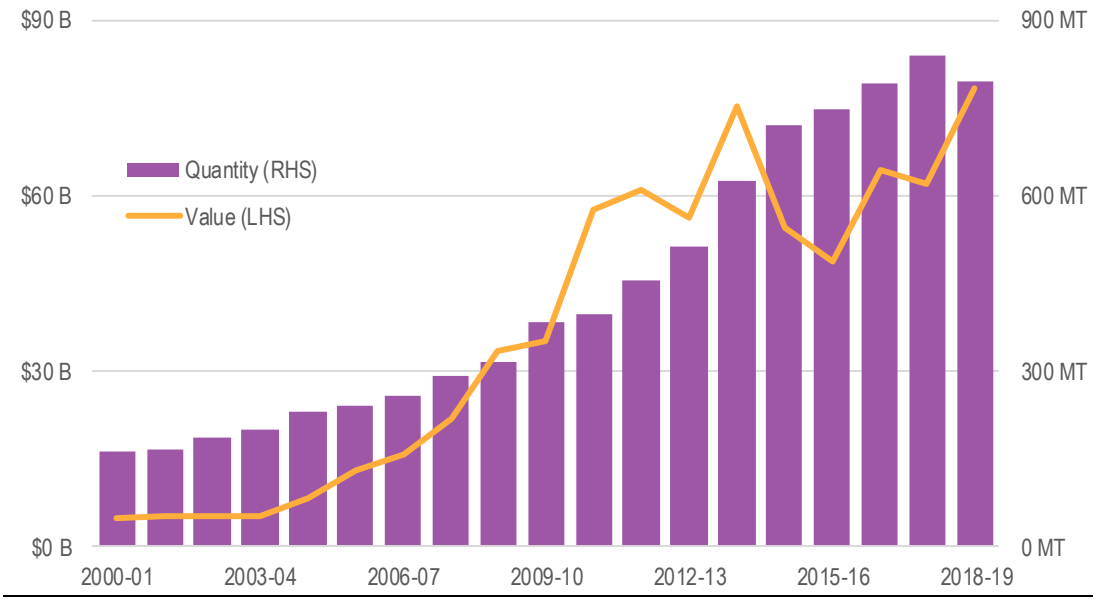


SOURCE: WORLD STEEL ASSOCIATION, WORLD STEEL IN FIGURES 2019

Australia is the largest iron ore producer in the world, accounting for almost twice as much production as second ranked Brazil. Significantly, around 99 per cent of Australia's iron ore is mined in Western Australia[6]. The majority (59 per cent) of iron ore produced in Western Australia is exported via Port Hedland[7], making it the largest bulk export terminal in the world. Significant investments in Western Australia's iron ore sector during the mid-2000's led to a five-fold increase in production, from 162 million tonnes in 2000-01 to 794 million tonnes in 2018-19[8].

The value of Western Australia's iron ore production has increased by an annual average of 17 per cent over the past two decades, reaching A$78 billion in 2018-19 (**Figure 2.9**).

FIGURE 2.9 IRON ORE PRODUCTION IN WA – QUANTITY AND VALUE BY YEAR



SOURCE: WA DEPARTMENT OF MINES, INDUSTRY REGULATION AND SAFETY, MAJOR COMMODITIES, 2019

[6] Ibid.
[7] WA Government, Department of Jobs, Tourism, Science and Innovation, The World Iron Ore Market
[8] WA Government, Department of mines, industry regulation and safety. Major Commodities 2018-19

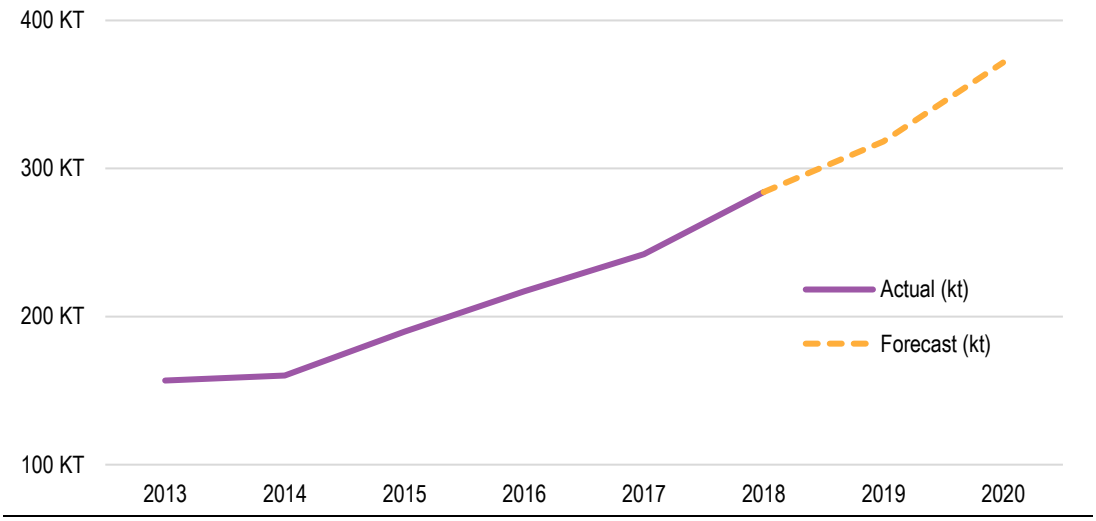
2.3.2 Lithium

Lithium has been flagged as an important metal for future battery technologies, together with nickel, copper, cobalt and palladium. Lithium, and associated by-products, are beginning to be framed not as a commodity, but rather a specialist chemical play in the broader battery technology industry.

The usages for lithium have historically ranged from glass and rubber to ceramics and pharmacy, but it is most commonly used in batteries for electronics[9]. Lithium production was traditionally dominated by salt lake brines, however due to growing demand and an increasing price, it has evolved to include lithium minerals which now account for 50 per cent of global production[10]. The most common lithium mineral in Western Australia is spodumene concentrate. Minerals containing lithium are ground, cleaned and then roasted to produce lithium. It is then further processed via carbonation or electrodialysis to produce lithium hydroxide or lithium carbonate – the state required for most of its uses[11].

The growing demand for lithium (averaged 13 per cent annually since 2013) has been fuelled by the demand for lithium ion batteries (**Figure 2.10**). In 2011, batteries accounted for 29 per cent of lithium use. In 2020 that figure is estimated to reach 51 per cent and grow to 66 per cent by 2024[12]. One of the main uses for lithium ion batteries is in electric vehicles. The greater efficiency (estimated to be 13 times[13] cheaper to operate) and environmental benefits have led to a significant increase in demand for electric vehicles. The largest market for electric vehicles is in China, which accounted for 40 per cent of sales in 2016[14].

FIGURE 2.10 LITHIUM DEMAND (LITHIUM CARBONATE EQUIVALENT)



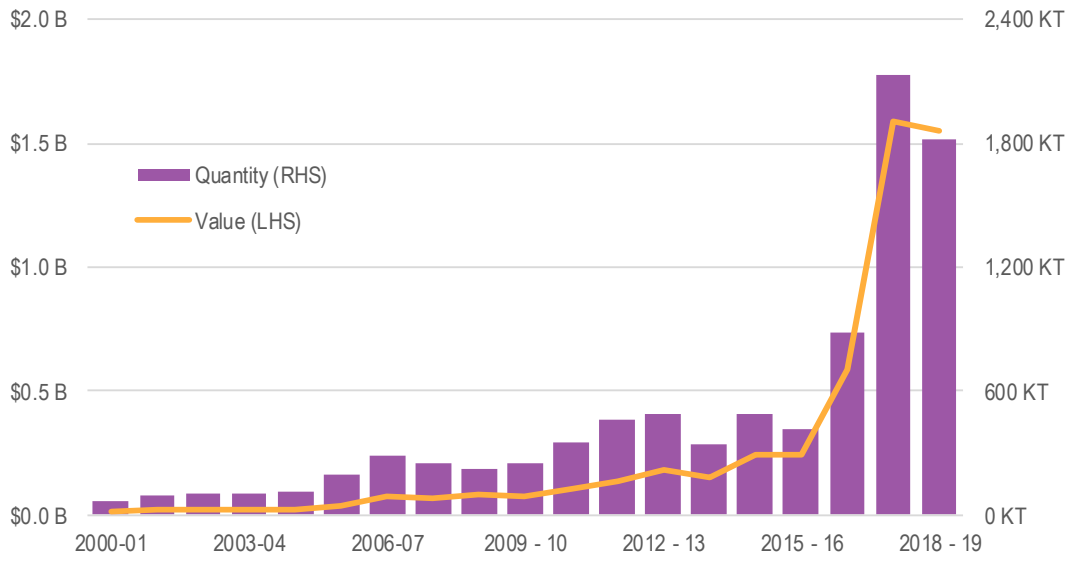
SOURCE: DEUTSCHE BANK MARKETS RESEARCH – LITHIUM 101

Lithium prices continued a sharp decline throughout 2019, causing companies with a financial stake in lithium projects in the Pilbara region such as Albemarle, Mineral Resources, Pilbara Minerals and Altura Mining to face operational and production difficulties with their respective projects. Forecasts for a recovery in lithium prices in 2020 have been linked to higher electric vehicle uptake in key markets throughout Europe, alongside the Chinese government abandoning plans to lower electric vehicle subsidies and the UK government bringing forward a proposed ban on the sale of petrol, diesel and hybrid cars from 2040 to 2035.

[9] Dressemond, C et.al. (2019), Spodumene: The Lithium Market, Resources and Processes, Minerals 2019, 9, 334
[10] Ibid.
[11] Ibid.
[12] Kavanagh, L. et.al. (2018) Global Lithium Sources – Industrial Use and Future in the Electric Vehicle Industry: A Review.
[13] Wright, L. Lithium Dreams: Can Bolivia Become the Saudi Arabia of the Electric Car Era? New Yorker. 22 March 2010
[14] Kavanagh, L. et.al. (2018) Global Lithium Sources – Industrial Use and Future in the Electric Vehicle Industry: A Review.

Australia is the largest producer of lithium from minerals, accounting for 60 per cent of global production in 2018, followed by Chile (19 per cent) and China (9 per cent)[15]. Australia holds the second largest reserves of lithium, with 19 per cent of the identified global total. Chile has the highest reserves (57 per cent), followed by Argentina (14 per cent)[16]. Mining of spodumene concentrate in Western Australia escalated rapidly from 2016 in response to an expected uptick in demand for lithium (**Figure 2.11**). Annual production in WA averaged just over 400,000 tonnes between 2010 and 2016, before more than doubling successively in 2017 and 2018 to exceed 2 million tonnes. Production stabilised in 2019 as concerns were eased regarding the shortfall in supply.

FIGURE 2.11 SPODUMENE CONCENTRATE PRODUCTION IN WA – QUANTITY AND VALUE BY YEAR



SOURCE: DEPARTMENT OF MINES, INDUSTRY REGULATION AND SAFETY, MAJOR COMMODITIES, 2019

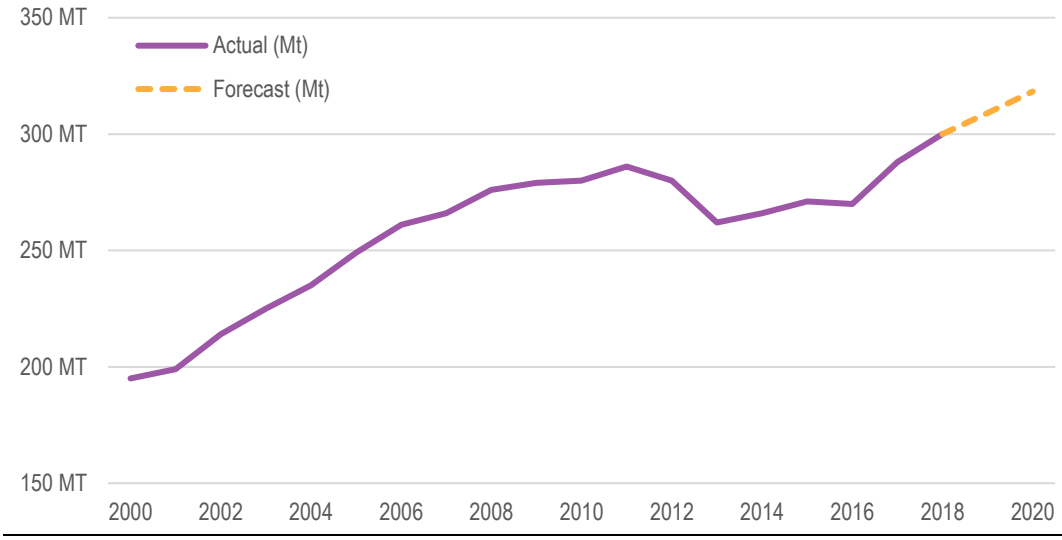
2.3.3 Salt

Salt is a highly versatile mineral, predominately used for chemical processing and agriculture. While large sedimentary deposits of salt occur in many countries, the largest resource is the world's oceans – which contain an average of 78Mt of salt per cubic kilometre[17]. Therefore, salt is typically harvested by solar evaporation, in a process that combines the action of sun and wind in a chain of concentration ponds to separate the salt from seawater.

In 2018, over a third of salt was used to create chlorine and sodium hydroxide in a process called chloralkali production. Over half of this took place in East Asia (China, Japan, South Korea and Taiwan)[18]. Chlorine production in China's chemical markets is forecast to increase by 50 per cent over the next decade (from 28Mt to 42Mt)[19], which will contribute to the continual steady growth in global salt production (**Figure 2.12**).

[15] Ibid.
[16] U.S. Geological Survey, Mineral Commodity Summary – Lithium, February 2019
[17] Ibid.
[18] Roskill (2019), Salt – Outlook to 2028, 18th Edition.
[19] Australian Mining (2018) Third salt mining project signals revival

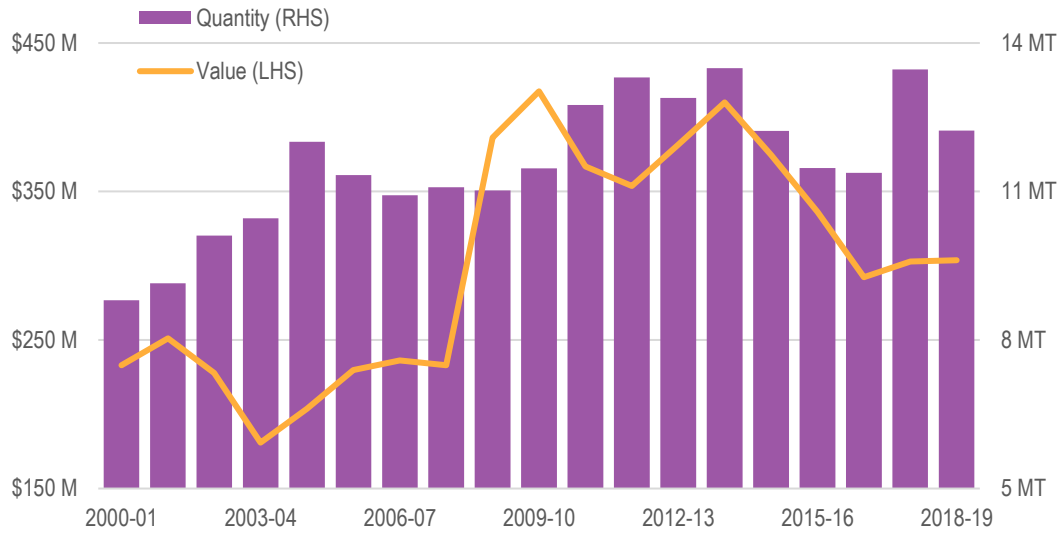
FIGURE 2.12 GLOBAL SALT PRODUCTION, MILLION METRIC TONNES



SOURCE: STATISTICA (2019) WORLD SALT PRODUCTION FROM 1975 TO 2019 (MILLION METRIC TONS)

With an annual production of 12Mt in 2018 (**Figure 2.13**), Australia was the fifth largest producer of salt globally behind Germany (13Mt), India (29Mt), the United States (42Mt) and China (68Mt)[20]. By contrast, Australia is the largest exporter of industrial salt, with only a small proportion of production used in the domestic market[21]. Western Australia dominates Australia's salt production – responsible for roughly 80 per cent of national production. Dampier Salt is the primary salt producer in Western Australia. Dampier Salt operates three salt mines in Western Australia, with the Port Hedland mine utilising the Port Hedland Port for shipments to export markets.

FIGURE 2.13 SALT PRODUCTION IN WA – QUANTITY AND VALUE BY YEAR



SOURCE: DEPARTMENT OF MINES, INDUSTRY REGULATION AND SAFETY, MAJOR COMMODITIES, 2019

[20] Statistica (2019) Major countries in salt production worldwide from 2010 to 2018
[21] Australian Mining (2018) Third salt mining project signals revival.

3 MODELLING METHODOLOGY AND ASSUMPTIONS

This section of the report provides an overview of the modelling methodology and data that has been collated from PHIC member companies to estimate the economic impact of the Port of Port Hedland and the trade through the Port to the town of Port Hedland, the Pilbara Region and the Wester Australian and Australian economies.

3.1 Methodology

To demonstrate the current and future economic benefits associated with the Port Hedland Port Supply Chain, ACIL Allen has undertaken an **economic contribution assessment** for the 2018-19 financial year and **economic impact assessment** for the subsequent ten-year period from 2019-20 to 2028-29 based on the **financial results of the most recent financial year and forward guidance provided by participating PHIC member companies**.

3.1.1 Modelling Framework

Economic Contribution Modelling

The economic contribution of the Port Hedland Port Supply Chain is examined using ACIL Allen's Input-Output (IO) modelling framework, with results produced in the form of the direct and indirect contribution of the Port Hedland Port Supply Chain to the Australian and Western Australian economies, at a regional level for the Pilbara and at a sub regional level for the town of Port Hedland in terms of the contribution to:

- **economic output** (Gross Domestic Product, Gross State Product, Gross Regional Product);
- **income** (wages and salaries earned);
- **employment** (Full Time Equivalent (FTE) jobs); and
- **direct taxation** payments made to the Commonwealth, WA Government and Town of Port Hedland.

Further information on ACIL Allen's Input Output (IO) modelling framework is provided in **Appendix A**.

An economic contribution study takes the financial and employment data of the Port Hedland Port Supply Chain entities for the 2018-19 financial year to determine the overall size and scope or "footprint" on the economy. The economic contribution is calculated on the basis of the Port Hedland Port Supply Chain's direct activities (such as profits generated, expenditure incurred, wages paid to employees) and indirect activities (such as flow on impacts from payments made to suppliers, goods and services purchased from employees) to determine the full extent of the flow-on economic contribution.

Economic Impact Modelling

The economic impact of the Port Hedland Port Supply Chain over the 10 years to 2029-30 will be estimated using ACIL Allen's its in-house Computable General Equilibrium model, *Tasman Global*.

Tasman Global is a powerful tool for undertaking economic impact analysis at the regional, state, national and global levels. *Tasman Global* is designed to account for all sectors within an economy and all economies across the world. ACIL Allen uses this modelling platform to undertake industry, project, scenario and policy analyses. The model is able to analyse issues at the industry, global, national, state and regional levels and to determine the impacts of various economic changes on production, consumption and trade at the macroeconomic and industry levels.

Further information on ACIL Allen's *Tasman Global* CGE model is provided in **Appendix B**.

ACIL Allen will estimate the economic impact of the Port Hedland Port Supply Chain's future operations using the following indicators:

- **Real output** (Gross Domestic Product (GDP), Gross State Product (GSP) and Gross Regional Product (GRP)): Real output represents the total dollar value of all finalised goods and services produced over a specific time period and is considered as a measure of the size of the economy.
- **Real income** (Gross Real Income): Real income measures the income available for final consumption and saving after adjusting for inflation. An increase in real income means that there has been a rise in the capacity for consumption as well as a rise in the ability to accumulate wealth in the form of financial and other assets. The change in real income from a development is a measure of the change in the economic welfare of residents within an economy. For this reason, real income is ACIL Allen's preferred measure of economic impact.
- **Employment:** Labour market impacts are typically produced on an annual FTE basis.
- **Real taxation:** Taxation results are completed by major heads of taxation. This typically includes royalties, payroll tax and GST at a State level, and company tax (both directly paid by the project and by others as a result of changes in economic activity), personal income tax, and other Commonwealth taxes like excise. Results for Local Government Rates to the Town of Port Hedland were not modelled due to insufficient information available.

The results for each indicator will be presented in terms of the **direct impacts** (for example, the workforce directly employed across the Port Hedland Port Supply Chain, or the direct taxation payments made) and the **indirect impacts** (this will be the primary output of the economic modelling, highlighting the flow on impacts of the Port Hedland Port Supply Chain operations across the economy and industry).These results will be presented at a national, state and regional level.

3.1.2 Key Assumptions

To support the IO and CGE modelling frameworks, ACIL Allen has established a set of key assumptions for this study. These assumptions include:

- Modelling of the 2018-19 financial year is completed using actual realised prices provided by producers in line with understanding their contribution to the economy and various heads of taxation;
- Constant flat real prices, set at 2018-19 levels, over the forecast period to isolate the impact of changed activity levels as opposed to fluctuations in prices and exchange rates;
- All values presented in this report are in real 2019 terms (inflation adjusted);
- Annual modelling results are presented in financial years; and
- For study participants who did not provide a complete set of data inputs through to 2028-29, ACIL Allen has used the data inputs for the final year of the projections provided by the study participant.

3.1.3 Data Inputs

With assistance from the PHIC and PPA in the data collection process, the input data used for the economic contribution and economic impact modelling in this report was provided directly to ACIL Allen by the companies participating in the study.

To protect the confidential information provided by participating members, **ACIL Allen has aggregated all results across the data categories** presented in **Table 3.1**. Any data gaps were addressed by ACIL Allen through its contemporary knowledge of the resources sector and the WA economy more broadly.

Aggregated production and expenditure estimates for the Port Hedland Port Supply Chain are presented in the next section.

TABLE 3.1 KEY DATA INPUTS

Data category	Description	Why is it needed?
Ownership structure	The percentage breakdown of the ownership structure of a company's mine/asset (pre-filled categories of Port Hedland, Rest of Pilbara, Rest of WA, Rest of Australia and Rest of World).	To attribute income flows to geographic areas, in particular accounting for the share of foreign ownership of some companies in the Pilbara region.
Macro	Actual and projected commodity unit price, exchange rate, Australian inflation and US inflation.	To build up robust estimates of the real prices for each commodity over the study period.
Production	Actual and projected commodity production	Key input that is used to project revenue flows over the study period.
OPEX	Actual and projected operating expenditure itemised to a level determined by the company	Breakdown of operating expenditure is coded to individual industries to understand how the economic activity flows through the economy over the study period.
CAPEX	Actual and projected capital expenditure itemised to a level determined by the company.	Breakdown of capital expenditure is coded to individual industries to understand how the economic activity flows through the economy over the study period.
Fiscal	Actual and projected company income taxation payments, personal income taxation payments, fringe benefits taxation payments, WA payroll taxation payments, royalty payments, local government rates, other taxation payments, average operational FTE salary and average construction FTE salary.	Provides estimates of the direct taxation payments made by the Port Hedland Port Supply Chain over the study period. Indirect taxation payments are estimated using ACIL Allen's CGE Model, *Tasman Global*.
Operational employment	Actual and projected FTE numbers for managers, professionals, technicians and trades workers, community and personal service workers, clerical and administrative workers, sales workers, machinery operators and drivers and labourers.	Provides estimates of the operating workforce directly employment by the companies across the Port Hedland Port Supply Chain by broad occupation classification. Indirect employment created as a result of the activities from the Port Hedland Port Supply Chian are estimated using ACIL Allen's CGE Model, *Tasman Global*.
Capital employment	Actual and projected FTE numbers for managers, professionals, technicians and trades workers, community and personal service workers, clerical and administrative workers, sales workers, machinery operators and drivers and labourers.	Provides estimates of the workforce directly employed when capital investment is undertaken by the companies across the Port Hedland Port Supply Chain by broad occupation classification. Indirect employment created as a result of the activities from the Port Hedland Port Supply Chian are estimated using ACIL Allen's CGE Model, *Tasman Global*.

SOURCE: ACIL ALLEN CONSULTING

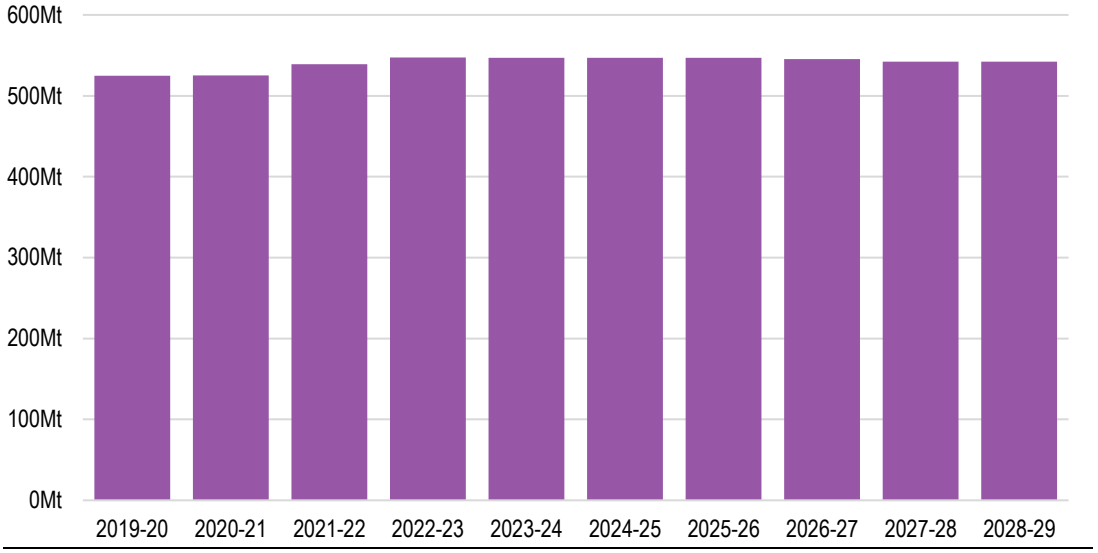
3.2 Projected Production and Expenditure Profiles

3.2.1 Production

Projected commodity production over the next ten years in the Port Hedland Port Supply Chain is a critical input into the economic modelling, as production underpins the levels of expenditure, employment, income and taxation payments made.

Based on the forward guidance provided by participating PHIC members, it is estimated that total **iron ore production** will increase from 524.9Mt in 2019-20, peaking at 547.5Mt in 2022-23 before easing back to an average of 545.2Mt over the remainder of the forecast period (**Figure 3.1**). These estimates take into account the estimated additional production from planned expansions of mining operations over the forecast period which will largely offset falling volumes from existing operations.

FIGURE 3.1 PROJECTED ANNUAL IRON ORE PRODUCTION

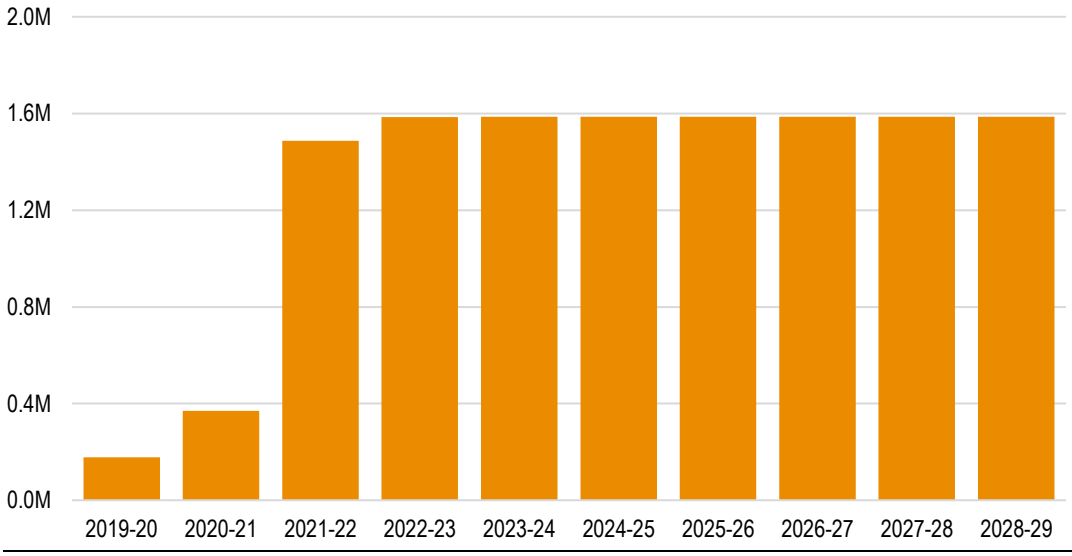


SOURCE: ACIL ALLEN CONSULTING

The development of the lithium industry in the Pilbara has been one of the most significant developments in the region in recent years. It is estimated that total spodumene concentrate production across the Port Hedland Port Supply Chain will accelerate from 180,000 DMT in 2019-20 to 1,500,000 DMT in 2021-22, and average 1,600,000 DMT over the remainder of the forecast period

The development of the lithium industry in the Pilbara has been one of the most significant developments in the region in recent years. Based on forward guidance from participating member companies, it is estimated that total **spodumene concentrate production** for the Port Hedland Port Supply Chain will accelerate from 180,000 DMT in 2019-20 to 370,000 DMT in 2020-21 and then again to 1,500,000 DMT in 2021-22. In subsequent years, total production is expected to average 1,600,000 DMT over the remainder of the forecast period (**Figure 3.2**).

FIGURE 3.2 PROJECTED ANNUAL SPODUMENE CONCENTRATE PRODUCTION (MILLIONS OF DMT)

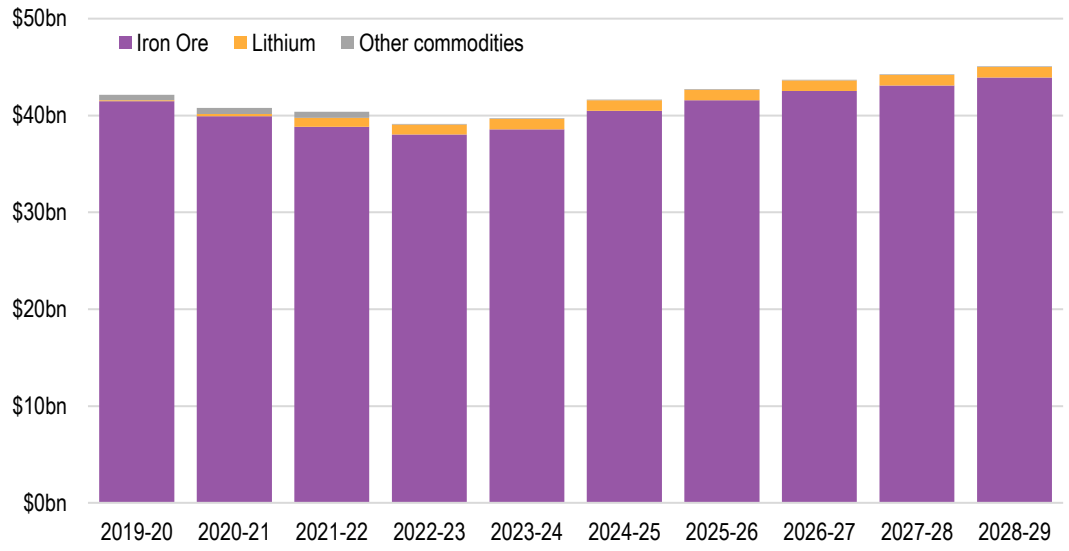


SOURCE: ACIL ALLEN CONSULTING

Some of the commodities in the Port Hedland Port Supply Chain are produced by only one participating company in this study. As such, the projected production volumes for these commodities have not been disclosed in this section to protect the confidentiality of the data provided to ACIL Allen.

In relation to the projected value of production from the Port Hedland Port Supply Chain, ACIL Allen has calculated the projected value of production across all commodities in the ten-year period through to 2028-29 (**Figure 3.3**). This analysis presents a decline in the total value of production in the first four years of the projection period to a minimum level of US$39.1 billion in 2022-23, before a steady increase over the remaining years to reach US$45.1 billion in 2028-29. This reflects industry's expectations regarding a gradual reduction in prices from current multi-year highs.

FIGURE 3.3 PROJECTED NOMINAL VALUE OF PRODUCTION ($US)



Note: The projected value of production of lithium includes the production of both spodumene concentrate and tantalum concentrate.

SOURCE: ACIL ALLEN CONSULTING

3.2.2 Operating Expenditure

It is estimated that operating expenditure across the Port Hedland Port Supply Chain will average over $14 billion per annum over the forecast period.

The forecast operational expenditure for the Port Hedland Port Supply Chain was based on forward guidance provided by participating member companies. Consistent with the trends in production, it is estimated that operating expenditure will reach $12.8 billion in 2019-20 and again in 2020-21, before increasing to approximately in $14.2 billion in 2021-22. This level of expenditure is expected to be maintained across the remainder of the forecast period (**Figure 3.4**).

FIGURE 3.4 PROJECTED ANNUAL OPERATING EXPENDITURE

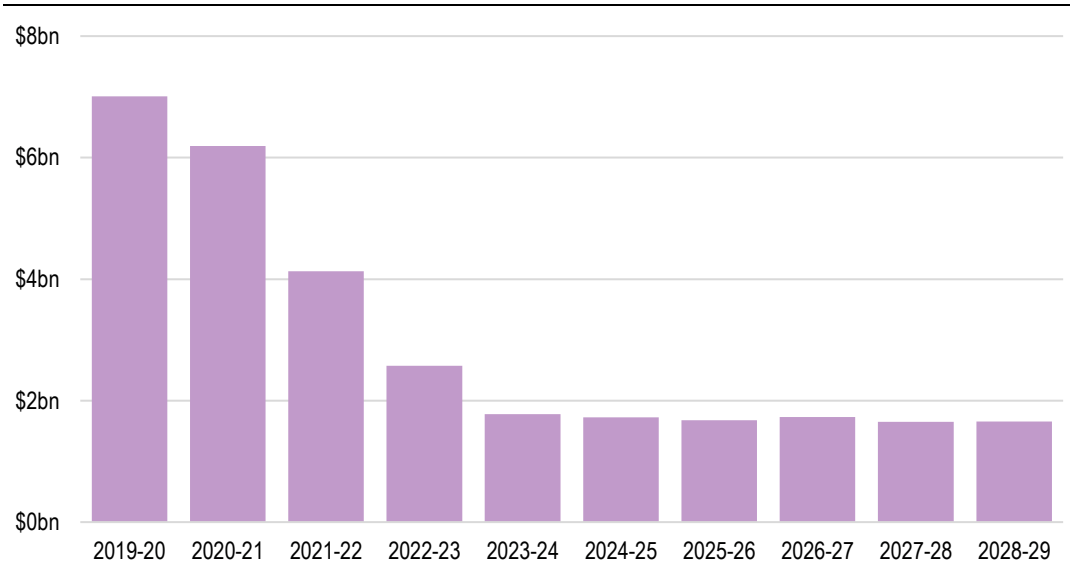
SOURCE: ACIL ALLEN CONSULTING

3.2.3 Capital Expenditure

In addition to the significant levels of operational expenditure across the Port Hedland Port Supply Chain, significant capital investment is undertaken each year.

The projected annual capital expenditure over the next ten years in the Port Hedland Port Supply Chain reflects the anticipated construction activity linked to major projects that are either currently under construction or due to commence construction in the projection period (**Figure 3.5**).

FIGURE 3.5 PROJECTED ANNUAL CAPITAL EXPENDITURE



SOURCE: ACIL ALLEN CONSULTING

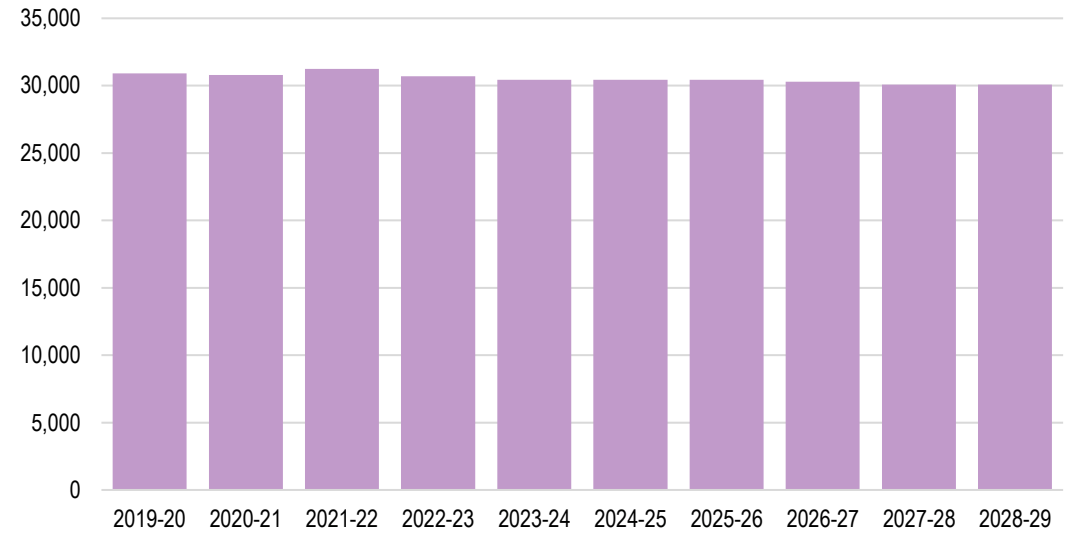
In 2019-20, there is expected to be total capital expenditure across the Port Hedland Port Supply Chain of approximately $7 billion, which is underpinned by large investments from BHP and FMG in their respective South Flank and Eliwana iron ore projects. Following this peak in 2019-20, total capital expenditure is the expected to steadily decline to $6.2 billion in 2020-21, $4.1 billion in 2021-22 and $2.6 billion in 2022-23 as the construction of the major iron ore projects is completed. Total capital expenditure is expected to average $1.7 billion over the remainder of the forecast period.

3.2.4 Operational Employment

Forward guidance provided by PHIC member companies suggests that stable, sustained employment opportunities will exist in the Region over the next ten years.

The forecast operational employment for the Port Hedland Port Supply Chain, based on the forward guidance provided by participating member companies, indicates stable, sustained employment opportunities over the next ten years. This provides a powerful signal that PHIC members hold a positive view of their longer term prospects in the Region (**Figure 3.6**).

FIGURE 3.6 PROJECTED ANNUAL OPERATIONAL EMPLOYMENT (FTE)



Note: Total operational employment excludes one small member company who didn't provide ACIL Allen with input data for this category.

SOURCE: ACIL ALLEN CONSULTING

4 ECONOMIC CONTRIBUTION OF PORT HEDLAND PORT AND THE TRADE THROUGH THE PORT, 2018-19

The results presented in this section articulate the economic contribution that the Port of Port Hedland and the trade through the Port made to the town of Port Hedland, the Pilbara Region and the Western Australian and Australian economies in 2018-19 using ACIL Allen's Input-Output modelling framework. The economic contribution has been measured in terms of the direct and indirect contribution to output (Gross Product), incomes (wages and salaries earned), employment (FTE basis) and taxation and royalty payments made to Commonwealth and Western Australian Governments (by key heads of taxation).

4.1 Port Hedland

The total economic contribution of the Port Hedland Port Supply Chain within the Town of Port Hedland was $1.1 billion in 2018-19

The Port Hedland Port Supply Chain accounted for $531.8 million in direct economic output in the Town of Port Hedland in 2018-19. The activities of the Port Hedland Port Supply Chain in the Town of Port Hedland generated $526.5 million of indirect economic output in the Town of Port Hedland. Together, the **total economic contribution of the Port Hedland Port Supply Chain within the Town of Port Hedland was approximately $1.1 billion in 2018-19** (**Figure 4.1**).

FIGURE 4.1 ECONOMIC CONTRIBUTION OF THE PORT HEDLAND PORT SUPPLY CHAIN TO THE TOWN OF PORT HEDLAND, 2018-19

SOURCE: ACIL ALLEN CONSULTING

High levels of economic activity in the Town of Port Hedland supported almost 3,600 full time jobs in 2018-19, which together accounted for 44 per cent of all jobs that year.

The economic multiplier of local expenditure by the Port Hedland Port Supply Chain is estimated to be 1.99, meaning every dollar of expenditure made in the area generated flow on expenditure of $0.99. The high economic multiplier highlights the significant role that the Port Hedland Port Supply Chain plays in supporting the economic and social fabric of the Town of Port Hedland.

This level of activity supported thousands of jobs in the Town in 2018-19. ACIL Allen estimates that the Port Hedland Port Supply Chain directly employed 1,142 FTE jobs, and a further 2,440 FTE jobs were indirectly created as a result of this activity, with an implied employment multiplier of 2.14. Overall, **the Port Hedland Port Supply Chain supported 3,581 direct and indirect FTE jobs in the Town of Port Hedland in 2018-19, accounting for 44 per cent of total employment in the Town in 2018-19**[22]. As employment is calculated on a place of residence basis, these results highlight the contribution that the Port Hedland Port Supply Chain in generating employment opportunities for residents of Port Hedland.

This is also reflected in the wages and salaries paid by Port Hedland Port Supply Chian employers. ACIL Allen estimates that direct wages and salaries paid to residents in Port Hedland region reached $225.6 million in 2018-19, with a further $266.3 million paid in wages and salaries indirectly as a result of the activities across the supply chain. Overall, the Port Hedland Port Supply Chain helped generate almost half a billion dollars ($491 million) in income to residents of Port Hedland in 2018-19.

4.2 Pilbara Region

ACIL Allen estimates that total economic contribution of the Port Hedland Port Supply Chain was $42.8 billion in 2018-19, accounting for 47 per cent of the Region's economy in 2018-19.

The Port Hedland Port Supply Chain accounted for $41.1 billion in direct economic output in the Pilbara Region in 2018-19, which together accounted for 45 per cent of the Region's output that year. The activities of the Port Hedland Port Supply Chain in Port Hedland generated an additional $1.7 billion of indirect economic output throughout the Region (including the Town of Port Hedland). ACIL Allen estimates that **total economic contribution of the Port Hedland Port Supply Chain was $42.8 billion in 2018-19, accounting for 47 per cent of the Region's economy in 2018-19** (**Figure 4.2**).

FIGURE 4.2 ECONOMIC CONTRIBUTION OF THE PORT HEDLAND PORT SUPPLY CHAIN IN THE PILBARA REGION, 2018-19

SOURCE: ACIL ALLEN CONSULTING

The Port Hedland Port Supply Chain supported 10,178 direct and indirect FTE jobs in the Pilbara Region in 2018-19, which equates to approximately 29 per cent of total employment in the Region.

The **Port Hedland Port Supply Chain supported 10,178 direct and indirect FTE jobs in the Pilbara region in 2018-19, which equates to approximately 29 per cent of total employment in the region**[23]. ACIL Allen estimates that the Port Hedland Port Supply Chain directly employed 2,928 FTE jobs in 2018-19, and a further 7,520 FTE jobs were indirectly created as a result of this

[22] Department of Employment. 2019. *Small Area Labour Markets*, December 2019 update.
[23] Department of Employment. 2019. *Small Area Labour Markets*, December 2019 update. Employment data for the Shire of East Pilbara from 2016 Census.

activity, with an implied employment multiplier of 2.48. This level of direct and indirect job creation highlights the important role that the activities of the Port and the companies that trade through the Port play in the Pilbara region more broadly.

In relation to the wages and salaries paid by Port Hedland Port Supply Chain employers, ACIL Allen estimates that over half a billion dollars ($505.7 million) was paid in wages and salaries in 2018-19, with a further $828.9 million in wages and salaries indirectly paid as a result of these activities – which together amounted to some $1.33 billion in wages and salaries paid in the Region.

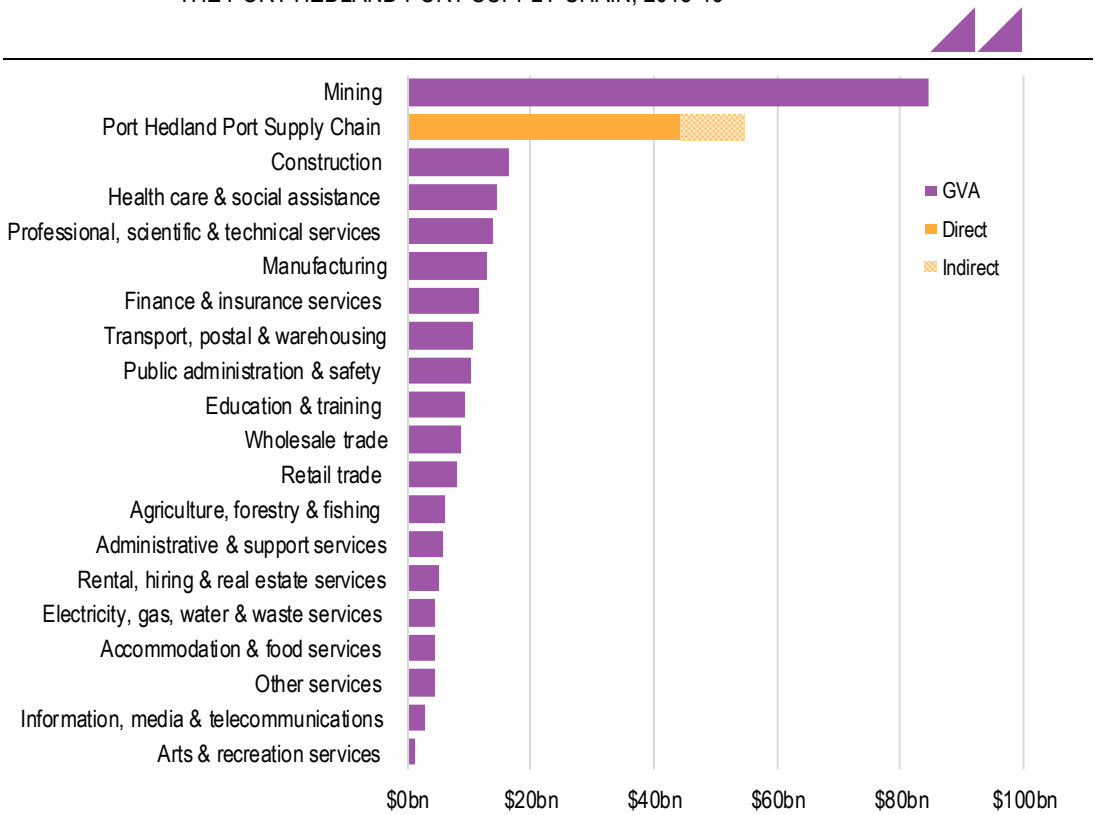
4.3 Western Australia

The Port of Port Hedland and the trade that is facilitated through the Port is a significant driver of the WA economy. ACIL Allen estimates that the Port Hedland Port Supply Chain contributed $44.5 billion to the Western Australian economy in 2018-19 – directly accounting for over 17 per cent of the State's GSP.

ACIL Allen estimates that the Port Hedland Port Supply Chain contributed $44.5 billion to the Western Australian economy in 2018-19 – almost four times the Gross Value Added of the Manufacturing Industry, five times the size of the Education and Training Industry and seven times the size of the output from the Agriculture Industry.

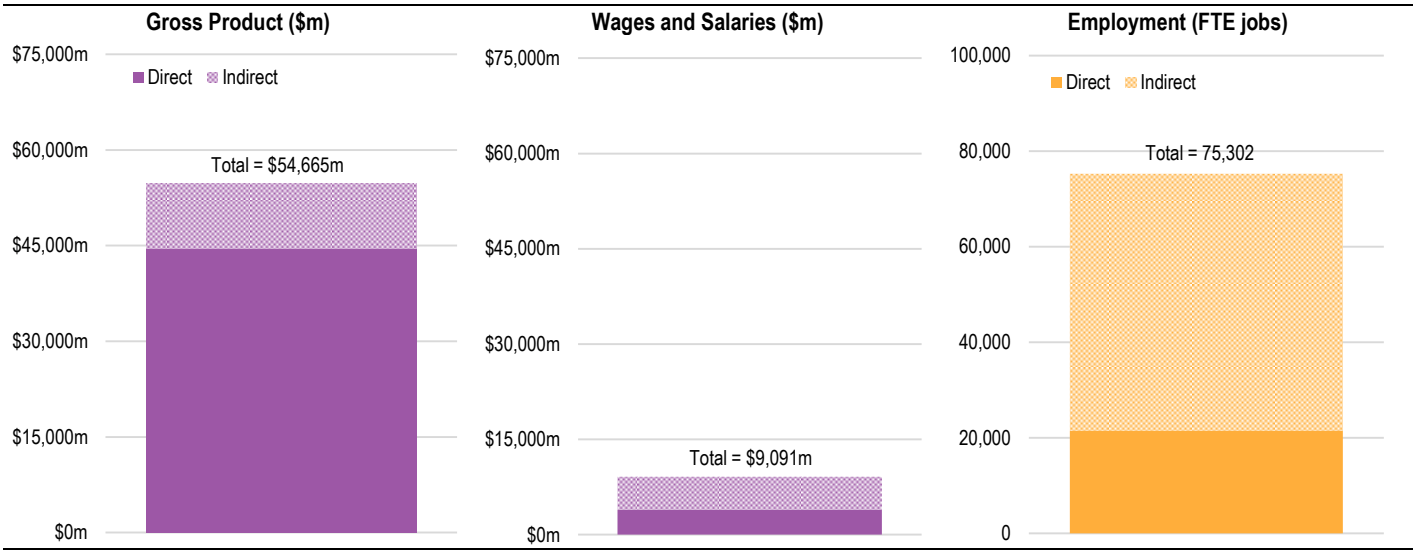
The significant contribution that the Port Hedland Port Supply Chain directly makes to the WA economy compares favourably against other industries. The Port Hedland Port Supply Chain **generated significantly higher levels of output than another other WA industry in 2018-19 (other than Mining) – almost four times the Gross Value Added of the Manufacturing Industry, five times the output of the Education and Training Industry and seven times the output from the Agriculture Industry in 2018-19** (**Figure 4.3**).

FIGURE 4.3 GROSS VALUE ADDED BY INDUSTRY IN WESTERN AUSTRALIA – COMPARISONS TO THE PORT HEDLAND PORT SUPPLY CHAIN, 2018-19



SOURCE: ACIL ALLEN CONSULTING

FIGURE 4.4 ECONOMIC CONTRIBUTION OF THE PORT HEDLAND PORT SUPPLY CHAIN IN WESTERN AUSTRALIA, 2018-19



SOURCE: ACIL ALLEN CONSULTING

ACIL Allen estimates that the total contribution of the Port Hedland Port Supply Chain to the WA economy reached $54.7 billion in 2018-19 – accounting for more than 20 per cent of WA's GSP in that year.

When combined with the indirect economic activity generated as a result of the Port Hedland Port Supply Chain ($10.2 billion), **ACIL Allen estimates that its total contribution to the WA economy reached $54.7 billion – accounting for more than 20 per cent of WA's GSP in 2018-19** (**Figure 4.4**).

The level of activity generated by the Port Hedland Port Supply Chain supported some 21,428 direct FTE jobs across Western Australia in 2018-19, with a further 53,874 FTE jobs indirectly created – implying an employment multiplier 2.51.

ACIL Allen estimates that one in every 12 full time jobs across Western Australia were either directly or indirectly supported by the Port of Port Hedland and the trade that is facilitated through the Port in 2018-19.

Overall, **ACIL Allen estimates that there were 75,302 direct and indirect FTE jobs created from the activities of the Port Hedland Port Supply** chain across Western Australia. Based on Western Australia's average full time workforce of 924,200 in 2018-19, ACIL Allen estimates that **one in every 12 workers jobs across Western Australia were either directly or indirectly supported by the Port of Port Hedland and the trade that is facilitated through the Port**.

Reflecting the significant levels of employment generated from the Port Hedland Port Supply Chain, ACIL Allen estimates that there were $3.1 billion in wages and salaries directly paid by businesses across the supply chain and a further $5.2 billion in wages and salaries paid by other businesses across the State not directly related to the activities through the Port of Port Hedland. Overall, the Port Hedland Port Supply Chain supported the payment of some $9.1 billion in wages and salaries to workers across Western Australia in 2018-19.

4.4 Australia

The Port of Port Hedland and the trade facilitated through the Port generated significant benefits to the Australian economy. ACIL Allen estimates that it contributed some $64.1 billion to the Australian economy in 2018-19, which equates to 3.4 per cent of GDP.

Not surprisingly, the majority of the economic and employment benefits accruing from the Port Hedland Port Supply Chain were realised in Western Australia in 2018-19. However, there were still significant benefits that accrued to other parts of Australia.

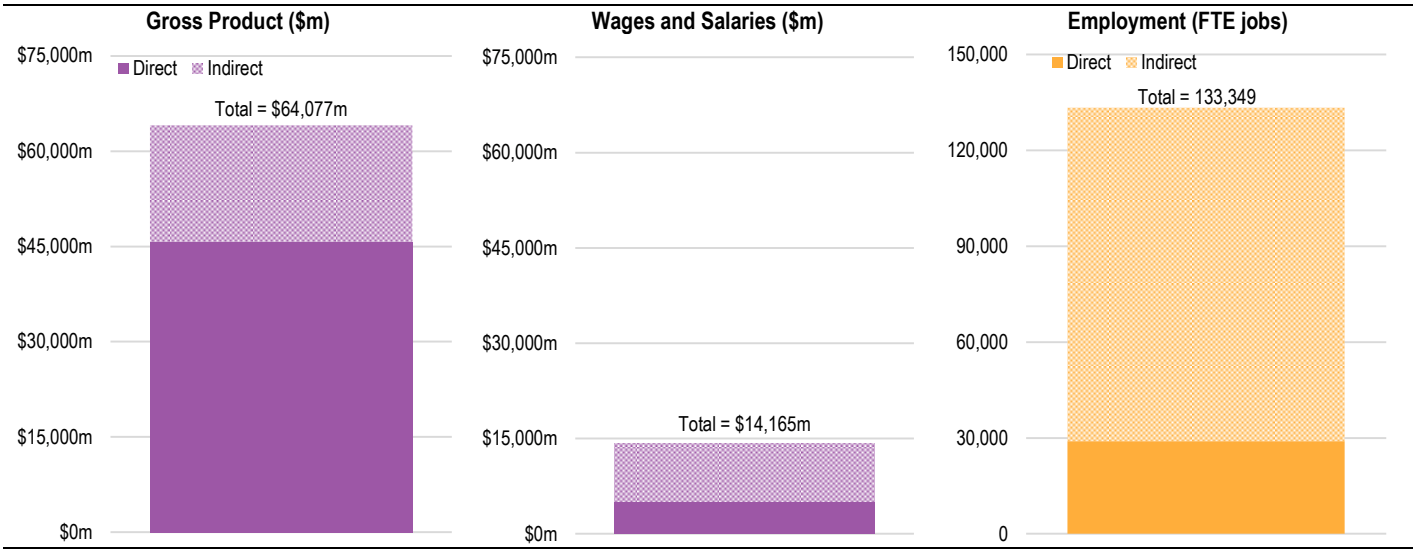
ACIL Allen estimates that across Australia, the Port Hedland Port Supply Chain directly boosted Australia's GDP by $45.7 billion in 2018-19. When the indirect economic contribution is also considered ($18.4 billion), it is estimated that the Port Hedland Port Supply Chain contributed some **$64.1 billion to Australia's GDP in 2018-19** (**Figure 4.5**). Based on Australia's GDP of $1.9 trillion in 2018-19, the **Port Hedland Port Supply Chain contributed either directly or indirectly some 3.4 per cent to the national economy**.

Of this amount, **85 per cent of the boost to national output was realised in Western Australia**. However, from an employment perspective, there were significant job opportunities created outside of Western Australia as a result of the Port Hedland Port Supply Chain. ACIL Allen estimates that there

were **133,349 direct and indirect FTE jobs created from the activities of the Port Hedland Port Supply Chain across Australia in 2018-19, of which 58,046 FTE jobs were created outside of Western Australia**.

Reflecting the significant levels of employment generated from the Port Hedland Port Supply Chain, ACIL Allen estimates that there were $14.2 billion in wages and salaries paid by businesses across Australia either directly or indirectly in 2018-19. Of this amount, **some $3.9 billion was paid in wages and salaries to workers not directly related to the Port Hedland Port Supply Chain and living outside of Western Australia – highlighting the significant role that the Port and the trade that is facilitated through the Port contributes to the nation's prosperity**.

FIGURE 4.5 ECONOMIC CONTRIBUTION OF THE PORT HEDLAND PORT SUPPLY CHAIN IN AUSTRALIA, 2018-19



SOURCE: ACIL ALLEN CONSULTING

4.5 Taxation and Royalties

One of the other primary means by which the economic contribution of the Port Hedland Port Supply Chain can be measured is through the taxes and royalties that are paid to the Commonwealth, WA Government and Town of Port Hedland.

In the context of this study, ACIL Allen has estimated the following taxes and royalties that are directly and indirectly paid by the Port Hedland Port Supply Chain:

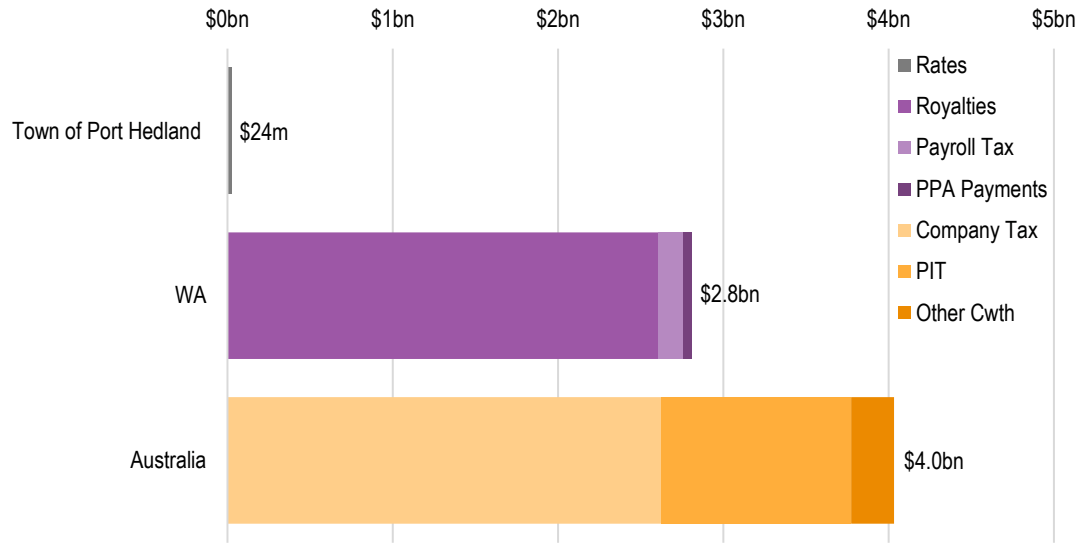
- State Government Royalties
- Payroll Tax
- Dividends and Tax Equivalent Payments
- Company Tax
- Personal Income Tax
- Goods and Services Tax
- Import Duties
- Local Government Rates.

The Port Hedland Port Supply Chain directly paid $2.8 billion in taxation receipts to the Western Australia Government. This is equivalent to approximately 10 per cent of the General Government sector revenue in 2018-19

In total, **ACIL Allen estimates that the Port Hedland Port Supply Chain directly paid $2.8 billion in taxation receipts to the Western Australia Government in 2018-19**. The majority of these payments were in the form of resource royalties ($2.6 billion), with payroll tax paid by businesses across the supply chain ($147 million) and dividend and tax equivalent payments (by the PPA) ($54 million) making up a smaller proportion (**Figure 4.6**).

To put this into perspective, **this is equivalent to approximately 10 per cent of the General Government sector revenue in 2018-19**, and is three times larger than the State's land tax revenue in any one year.

FIGURE 4.6 TAXATION PAYMENTS TO COMMONWEALTH, WESTERN AUSTRALIAN GOVERNMENT AND TOWN OF PORT HEDLAND, 2018-19



SOURCE: ACIL ALLEN CONSULTING

ACIL Allen estimates that the Port Hedland Port Supply Chain paid $4.0 billion to the Commonwealth Government in 2018-19, primarily as a result of company income tax ($2.6 billion) and personal income taxation ($1.1 billion)

In relation to Commonwealth taxation payments to the Commonwealth, **ACIL Allen estimates that the Port Hedland Port Supply Chain paid $4.0 billion to the Commonwealth Government in 2018-19**, primarily as a result of company income tax ($2.6 billion) and personal income taxation ($1.1 billion) as a result of the direct employment on projects. This is equivalent to five times the Commonwealth's annual contribution to State Government infrastructure projects.

4.6 Summary – Economic Contribution

Table 4.1 provides a summary of the results of the economic contribution assessment of the Port Hedland Port Supply Chain for the Town of Port Hedland, Pilbara region, Western Australia and Australia across the key economic indicators presented in this section.

TABLE 4.1 SUMMARY OF ECONOMIC CONTRIBUTION RESULTS

	Gross Product	Wages and Salaries	Employment (FTE)
Port Hedland			
Direct	$531.8m	$225.6m	1,142
Indirect	$526.5m	$266.3m	2,440
Total	$1,058.3m	$492m	3,581
Pilbara Region			
Direct	$41,092.5m	$505.7m	2,928
Indirect	$1,687.3m	$828.7m	7,250
Total	$42,779.8m	$1,334.3m	10,178
Western Australia			
Direct	$44,504.8m	$3,908m	21,428
Indirect	$10,160.4m	$5,182.9m	53,874
Total	$54,665.2m	$9,091.4m	75,302
Australia			
Direct	$45,720.6m	$5,093.6m	28,950
Indirect	$18,356.3m	$9.070.9m	104,399
Total	$64,077m	$14,164.5m	133,349

SOURCE: ACIL ALLEN CONSULTING

5 ECONOMIC IMPACT OF PORT HEDLAND PORT AND THE TRADE THROUGH THE PORT, 2019-20 TO 2028-29

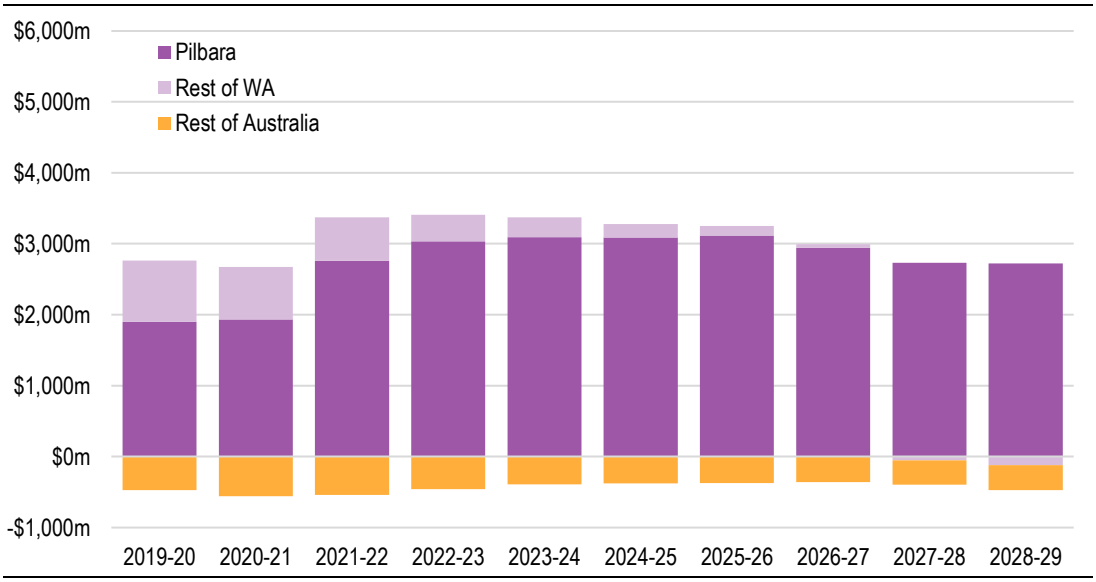
The section presents the incremental economic impact of the Port of Port Hedland and the trade through the Port to the Pilbara Region and the Western Australian and Australian economies over the 10 years to 2028-29 using ACIL Allen's CGE Model, Tasman Global. The results are the incremental over and above the economic contribution of the Port of Port Hedland and the trade through the Port that was presented in the previous section. The results are measured in terms of the direct and indirect impact to output (Gross Product), incomes (wages and salaries earned by individuals and profits generated by businesses), employment (FTE basis) and taxation and royalty payments made to Commonwealth and Western Australian Governments (by key heads of taxation).

5.1 Gross product

ACIL Allen estimates that the Gross Regional, State and Domestic Product increase associated with the Port Hedland Port Supply Chain's additional activities over the next decade is a cumulative $26.2 billion above the baseline contribution of $64.1 billion in 2018-19.

ACIL Allen estimates that the **potential Gross Regional, State and Domestic Product increase associated with the Port Hedland Port Supply Chain's additional activities over the next decade is a cumulative $26.2 billion above the baseline contribution of $64.1 billion in 2018-19** (**Figure 5.1**). The incremental impact follows the forward guidance on production levels from across the Supply Chain, with an average annual impact of $2.6 billion across the national economy.

FIGURE 5.1 REAL OUTPUT IMPACT, ANNUAL TOTALS



SOURCE: ACIL ALLEN CONSULTING

The **potential increase in real output over the next ten years is concentrated primarily in the Pilbara region ($27.3 billion).** However, this is a reflection of the way production is accounted for, with real income (discussed below) demonstrate how this increase in production is distributed across the region and felt by local residents and businesses.

A further $3.1 billion in output is realised in the Rest of Western Australia as a result of the purchases of supplies and services required to facilitate the mining and port operations in the Pilbara. ACIL Allen estimates that output in the Rest of Australia would potentially fall by an average $423 million per annum as the modelled appreciation in the Australian Dollar impacts on the competitiveness of other export industries across the Rest of Australia.

In the Pilbara region, the average potential annual increase in the region's output is equivalent to approximately 3 per cent of the Pilbara economy's GRP in 2017-18.

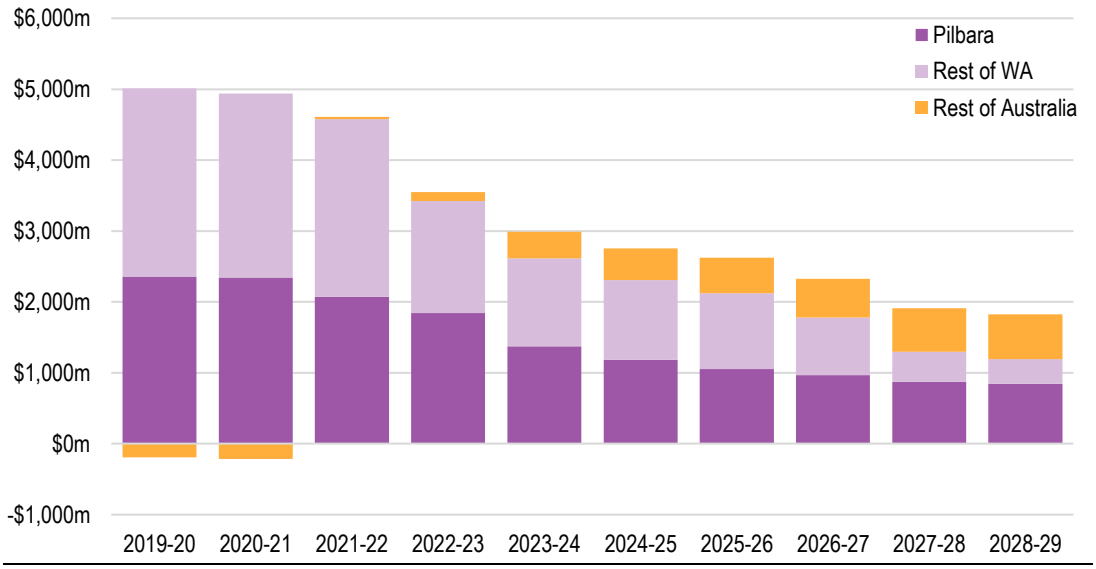
5.2 Real income

Real income measures how the returns associated with an increase in production, expenditure and employment flow through to increased wealth and purchasing power by households, businesses and Government. Given this it is the preferred measure of the economic impact of forward guidance of the Port Hedland Port Supply Chain on the welfare of each region and society as a whole.

ACIL Allen estimates that the potential real income increase associated with the Port Hedland Port Supply Chain is a cumulative $32.1 billion over the ten years through to 2028-29, and reflects the returns associated with future profits, taxation payments to governments, and wages and salaries earned by individuals.

ACIL Allen estimates that the **potential real income increase associated with the Port Hedland Port Supply Chain is a cumulative $32.1 billion over the ten years through to 2028-29** (**Figure 5.2**). The distribution of real income reflects the fact that the returns associated with future profits, taxation, wages and salaries are more in line with the employment patterns of the Port Hedland Port Supply Chain, ownership structures of supply chain participants, and taxing powers of the Commonwealth and State Governments.

FIGURE 5.2 REAL INCOME IMPACT, ANNUAL TOTALS



SOURCE: ACIL ALLEN CONSULTING

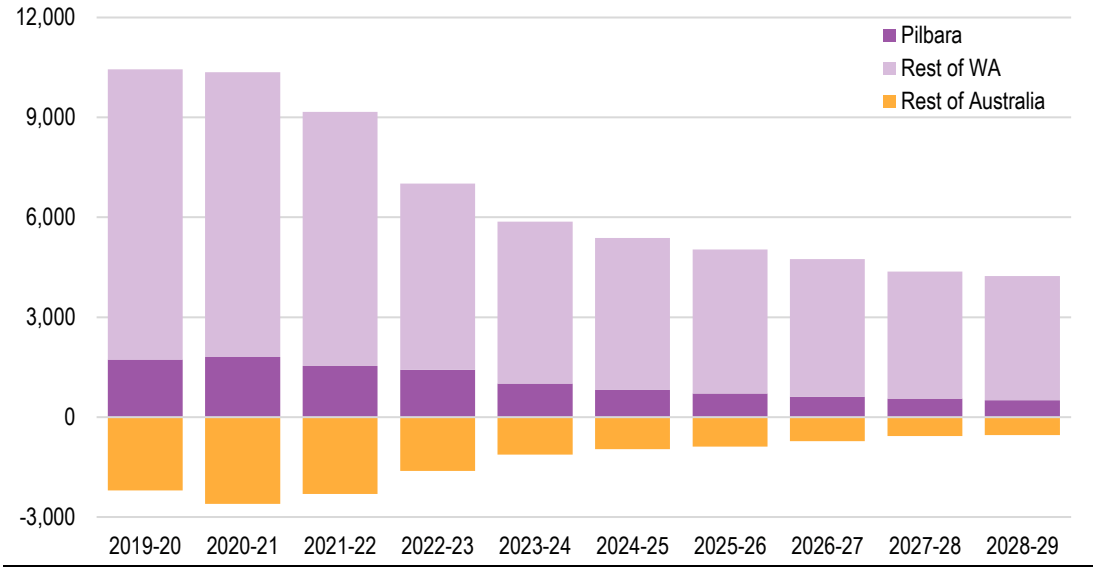
The **potential increase in real income over the next ten years is spread evenly across the Pilbara ($14.9 billion) and the Rest of Western Australia ($14.4 billion).** However, the potential increase in real income across the Rest of Australia ($2.9 billion) is significantly lower. This reflects the offsetting impacts of future company income tax receipts and exchange rate effects on non-mining sectors.

5.3 Employment

ACIL Allen estimates that the potential increase in employment associated with the Port Hedland Port Supply Chain will average a net 5,307 FTE jobs per annum over the ten years through to 2028-29, over and above the current 133,349 FTE jobs in 2018-19.

ACIL Allen estimates that the **potential increase in employment associated with the Port Hedland Port Supply Chain will average a net 5,307 FTE jobs per annum over the ten years through to 2028-29, over and above the current 133,349 FTE jobs supported according to the 2018-19 contribution study** (**Figure 5.3**).

FIGURE 5.3 EMPLOYMENT IMPACT, ANNUAL TOTALS



SOURCE: ACIL ALLEN CONSULTING

Additional employment ranges from a high of 8,243 FTE jobs in 2019-20, falling to 3,694 FTE jobs in 2028-29. The pattern of employment reflects the strong focus on capital expansions across the Port Hedland Port Supply Chain in the early years of the study, which is an important development given the expected impact of restrictions associated with Covid-19 on the Australian economy. By the end of the forward guidance period, the capital expenditure profile of participants is more in line with maintenance of production as opposed to new projects and expansions.

The majority of the potential impact on jobs occurs in the Rest of Western Australia (potential increase of 5,587 FTE jobs on average per annum), while a potential increase of 1,072 FTE jobs on average per annum occurs in the Pilbara region. **The potential impact on the Pilbara region is most pronounced, with the number of FTE jobs added per annum equivalent to 3 per cent of its current workforce.**

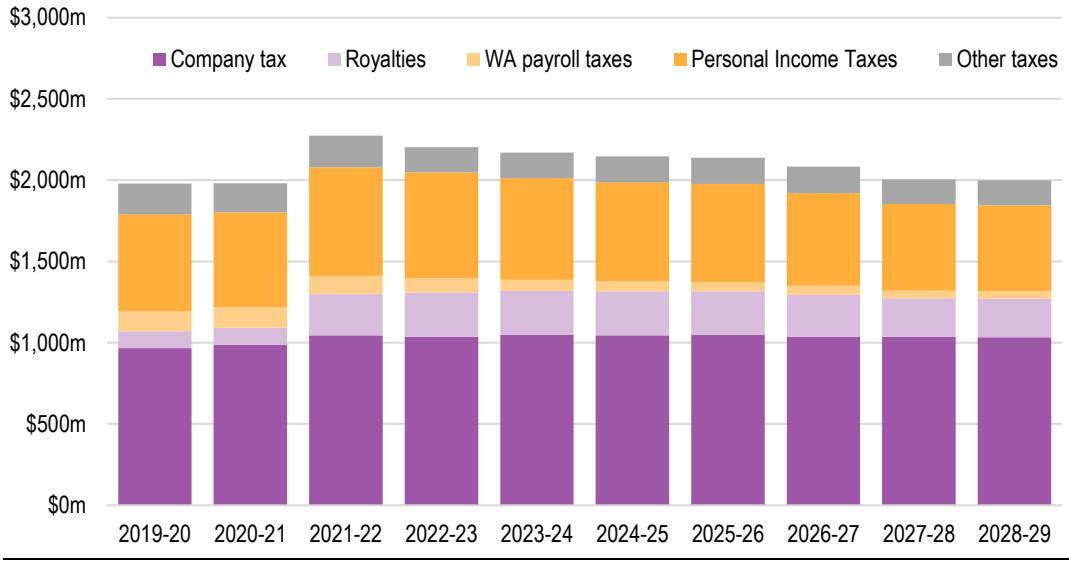
Total employment across the Rest of Australia is projected to be slightly negative across the forward guidance period, averaging a reduction of 1,352 FTE jobs across the ten year period. This reflects the role of exchange rate effects reducing the output of some trade-exposed sectors outside of Western Australia, but also reflects changes in real wages in Western Australia relative to the Rest of Australia which results in higher population flows from the Eastern States to Western Australia.

5.4 Taxes and royalties

ACIL Allen estimates that the **potential increase in real taxation and royalty receipts associated with the Port Hedland Port Supply Chain is a cumulative $21 billion over the ten years through to 2028-29** (**Figure 5.4**), or an additional $2.1 billion per annum over and above the baseline contribution of $6.8 billion in 2018-19.[24]

[24] The economic contribution study does not take into account indirect company or personal income taxation receipts associated with the supplies and services used by the Port Hedland Port Supply Chain due to the modelling technique applied. The economic impact assessment takes these into account. As a result the contribution study understates the taxation payments associated with the Port Hedland Port Supply Chain relative to the methodology applied in the economic impact assessment.

FIGURE 5.4 REAL TAXATION IMPACT, ANNUAL TOTALS



SOURCE: ACIL ALLEN CONSULTING

ACIL Allen estimates that the potential increase in real taxation and royalty receipts associated with the Port Hedland Port Supply Chain is a cumulative $21 billion over the ten years through to 2028-29

The majority of the potential impact on taxation receipts (on average 49 per cent annually) is attributed to Australian company taxation receipts, which are forecasted to average over $1 billion annually over ten years.

The remaining potential impact on taxation receipts is attributed to:

- Western Australia Royalty receipts, which are potentially $2.3 billion higher over ten years;
- Western Australia Payroll tax receipts, which are potentially $789 million higher over ten years;
- Personal income taxes, which are potentially $6 billion higher over ten years; and
- Other taxes, which are potentially $1.7 billion higher over ten years.

The potential taxation receipts by taxation type and jurisdiction is outlined below in **Table 5.1**.

TABLE 5.1 PROJECTED CUMULATIVE CHANGE IN REAL TAXATION

	Total	Average
Company tax (Commonwealth)	$10,281m	$1,028m
Personal income taxes (Commonwealth)	$5,966m	$597m
Other taxes (Commonwealth)	$1,659m	$166m
Royalties (WA)	$2,278m	$228m
Payroll tax (WA)	$789m	$79m
Total	**$20,972m**	**$2,097m**

SOURCE:ACIL ALLEN CONSULTING

5.5 Summary – Economic Impact

The economic impacts discussed above are incremental to the contribution of the Port Hedland Port Supply Chain as described in Section 4, insofar as they reflect how the forward guidance provided by each participant in the supply chain can be expected to impact on the local, State and national economies over the next ten years. Charts demonstrate an estimate of the total future economic contribution of the Port Hedland Port Supply Chain to Gross Product, Employment and taxation are presented below.

FIGURE 5.5 TOTAL FORECAST ECONOMIC CONTRIBUTION OF PORT HEDLAND PORT SUPPLY CHAIN ON PILBARA, WESTERN AUSTRALIA AND AUSTRALIAN ECONOMY(2018-19 TO 2028-29)

*There was $24 million in local government rates paid to the Town of Port Hedland in 2018-19.

SOURCE: ACIL ALLEN CONSULTING

Table 4.1 provides a summary of the results of the economic contribution assessment of the Port Hedland Port Supply Chain for the Town of Port Hedland, Pilbara region, Western Australia and Australia across the key economic indicators presented in this section.

TABLE 5.2 SUMMARY OF ECONOMIC IMPACT RESULTS

	Total	Average
Gross Product		
Pilbara	$27,316m	$2,732m
Rest of Western Australia	$3,068m	$307m
Total Western Australia	**$30,384m**	**$3,038m**
Rest of Australia	-$4,226m	-$423m
Total Australia	**$26,158m**	**$2,616m**
Real Income		
Pilbara	$14,912m	$1,491m
Rest of Western Australia	$14,356m	$1,436m
Total Western Australia	**$29,268m**	**$2,927m**
Rest of Australia	$2,862m	$286m
Total Australia	**$32,130m**	**$3,213m**
FTE Employment		
	Average	Peak (Number, Year)
Pilbara	1,072	1,808 (2020-21)
Rest of Western Australia	5,587	8,707 (2019-20)
Total Western Australia	**6,659**	**10,441 (2019-20)**
Rest of Australia	-1,352	-538 (2028-29)
Total Australia	**5,307**	**8,244 (2019-20)**

Note: totals can be subject to rounding errors

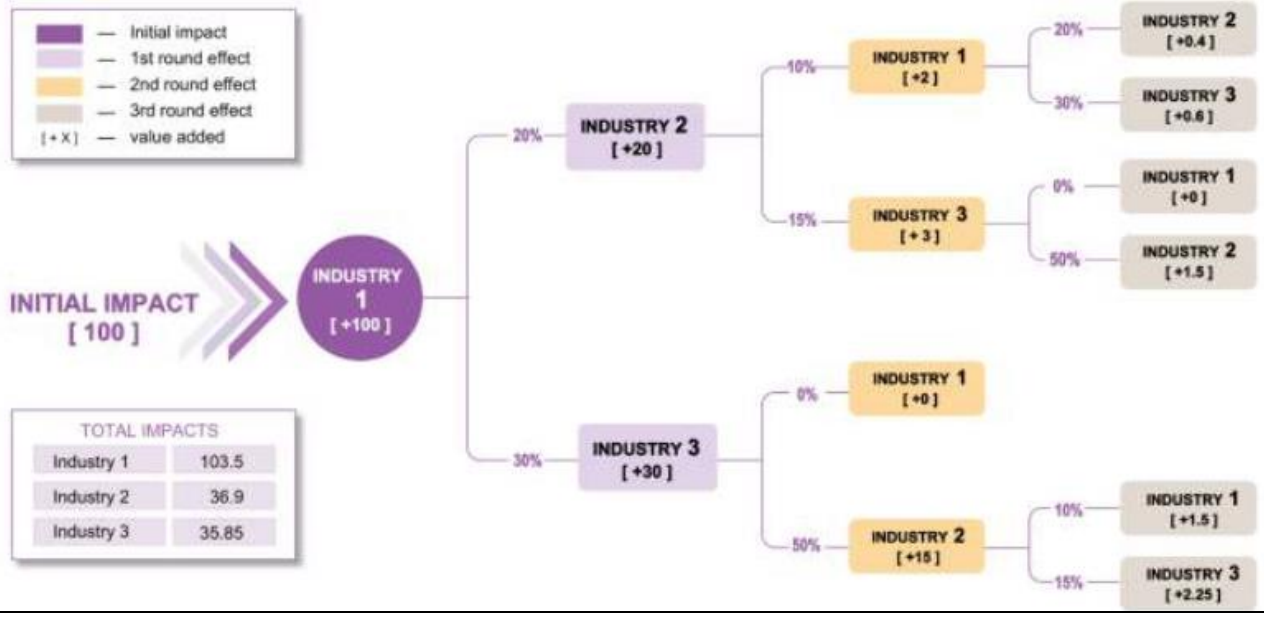
SOURCE: ACIL ALLEN CONSULTING

A

INPUT OUTPUT MODELLING

IO models capture the direct and indirect effects of expenditure by capturing, for each industry, the industries it purchases inputs from and also the industries it sells its outputs to. For example, the IO model for Western Australia captures purchases from and sales to industries located in Western Australia, as well as imports from outside Western Australia. **Figure A.1** depicts how an impact is traced through a (very simple) economy with three industries (1, 2 and 3), and is described below.

FIGURE A.1 "TRACE THROUGH" OF AN INPUT OUTPUT MODEL



SOURCE: ACIL ALLEN CONSULTING

1. The initial impact occurs in Industry 1 where an additional 100 units of value are added to its output. In order to generate this additional output, Industry 1 requires additional inputs from Industry 2 and Industry 3.
2. Therefore, Industry 2 and 3 increase their output as well. This in turn requires input from Industry 1 and 3 and Industry 1 and 2 respectively which increase their output to satisfy this additional demand, and so on.
3. The impacts grow smaller with each iteration and ultimately converge to zero. This is because they always only share the impact that occurred in the preceding iteration.

B

TASMAN GLOBAL

B.1 Tasman Global

ACIL Allen's computable general equilibrium model *Tasman Global* is a powerful tool for undertaking economic impact analysis at the regional, state, national and global level.

There are various types of economic models and modelling techniques. Many of these are based on partial equilibrium analysis that usually considers a single market. However, in economic analysis, linkages between markets and how these linkages develop and change over time can be critical. *Tasman Global* has been developed to meet this need.

Tasman Global is a large-scale computable general equilibrium model which is designed to account for all sectors within an economy and all economies across the world. ACIL Allen uses this modelling platform to undertake industry, project, scenario and policy analyses. The model is able to analyse issues at the industry, global, national, state and regional levels and to determine the impacts of various economic changes on production, consumption and trade at the macroeconomic and industry levels.

B.1.1 A Dynamic Model

Tasman Global is a model that estimates relationships between variables at different points in time. This is in contrast to comparative static models, which compare two equilibriums (one before a policy change and one following). A dynamic model such as *Tasman Global* is beneficial when analysing issues where both the timing of and the adjustment path that economies follow are relevant in the analysis.

B.1.2 The Database

A key advantage of *Tasman Global* is the level of detail in the database underpinning the model. The database we will use for this project is derived from the Global Trade Analysis Project (GTAP) database (version 8.1). This database is a fully documented, publicly available global data base which contains complete bilateral trade information, transport and protection linkages among regions for all GTAP commodities.

The GTAP model was constructed at the Centre for Global Trade Analysis at Purdue University in the United States. It is the most up-to-date, detailed database of its type in the world.

Tasman Global builds on the GTAP model's equation structure and database by adding the following important features:

— dynamics (including detailed population and labour market dynamics)

- detailed technology representation within key industries (such as electricity generation and iron and steel production)
- disaggregation of a range of major commodities including iron ore, bauxite, alumina, primary aluminium, brown coal, black coal and LNG
- the ability to repatriate labour and capital income
- a detailed emissions accounting abatement framework
- explicit representation of the states and territories of Australia
- the capacity to explicitly represent multiple regions within states and territories of Australia

Nominally the *Tasman Global* database divides the world economy into 141 regions (133 international regions plus the 8 states and territories of Australia) although in reality the regions are frequently disaggregated further. ACIL Allen regularly models Australian projects or policies at the regional level.

The *Tasman Global* database also contains a wealth of sectoral detail currently identifying up to 70 industries. The foundation of this information is the input-output tables that underpin the database. The input-output tables account for the distribution of industry production to satisfy industry and final demands. Industry demands, so-called intermediate usage, are the demands from each industry for inputs.

For example, electricity is an input into the production of communications. In other words, the communications industry uses electricity as an intermediate input. Final demands are those made by households, governments, investors and foreigners (export demand). These final demands, as the name suggests, represent the demand for finished goods and services. To continue the example, electricity is used by households – their consumption of electricity is a final demand.

Each sector in the economy is typically assumed to produce one commodity, although in *Tasman Global*, the electricity, transport and iron and steel sectors are modelled using a 'technology bundle' approach. With this approach, different known production methods are used to generate a homogeneous output for the 'technology bundle' industry. For example, electricity can be generated using brown coal, black coal, petroleum, base load gas, peak load gas, nuclear, hydro, geothermal, biomass, wind, solar or other renewable based technologies – each of which have their own cost structure.

The other key feature of the database is that the cost structure of each industry is also represented in detail. Each industry purchases intermediate inputs (from domestic and imported sources) primary factors (labour, capital, land and natural resources) as well as paying taxes or receiving subsidies.

B.1.3 Factors of Production

Capital, land, labour and natural resources are the four primary factors of production. The capital stock in each region (country or group of countries) accumulates through investment (less depreciation) in each period. Land is used only in agriculture industries and is fixed in each region. *Tasman Global* explicitly models natural resource inputs as a sector specific factor of production in resource based sectors (coal mining, oil and gas extraction, other mining, forestry and fishing).

B.1.4 Population Growth and Labour Supply

Population growth is an important determinant of economic growth through the supply of labour and the demand for final goods and services. Population growth for the 112 international regions and for the 8 states and territories of Australia represented in the *Tasman Global* database is projected using ACIL Allen's in-house demographic model. The demographic model projects how the population in each region grows and how age and gender composition changes over time and is an important tool for determining the changes in regional labour supply and total population over the projection period.

For each of the 120 regions in *Tasman Global*, the model projects the changes in age-specific birth, mortality and net migration rates by gender for 101 age cohorts (0-99 and 100+). The demographic model also projects changes in participation rates by gender by age for each region, and, when combined with the age and gender composition of the population, endogenously projects the future supply of labour in each region. Changes in life expectancy are a function of income per person as well as assumed technical progress on lowering mortality rates for a given income (for example,

reducing malaria-related mortality through better medicines, education, governance, etc.). Participation rates are a function of life expectancy as well as expected changes in higher education rates, fertility rates and changes in the workforce as a share of the total population.

Labour supply is derived from the combination of the projected regional population by age by gender and the projected regional participation rates by age by gender. Over the projection period labour supply in most developed economies is projected to grow slower than total population as a result of ageing population effects. For the Australian states and territories, the projected aggregate labour supply from ACIL Allen's demographics module is used as the base level potential workforce for the detailed Australian labour market module, which is described in the next section.

TABLE B.1 SECTORS IN THE *TASMAN GLOBAL* DATABASE

	Sector		Sector
1	Paddy rice	36	Paper products, publishing
2	Wheat	37	Diesel (incl. nonconventional diesel)
3	Cereal grains nec	38	Other petroleum, coal products
4	Vegetables, fruit, nuts	39	Chemical, rubber, plastic products
5	Oil seeds	40	Iron ore
6	Sugar cane, sugar beef	41	Bauxite
7	Plant-based fibres	42	Mineral products nec
8	Crops nec	43	Ferrous metals
9	Bovine cattle, sheep, goats, horses	44	Alumina
10	Animal products nec	45	Primary aluminium
11	Raw milk	46	Metals nec
12	Wool, silk worm cocoons	47	Metal products
13	Forestry	48	Motor vehicle and parts
14	Fishing	49	Transport equipment nec
15	Brown coal	50	Electronic equipment
16	Black coal	51	Machinery and equipment nec
17	Oil	52	Manufactures nec
18	Liquified natural gas (LNG)	53	Electricity generation
19	Other natural gas	54	Electricity transmission and distribution
20	Minerals nec	55	Gas manufacture, distribution
21	Bovine meat products	56	Water
22	Meat products nec	57	Construction
23	Vegetables oils and fats	58	Trade
24	Dairy products	59	Road transport
25	Processed rice	60	Rail and pipeline transport
26	Sugar	61	Water transport
27	Food products nec	62	Air transport
28	Wine	63	Transport nec
29	Beer	64	Communication
30	Spirits and RTDs	65	Financial services nec
31	Other beverages and tobacco products	66	Insurance
32	Textiles	67	Business services nec

	Sector		Sector
33	Wearing apparel	68	Recreational and other services
34	Leather products	69	Public Administration, Defence, Education, Health
35	Wood products	70	Dwellings

Note: nec = not elsewhere classified

SOURCE: ACIL ALLEN CONSULTING

B.1.5 The Australian Labour Market

Tasman Global has a detailed representation of the Australian labour market which has been designed to capture:

- different occupations
- changes to participation rates (or average hours worked) due to changes in real wages
- changes to unemployment rates due to changes in labour demand
- limited substitution between occupations by the firms demanding labour and by the individuals supplying labour
- limited labour mobility between states and regions within each state.

Tasman Global recognises 97 different occupations within Australia – although the exact number of occupations depends on the aggregation. The firms who hire labour are provided with some limited scope to change between these 97 labour types as the relative real wage between them changes. Similarly, the individuals supplying labour have a limited ability to change occupations in response to the changing relative real wage between occupations. Finally, as the real wage for a given occupation rises in one state relative to other states, workers are given some ability to respond by shifting their location. The model produces results at the 97 3-digit ANZSCO (Australian New Zealand Standard Classification of Occupations) level.

The labour market structure of *Tasman Global* is thus designed to capture the reality of labour markets in Australia, where supply and demand at the occupational level do adjust, but within limits.

Labour supply in *Tasman Global* is presented as a three stage process:

- labour makes itself available to the workforce based on movements in the real wage and the unemployment rate;
- labour chooses between occupations in a state based on relative real wages within the state; and
- labour of a given occupation chooses in which state to locate based on movements in the relative real wage for that occupation between states.

By default, *Tasman Global*, like all CGE models, assumes that markets clear. Therefore, overall, supply and demand for different occupations will equate (as is the case in other markets in the model).

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