OECD Rural Studies

Mining Regions and Cities
Case of the Pilbara, Australia

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Foreword

This study offers guidance on how the region of the Pilbara, Western Australia, can shape a more inclusive and sustainable development model that supports economic diversification and prioritises improving the living conditions of its communities, particularly of First Nations peoples.

The demand for metals and minerals is rapidly evolving due to the profound digital and environmental transformations of our economies and societies. Amidst the escalating demand for minerals, governments, investors and society have increased their focus on ensuring a reliable supply of minerals while improving the environmental and social effects of mineral production. For example, most OECD countries have set national strategies to ensure a reliable and environmentally sustainable minerals supply.

The green and digital transitions in mining will bring opportunities and challenges for regional and local development. Greater use of renewable energy to power mining operations or circular economy practices in mining can open new business opportunities in local economies and reduce environmental impacts. However, without the right policy framework, local communities and businesses might miss out on the benefits of these developments and, instead, be left with their adverse effects.

Against this backdrop, this study highlights that the Pilbara, a top global supplier of iron ore, can leverage the green transition to diversify its economy and improve the well-being conditions of its communities, particularly for First Nations peoples and thus lead in the shift towards more sustainable mining.

To this end, the Pilbara must address important challenges impacting quality of life and stifle growth potential and responsible mining investment in the region. These include addressing low economic diversification, high socio-economic disparities between First Nations and non-First Nations populations, shortage of affordable housing and difficulties in recruiting labour to deliver essential services.

This study identifies 16 recommendations across 4 thematic pillars to help the Pilbara adopt a new development model with a long-term vision that ensures greater participation of First Nations in the region's development and more effective co-ordination among state and federal ministries and private companies to address the main priorities of its communities.

This is the 4th study of the OECD Mining Regions and Cities Initiative, which supports countries and regions in implementing better regional development policies in a mining and extractive context. Previous studies in this series include Outokumpu and North Karelia (Finland), Norrbotten and Västerbotten (Sweden) and Andalusia (Spain). This report benefitted from input from many stakeholders in the Pilbara during the 4th OECD Mining Regions and Cities Conference in Karratha, Australia, in June 2023. It was approved by the OECD Working Party on Rural Policy (WPRUR) [CFE/RDPC(2023)13] via written procedure in August 2023.

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The OECD team responsible for the report includes Andres Sanabria, project co-ordinator, working under the guidance of Jose Enrique Garcilazo, Head of the Regional and Rural Policy Unit in the Regional Development and Multi-level Governance Division, led by Dorothée Allain-Dupré. The report was drafted by Fernando Riaza and Jenny Vyas (Chapter 2), Andres Sanabria (Chapters 3 and 4) and Russell Barnett (Australian Venture Consultants) (Chapter 4). The review has benefitted from comments from other OECD colleagues, including Bridget Donovan, Lisanne Raderschall and Isidora Zapata (CFE). Evangelina Thanasi co-ordinated the organisation of meetings and missions, and Pilar Phillip led the publication process. The report was copy-edited and formatted by Eleonore Morena. Special thanks are due to Alicia Dubois (Royal British Columbia Museum and Canadian Council for Aboriginal Business) for her invaluable input and advice as an external peer reviewer and for her commitment to exchanging good practices with First Nations in the region. The OECD also extends its gratitude and respect to all First Nations representatives from Eastern Guruma, Kariyara, Ngarluma and Nyiyaparli communities who offered us their time and visions.

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Abbreviations and acronyms

ACCHS	Aboriginal Community Controlled Health Services
CSR	Corporate social responsibility
DAMA	Designated Area Migration Agreement
DMIRS	Department of Mines, Industry Regulation and Safety of Western Australia
DPIRD	Department of Primary Industries and Regional Development of Western Australia
ESG	Environmental, social and corporate governance
FIFO	Fly-in fly-out
GDP	Gross domestic product
GHG	Greenhouse gas
GRP	Gross regional product
GSWA	Geological Survey of Western Australia
GVA	Gross value added
ILUA	Indigenous Land Use Agreement
IT	Information technology
LGA	Local government area
LNG	Liquefied natural gas
METS	Mining equipment, technology and services
NATSISS	National Aboriginal and Torres Strait Islander Social Survey
PDC	Pilbara Development Commission
R&D	Research and development
RDA	Regional development agency
RFDS	Royal Flying Doctor Service
SIA	Strategic industrial area
SMEs	Small and medium-sized enterprises
TL2	Territorial Level 2 – Large regions
TL3	Territorial Level 3 – Small regions
VET	Vocational education and training
WA	Western Australia
WACHS	Western Australian Country Health Service

Executive summary

This study analyses the primary bottlenecks and opportunities for development in the region of the Pilbara, Western Australia, within the context of its high specialisation in mining activities. It provides recommendations to attain a more inclusive and sustainable development model that supports economic diversification and improves the living conditions of its communities, with a particular focus on First Nations.

Assessment

The Pilbara is one of nine regions located in the state of Western Australia. It is known for its thriving mining and resource extraction industries. The region is large and has a low population density. Its geographical size is equivalent to Spain but 780 times less populated, which places it among the 5% least densely-populated regions in the OECD. While the Pilbara's industrialisation is relatively recent, dating back to the 1960s when towns were established to accommodate the mining workforce, First Nations peoples (Indigenous or Aboriginal) have inhabited the region for approximately 50 000 years. For many, the Pilbara is a difficult place to live, given its harsh climate and distance to major cities but, for First Nations peoples, it is the place where its ancestral, kinship, community, cultural and spiritual ties remain.

The Pilbara's mining sector is a top supplier of iron ore in the world, particularly to the Asian market, and has fuelled the economic growth of the state and country. The mining sector contributes to the bulk of the Pilbara's regional output (86.9%) and has also supported community and exported-oriented infrastructure (e.g. Australia's largest port by tonnage). The Pilbara accounts for 19.2% of Western Australia's gross domestic product (GDP) and 3.4% of Australia's GDP, ranking the region 5th in terms of GDP per capita, with the 7th lowest unemployment rate among 50 OECD mining regions (see the next chapter for an explanation of this benchmark). Beyond mining, the region benefits from a strategic geographic location to Asian markets, a rich cultural heritage, home to 30 First Nations, renewable energy potential and the presence of a unique landscape and natural amenities.

Despite these assets and wealth, the Pilbara faces important challenges to improve its attractiveness and well-being standards, especially for First Nations and non-mining workers. Harsh climate, remoteness from metropolitan areas and low population density act as disincentives for more diversified businesses and workers and their families to establish or remain in the region. Furthermore, the high dependence on extractive activities, particularly on iron ore, increases its vulnerability to economic volatility and makes it reliant on fly-in fly-out (FIFO) workers. Combined with an uncertain long-term vision of the mining legacy in the region, these factors have fuelled a number of well-being challenges, including the highest cost of living in the state, acute socio-economic disparities with First Nations populations and shortage of affordable housing, which compound already difficult circumstances in recruiting workers for service provision such as childcare. Furthermore, greenhouse gas emissions of the region are twice as high as the average of 50 OECD mining regions.

These challenges also stifle current and future growth opportunities in the Pilbara and can impede the region from becoming a global leader in the green energy transition. Well-being challenges, especially in First Nations communities, can impact investment attractiveness, including through social licence for future projects in energy and mining, as social movements and international investment strategies increasingly focus on the impact of mining on the environment and people.

Against this backdrop, the green transition presents the Pilbara with an opportunity to diversify its economy and improve the well-being conditions of its communities, particularly for First Nations, while becoming a strategic player in the global shift towards more sustainable mining. To achieve this, the region needs to adopt an inclusive and long-term development strategy that ensures the participation of First Nations and local governments in regional policy making, with better co-ordination amongst different levels of government, local initiatives and private companies' social and environmental programmes to address the main priorities of its communities and First Nations.

To support the region in attaining a more inclusive and sustainable development model, this study identifies 16 recommendations across 4 pillars: i) enhancing the development opportunities of First Nations, through First Nations co-designed reforms ; ii) improving access and provision of housing and services; iii) diversifying the economy inside and outside the mining sector with a focus on green activities; and iv) establishing a coherent place-based strategy with a long-term vision for development.

Key recommendations

	Recommendations
I.	**Enhancing the development opportunities of First Nations, through First Nations co-designed reforms**
1.	**Organise a Pilbara First Nations Self-determination Summit** to unite the region's First Nations, local governments, industry and the broader community to address truth telling, First Nations' greater involvement in regional policy and to examine the alternative deployment of trust funds
2.	**Tailor education services to First Nations' needs and establish a Pilbara First Nations Capacity Building Program** by tailoring curricula and attracting organisations focused on First Nations education and capacity-building programmes
3	**Standardise First Nations procurement across industries and government** by clarifying industry's First Nations procurement criteria, processes and procedures
4.	**Establish a Pilbara First Nations Chamber of Commerce** to promote First Nations' business initiatives and access to capital
II.	**Improving access and provision of housing and services in the Pilbara**
5	**Attract and retain professionals to improve local service provision** by evaluating the implementation of a living cost incentive and by increasing the use of institutional mechanisms to attract and integrate migrant workers
6	**Improve the housing market** by creating a dedicated space to reach common solutions among various stakeholders and setting a formal state strategy to promote collaboration among levels of government and mining companies to improve the housing market
7	**Establish a task force to strengthen access to quality education and training in the region** that carries out a future skill mapping for mining and for potential new industries in the region and links training programmes of mining companies to government programmes
8	**Better integrate fly-in fly-out (FIFO) workers to increase social cohesion and strengthen local communities** by improving co-ordination of industry needs for FIFO camps with governments' plans and by incentivising FIFO participation in the local economy
III.	**Diversifying the economy inside and outside the mining sector with a greater focus on green-related activities**
9	**Facilitate projects on critical minerals** co-developed with industry, various levels of government and First Nations by promoting value-added initiatives and greater local linkages with improved information on government support for downstream projects
10	**Promote renewable energy projects with the participation of First Nations communities and local businesses** by monitoring emissions reduction of mining companies, identifying schemes that allow co-ownership and promoting infrastructure for common use
11	**Accelerate circular economy practices around and in the mining value chain** by establishing a multi-stakeholder platform to explore opportunities around circularity and developing regulations and public-private agreements to incentivise circular practices
12	**Promote more sustainable mining with greater transparency on environmental impacts** by supporting environmental monitoring led by First Nations and universities and improving accessibility to public information reported by companies

	Recommendations
13	**Increase the support to local entrepreneurs, small -and medium-sized enterprises and social enterprises** by establishing a formal mechanism to connect them with government programmes and mining and financing companies, co-adapting existing entrepreneurship programmes with First Nations, promoting entrepreneurship across mining workers and easing not-for-profit organisations' access to long-term funding
IV.	**Establishing a coherent place-based strategy with a long-term vision for development**
14	**Create a coherent long-term vision for the Pilbara's development, with a communication plan** to clarify the priorities for development
15.	**Adopt a long-term place-based development strategy** for the Pilbara with a proactive approach to prioritise policy actions based on the participation of local governments and First Nations in policy making and greater use of foresight analysis
16	**Establish a formal co-ordination mechanism to implement and monitor the Pilbara's development policies** by involving state departments and regional stakeholders and improving local government areas' capacity and better linking government plans with corporate social responsibility strategies

1 Assessment and recommendations

Assessment

The Pilbara's industrialisation is relatively recent, with First Nations people comprising most of the region's history

The Pilbara is a vast region located in the northwest Western Australia that covers around 20% of the state of Western Australia, equivalent to Spain's total land mass. With a residential population of around 58 000 people, the Pilbara is one of the least densely populated regions of the OECD and the world. The Pilbara's population density (0.17 people per square kilometre) is even lower than the Northern Territory in Australia and in line with regions such as the Yukon, Canada, or Greenland, Denmark.

The Pilbara's industrialisation dates back to the 1960s, when towns were established to accommodate the mining workforce, while First Nations people[1] have inhabited the region for approximately 50 000 years (Webb, 2003[1]). The Pilbara is located on the traditional lands of approximately 25 First Nations language groups who have continuously practised their culture in the Pilbara region (Wangka Maya Pilbara Aboriginal Language Centre, 2020[2]). According to data from the 2021 Census, in the Pilbara, individuals identifying as Aboriginal and/or Torres Strait Islander constitute 12.9% of the population. East Pilbara has a notably higher proportion at 17.9%, compared to West Pilbara's 11.4%. These figures are above the 3.2% observed in Western Australia as a whole and the 2.9% nationwide in Australia[2] (Australian Bureau of Statistics, 2021[3]).

Over the course of the 1950s and 1960s, the discovery of vast deposits of iron ore across the region and the repeal of a World War II export ban on iron ore by the Australian Government set the foundation for the industrial transformation and led the construction of the first towns (including the current four main cities in the region). While two of the ten towns initially built were eventually closed, others evolved from closed mining camps to open settlements. The industrialisation and the infrastructure development of this region was driven by extractive companies, which built roads, rail trains and utility infrastructure as part of agreements with the state of Western Australia (State Agreements).

The Pilbara's mining and energy sector is an economic engine for the state and country

The Pilbara is a leading global mining and energy producer, accounting for a major share of the global mining value production of iron ore and is home to important endowments of offshore petroleum (primarily natural gas), lithium, gold, copper, and nickel. These mineral assets have fuelled economic growth in the region (86.9% of total output in 2020 and 53% of the employed workforce) (REMPLAN, 2023[4]). The Pilbara's mining resources are nationally and globally relevant:

- **Iron ore**: 93% of Australia's iron ore and 28% of global production are sourced from the Pilbara.
- **Lithium**: The Pilbara hosts the fourth-biggest lithium mine in the world and the second- and third-largest lithium-producing mines in Australia.

- **Gold**: The Pilbara is home to Western Australia's third-largest gold-producing mine (Telfer).
- **Petroleum**: 85% of Australia's crude oil and 70% of Australia's liquefied natural gas are sourced from the Pilbara.

Mining activities have not only driven the bulk of growth in the region but have also made significant contributions to the development of both the state and the country. The Pilbara accounts for 19.2% of Western Australia's gross domestic product (GDP) and 3.4% of that of the whole country – approximately 15 times higher than its share of the national population (0.2%) (REMPLAN, 2023[4]). During 2012-20, the Pilbara's economic growth rate (4%) was almost double that of the national average (2.2%) and was significantly higher than the OECD mining benchmark (3.0%)[3]. Mining activities have also created around 30 000 direct jobs (52% of the total in the region) over the same period. Other key economic figures in the Pilbara include:

- Major exporter in the state accounting for 31.5% of total exports in Western Australia and 11.5% in the country in 2022.
- A major provider of fiscal revenue for the state, generating 91% of royalties received by Western Australia (2021-22) and around one-quarter of the state's total fiscal revenue (WA Government, 2022[5]).
- One of the lowest unemployment rates in the country and OECD mining regions, at 1.8% (December 2022), one-third the average of OECD regions (4.9%) (OECD.stat, 2022[6]).

The security of employment and high-income opportunities have also attracted people to the region. The average population growth has been 1% over the last 10 years, higher than Western Australia's average. In fact, in the 2016 census, nearly half the population had been living elsewhere in Australia five years prior.

The region has the potential to become a global leader in the green transition

The Pilbara region is witnessing an expansion in projects fuelled by green energy initiatives. Lithium, rare earths and green energy are offering extensive opportunities, while iron ore continues to be a foundational element of the region's economy. In fact, the value of projected investments in 2022 from mining and energy projects over the next decade is equivalent to twice the value of regional GDP in 2021. Most of these investments respond to the sector's need to adapt to the surge in global demand for minerals and the shift towards more environmentally conscious and digital mining practices.

The Pilbara has a number of assets that it can leverage to become a global leader in the green energy transition (Table 1.1). They include its competitive mining ecosystem, robust export infrastructure, proximity to Asian markets and renewable energy potential (solar, wind and hydrogen) to decarbonise mining operations and export low-emissions raw materials (green iron ore or green ammonia). The Pilbara has a strategic opportunity to reinforce its position as a key partner in supporting Asia's efforts to reduce the overall carbon footprint of its production through a more environmentally sustainable supply of iron ore and critical minerals and a potential capacity to export green hydrogen.

Table 1.1. Main assets for the sustainable development in the Pilbara

	Assets	Description
Economy	Internationally competitive mining business ecosystem	• 94% of Australia's iron ore exports and around 60% of natural gas production.
	Attractive geology with critical minerals	• 90% of Australia's total iron ore production. • Deposits of lithium, gold, copper, nickel and offshore petroleum.
	Strategic location in Asia with an export-oriented infrastructure	• The Pilbara's proximity to Asia. • Australia's largest port by tonnage (Port Hedland).

	Assets	Description
	Renewable energy potential	• Vast open landscapes and consistent sunlight for large-scale solar power generation and strong winds for wind power generation.
Social	Multi-culturalism with a diversity of First Nations people	• First Nations people represent 14% of the total population.
	Young population	• With a median age of 33 years (40 years for the OECD average). • Population growth (0.7% annually during 2010-20), higher than OECD mining regions.
	Safety and recreational infrastructure	• A rich natural environment fosters an outdoor lifestyle and access to extensive recreational infrastructure with high safety standards.
Environment	Natural parks and environmental amenities	• Rich and unique landscape, characterised by deep gorges, high canyons, waterfalls and serene waterholes. • Four National Parks, including the Karijini National Park, a top tourism spot in the state.

In order to succeed, the Pilbara will also need to ensure better social outcomes, in addition to better environmental results, as these factors are increasingly important to both society and investors. To achieve this, greater participation of First Nations people in mining and energy initiatives, stronger commitments to preserve the environment and cultural heritage and to support thriving local communities must be at the core of policies. At the same time, the Pilbara should also look to diversify its economy by fostering entrepreneurship both within and outside of mining value chains, including tourism and leveraging First Nations know-how.

Despite its mining wealth, the Pilbara faces well-being challenges that especially affect First Nations people and non-mining workers and stifle growth opportunities

The Pilbara's topology and remoteness to markets make it difficult to attract permanent residents. While the Pilbara region can offer a good lifestyle with a unique and spectacular natural environment and community lifestyle, harsh climate (prone to cyclones and high temperatures), remoteness from metropolitan areas and low population density act as disincentives for businesses and people to establish or remain in the region. The main population centre of the Pilbara, Karratha, is approximately 1 530 kilometres by road from Perth or a 2-hour flight and does not have any direct commercial flights from other Australian or international capital cities.

These factors are further complicated by a development model highly reliant on extractive activities (especially iron ore), which increases the vulnerability to economic volatility and the reliance on fly-in, fly-out (FIFO) workers. The volatility of the Pilbara's economic growth (40%, measured as the average coefficient of deviation of GDP growth between 2008 and 2020) is 4 times the national average (10%). The region is one of the least diversified among 50 OECD mining regions. There are significantly fewer companies per capita in the Pilbara, with only 34 firms per 1 000 inhabitants, compared to the 82 per 1 000 seen in OECD mining regions. Furthermore, out of the 73 mining businesses operating in the Pilbara, only 31 are registered there and 24 of them report having no employees. Many companies in the Pilbara heavily rely on FIFO workers rather than establishing a more permanent, locally based workforce.

In this context, the Pilbara's development model, heavily reliant on the mining sector, has fuelled a number of well-being challenges (Table 1.2)., including the highest cost of living in the state, acute socio-economic disparities between First Nations and non-First Nations populations and shortage of affordable housing, which in turn make it difficult to attract and retain workers for service provision such as childcare. In addition, greenhouse gas (GHG) emissions of the region are double the average value of 50 OECD mining regions.

Table 1.2. Main well-being challenges in the Pilbara

	Challenge	Description
Economy	The least diversified region across the sample of the 50 OECD regions specialised in mining, which reduces economic resilience	• High reliance on a single product, iron ore, limited trade partners, and about 3 times fewer firms (34 per 1 000 inhabitants) than the average of the 50 OECD mining benchmark (82). • Four times higher economic volatility (coefficient of deviation of GDP growth of 40%) than the national average (10%).
	Lower share of women in the workforce	• The lowest share of women in the workforce (30 women for 100 men) amongst OECD mining regions (96 women for 100 men).
	Highest living costs in the state and Australia	• The regional price in the Pilbara is 15% higher than in Perth.
Social	FIFO working model linked to an industry strategy to access a large workforce	• Approximately half of the people working in the region can be identified as FIFO. • Growth of FIFO workforce (20.17% annual average increase since 2020).
	Shortage of affordable housing	• Residential vacancies in 2021 were below 1%.
	Lack of quality childcare, specialised health and education, mainly due to workforce availability	• Share of adults needing medical treatment for injuries and preventable hospitalisations (24%) exceeds the state average. • School completion rates in the Pilbara (42% in 2016) remain below the Western Australian average (over 50%). • One of the highest deficits of childcare spots in Australia. In East Pilbara there is only one childcare spot for every nine children – a deficit almost three times higher than the Australian average (Hurley, Matthews and Pennicuik, 2022[7])
	High inequality levels between First Nations and non-First Nations people	• Among First Nations people, a significant proportion (60%) face long-term health problems, compared to only 26% among non-First Nations people. Despite high incomes from the mining industry in both Western Australia and the Pilbara, these health disparities are only slightly below the Australian state average (65%) and remain above 3 states, including the Northern Territory (52%) • Unemployment rates have soared to as high as 60% in recent decades among First Nations workers. Moreover, those who were employed typically held positions in lower occupational classes and earned an average of AUD 250 less per week than their non-First Nations counterparts.
Environment	Harsh climate	• Hot and dry climate, with tropical cyclones. In summer, average daily temperatures exceed 30 degrees Celsius (°C) with average daily maxima exceeding 35°C.
	Higher GHG emissions than the average of the OECD mining benchmark	• GHG emissions in the Western Australia Outback, including the Pilbara, are between 2 and 10 times higher than the OECD mining regions and OECD regional average respectively.

Well-being challenges underline permanent population turnover in the region

Challenges such as high cost of living, a volatile housing market and limited options for secondary or higher-level education represent significant deterrents to longer-term residency. Despite population growth, the Pilbara faces an important turnover in its permanent population. Many work in the Pilbara temporarily due to favourable financial conditions but eventually move to areas with more amenities, including better education options or leave during economic downturns (REMPLAN, 2023[4]). Between 2001 and 2016, 68.5% of the Pilbara's permanent population changed, meaning that over two-thirds of its residents either moved to or left the region during this period.

An important exception relates to the First Nations people of the Pilbara region, whose ancestors have lived in the region and managed its lands for millennia. For these people, their ancestral and contemporary ties to kinship and community, as well as their spiritual and cultural connections to the lands, waters and Sea Country of the Pilbara, render them a far more permanent, albeit on average, less prosperous component of the Pilbara residential population.

They also stifle future growth opportunities

These challenges also stifle current and future growth opportunities in the Pilbara and can impede the region from becoming a global leader in the green energy transition. The way mining is carried out and its effects on the environment and people is increasingly at the centre of social movements and international investment strategies. Thus, addressing these challenges will contribute to the region's well-being and help attract investment.

To mobilise the Pilbara's assets and address its challenges, this study identifies four priority pillars for the Pilbara's policy development:

- Enhancing well-being and development opportunities of First Nations people, through First Nations co-designed reforms.
- Improving access and provision of housing and services in the Pilbara.
- Diversifying the economy inside and outside mining with a greater focus on green-related activities.
- Establishing a coherent place-based strategy with a long-term vision for the Pilbara's development.

There are opportunities to enhance the well-being of First Nations people.

First Nations people face substantial socio-economic disadvantages compared to non-First Nations Australians. In line with the national trend, First Nations people in the Pilbara have the highest unemployment rate, lowest median income, greatest deficits in access to basic services, worst health outcomes and higher rates of non-completion of secondary school. Improving the well-being standards of First Nations communities in the Pilbara will have overall benefits for the region, including a stronger labour market and possibilities of new business opportunities beyond mining.

In line with the principles of self-determination and "nothing about us without us", any policy aimed at addressing historical well-being gaps of First Nations people requires providing clear opportunities for these communities to participate in the policy-making process. Improving the well-being of First Nations people in the Pilbara will require the empowerment of First Nations people to decide and manage resources from mining on their traditional lands and tailor education and entrepreneurship support:

- The self-determination of First Nations people to manage resources from mining on their traditional lands should be strengthened. First Nations groups and mining companies have entered into arrangements that allow mining companies to access native title lands for the operation of mines in exchange for royalty payments that are made into trusts for which Prescribe Body Corporates (PBC) manage on behalf of native title holders. These substantial and growing funds have the potential to be mobilised to facilitate the economic empowerment of First Nations people. However, the current royalties system follows "mainstream" and top-down practices, making it difficult for First Nations people to navigate the system and hindering self-determination as it controls how and when communities spend their royalties (O'Faircealligh, 2017[8])).Thus, the federal and state governments together with First Nations leaders should examine alternative systems to manage native title royalties to enhance the self-determination and encourage enterprise and job creation.
- Existing education models and capacity and training programmes need to be tailored to First Nations culture and development visions. New education models need to incorporate and align with traditional ways of transferring knowledge and skills to ensure First Nations youth have both the scholarly foundation and cultural connection to prosper as adults in the region.
- Entrepreneurship and business growth models can be tailored to First Nations people. Building economies of scale and knowledge exchange spaces across First Nations' business initiatives in the region and with other OECD First Nations groups will assist in sharing best practices, given the remoteness of communities across the region. Easing access to capital for First Nation businesses is also needed, as these communities find it difficult to access mainstream financial channels. Other

OECD mining regions have supported First Nations entrepreneurship with First Nations-led associations or First Nations-owned local financial institutions funded by multiple sources (e.g. Canadian Council for Aboriginal Business). Immediate business opportunities include land management and conservation or involvement in renewable energy and circular economy projects.

The Pilbara needs to improve access and provision of housing and public services.

Many people arrive in the Pilbara for employment opportunities rather than the lifestyle. Improving the attractiveness of the region requires better access to public services and more affordable housing.

Public service provision requires labour force availability

More than quality infrastructure, labour supply is the main constraint to improving the quality of public services in the region. For employees working in the non-resource sector, the high cost of living, lack of affordable housing and isolation from metropolitan areas represent major bottlenecks to attracting services sector workers. Even after adjusting wages to higher living standards, there is a shortage of workers, especially for childcare, secondary and tertiary education and specialised health. Some Pilbara towns have in turn relied on FIFO workers to cover some specialised services as an immediate and short-term solution (e.g. healthcare specialists). This, however, is a less sustainable option for long-term local development.

Other remote OECD regions face similar challenges to improve service delivery. Several OECD studies have identified policy responses to address them. These include fostering collaboration among different levels of government for long-term investments and strategic planning, promoting economies of scale in service provision (e.g. through school networks) and implementing targeted attraction policies for public service workers (e.g. offering career incentives to attract rural teachers) (OECD, 2021[9]; OECD.stat, 2022[6]).

Unlike many remote regions across the OECD, the Pilbara stands out, given its significant wealth contribution to the state. Some of these resources could be reallocated to offer grants or other public incentives to compensate service workers for the region's high living costs, particularly housing expenses. Beyond living costs, specificities of work in rural remote areas, such as small and multi-grade classroom teaching for teachers or feelings of isolation and long travel times, can also deter specialised service workers. To this end, non-financial incentives for service workers used in other OECD remote rural regions include more flexibility in roles for older staff, strong career and training incentives for newly qualified staff or greater use of part-time contracts (OECD.stat, 2022[6]).

The cost and supply of housing and accommodation are major deterrents to attracting people and businesses to the region

The Pilbara faces a shortage of affordable housing. Prices have risen by 25% over 2015-21, with residential vacancies below 1% (PDC, 2022[10]). Critical to both mining companies and communities, this has been a long-standing barrier to improving liveability and economic opportunities locally, contributing to inequality in the region and reducing incentives for people and businesses to move into the area. Although the causes are multifaceted, they are rooted in the Pilbara's high volatility, high construction costs and complex system of land tenure. These challenges are exacerbated by a reactive and siloed policy approach to dealing with housing issues (Table 1.3).

The nature of these challenges – managing a housing market in the midst of booms and busts – is also present in other remote OECD regions specialised in mining. Some of these OECD mining regions have created dedicated public funds to support affordable housing during bust periods (e.g. the local government of Thompson in Northern Manitoba, Canada) or created special task forces where different stakeholders join forces to develop strategic action plans and raise funds and awareness (Labrador West Housing and Homelessness Coalition of Labrador West, Canada).

Table 1.3. Summary of the main challenges in the housing market of the Pilbara

Challenge	Description
The volatility of the economy	The demand for housing has followed the boom-and-bust periods, with a high correlation of residential population and expansion phases in the Pilbara. This creates uncertainty for developers, financial institutions and individuals and thus volatility in the housing market.
Complex land tenure and reactive policy approach	Most land in the Pilbara that is zoned or suitable for zoning for residential development is held by the Western Australian government through Development WA (WA Government, 2022[5]). The region's economic volatility has led the state to adopt a conservative approach to residential land release and development, which combines with time-consuming and siloed approval processes.
High cost of construction	From a construction perspective, Western Australia is one of the most expensive states in Australia (Townsend & Turner, 2022[11]). In the case of the Pilbara region, this is further exacerbated by the fact that most residential developments are greenfield developments requiring the additional cost of significant infrastructure, which is challenging due to remoteness and limited local building services.
High property price and finance valuation	During periods of high housing demand, there is typically a significant differential between the market price of a residential property and the valuation that a bank will place on the property for the purposes of mortgage calculations. Insurance cost is also high due to cyclone rating.

Better integrate FIFO workforce to improve regional attractiveness

Although regional communities have consistently advocated for measures to permanently locate workers in the regions, the FIFO working model has played an essential role in attracting and retaining a skilled and professional workforce from a larger pool of options in remote areas of operation and providing a buffer for governments to develop local community infrastructure during expansions or construction periods (Haslam McKenzie, 2020[12]). Despite these benefits, relying on high flows of FIFO workers brings major drawbacks, including pressures on the local cost of living, increased local inequalities, lack of social cohesion and deterioration of the mental health of FIFO workers.

The use of FIFO in the region needs to be planned and co-ordinated across levels of government to avoid pressures on the housing market and services. Some initiatives to help mitigate the negative impacts of a FIFO workforce locally include standardising models on how an effective FIFO camp is designed and operates and encouraging, where possible, better integration of FIFO accommodation within the Pilbara towns to help attain economies of scale for local businesses. These decisions need to involve communities early on, to attain common agreements with local governments and industry.

A diversified economy through greater focus on sustainable activities to improve resilience

Economic diversification is essential to attain sustained and resilient growth in the Pilbara and reduce economic volatility. A strategy to advance economic diversification should be anchored on regional strengths, including its resource sector and co-developed with communities and First Nations people. The Pilbara needs to work with the region's First Nations people to co-create an inclusive economic ecosystem that continues to attract international investments and unlock new growth opportunities inside and outside the mining and energy sector.

Inside the mining and energy sector, the region has the potential to:

- Diversify its current mineral production by exploring ventures in critical minerals, leveraging its world-class mineral deposits with competitive deposits of at least four critical minerals (lithium, nickel, manganese and copper).

- Leverage renewable energy sources to accelerate the decarbonisation of the mining process, incentivise downstream activities and create new opportunities for First Nations. The Pilbara has large solar and wind resources and extensive areas of undeveloped land. Most of the main mining companies in the region have set investment plans to increase renewable energy sources for mining production, which can help decarbonise the energy matrix of the region and create new employment. Moreover, the creation of the Pilbara Hydrogen Hub to fast-track renewable (green) hydrogen production and exports can help build the know-how and value chain to produce and export green hydrogen at scale via green ammonia. Working together with First Nations people can empower them to own stakes in these projects and ease access to land.
- Create new businesses and attract new investments with circular mining practices. For example, mining waste in some operations can often reach well over double the amount of extracted ore, e.g. for each tonne of iron ore extracted, between 2 to 12 tonnes of overburden might be removed (Kinnunen and Kaksonen, 2019[13]; Mohanty et al., 2010[14]). However, creating a system that harnesses the benefits of the circular economy in mining requires facilitating partnership opportunities with small and medium-sized enterprises (SMEs) and research centres to put in place an appropriate value chain and technological development.

Outside the mining and energy sector, the region is well positioned to work with First Nations people and interested stakeholders to unlock: i) cultural and traditionally based business opportunities; ii) ecotourism and/or adventure-based businesses due to its environmental amenities; and iii) manufacturing, logistics and services that leverage the mining know-how and demand in the region. This requires actions to promote entrepreneurship in people already working in mining companies, such as in-company incubation, targeting entrepreneurship support programmes for women and First Nations people and improving infrastructure outside mining, particularly for tourism (e.g. accommodation and broadband).

The Pilbara can benefit from establishing a coherent place-based strategy with a long-term vision

The development of the Pilbara is mainly driven by the policies and strategies set by the Western Australia state. State departments are in charge of designing and implementing the main sectorial policies in the region, while local governments deliver a relatively narrow range of services, with all of their responsibilities defined by the state. Acting as a main link between state policies and local needs, the Pilbara's Regional Development Commission (PDC) helps identify the region's main development priorities and offers advice to regional businesses. The Pilbara has a range of development strategies that recognise the need to further diversify the economy and improve well-being.

Nevertheless, the region lacks a master plan or mechanism to co-ordinate actions across different state ministries for long-term strategies addressing pressing local priorities, such as housing affordability. Development plans are typically designed and delivered independently by each state department, following their respective sectorial scope, without common monitoring indicators to promote coherent implementation across departments. This lack of co-ordination is also evident at the local level, with little collaboration among strategic projects of local governments and with extractive companies' environmental, social and corporate governance goals.

Moreover, the Pilbara's policy-making process has been historically top-down driven, grounded in the region's industrialisation development that relied on direct agreements between the state and private companies to secure the investments needed to activate natural resources in the region. This approach has resulted in a lack of a systematic approach to identify and integrate local initiatives in regional development policies and limited subsidiarity in governance, which hampers the capacity to sustainably address well-being and economic diversification challenges.

Attaining a more diversified and inclusive development in the Pilbara requires a coherent, long-term vision that unites efforts of different levels of government and regional stakeholders towards specific strategies that

are tailored to the main well-being priorities in the region. A place-based policy can materialise this vision with a proactive approach to integrating regional actors in the policy-making process. This policy needs to be supported by a formal mechanism to co-ordinate different levels of government and regional stakeholders to monitor and implement strategic policies for the Pilbara's development by strengthening accountability and better linking corporate social responsibility (CSR) strategies of extractive companies with government plans.

Recommendations

	Recommendations [main responsible entity]	Actions
I.	**Enhancing development opportunities of First Nations people, through First Nations co-designed reforms**	
1.	**Support the organisation of a Pilbara First Nations Self-determination Summit** [State Government and First Nations leaders]	• Engaging with First Nation leaders to support the organisation of a Pilbara First Nations Self-determination Summit with the participation of companies and the broader community. Among others, this summit could help improve Truth Telling, First Nations visibility and involvement in regional decision-making and self-determination via alternative application of trust funds.
2.	**Tailor education services to First Nations' needs and establish a Pilbara First Nations Capacity Building Program**. [State Government and First Nations leaders]	• Adapt education provision to local First Nations children by tailoring curricula and attracting organisations focused on First Nations education (e.g. Studio Schools Australia). • Develop a coherent set of capacity-building programmes for First Nations people to improve training, financial literacy and joint venture partners.
3	**Standardise First Nations procurement across industries and government** [State Government, First Nations leaders and industry]	• Clarify industry's First Nations procurement criteria, processes and procedures with the goal of making opportunities as broadly accessible as possible.
4.	**Establish a Pilbara First Nations Chamber of Commerce with a programme to facilitate access to capital** [State Government, First Nations leaders and Industry]	• Promote First Nation financial grants, equity, lending or loan guarantee programmes to facilitate First Nation access to capital. Alberta, Canada's First Nations loan guarantee programme is a guide. • Support First Nations' business initiatives via links with public and private sponsorship. • Strengthen the Pilbara Indigenous Business Network Group with the capacity to serve as a broker for funding, connecting public or private funds with Indigenous businesses.
II.	**Improving access and provision of housing and services in the Pilbara**	
5	**Attract and retain professionals to improve local service provision** [State Government, PDC, LGAs and Federal agencies in the region]	• Evaluate the implementation of a living cost incentive to attract employees working in public and non-tradable service sectors (e.g. childcare). Incentives can involve housing support or tax credits through shared actions among private companies and governments. • Attract migrant workers through greater use of the Pilbara Designated Area Migration Agreement complemented with training for key vocations in childcare, health and education.
6	**Improve the housing market** with collaboration among various stakeholders [State Government, PDC, and LGAs]	• Create a Pilbara Housing task force where various stakeholders seek to develop a housing strategy for the region and raise funds and awareness among different levels of government. It can be in the form of a summit or a tailored multi-stakeholder group. Labrador West Housing and Homeless Coalition in Canada could provide models of inspiration. • Set a formal housing strategy to promote collaboration among levels of government and mining companies to support construction works and free up homes for permanent living or land with preferential prices for construction. • Create a one-stop shop in the state to co-ordinate approval processes simultaneously, including land use and environmental permits. • Evaluate densification strategies and construction of multi-family or multipurpose buildings.
5	**Set a task force to strengthen access to quality education and training in the region** [State Government, First Nations leaders and industry]	• Carry out a future skill mapping for mining and for potential new industries in the region • Scale up company training programmes by involving a wider share of the population and complementing them with public programmes. • Incentivise collaboration between local industry and education institutions to

	Recommendations [main responsible entity]	Actions
		encourage local youth to pursue fulfilling and diverse careers in the region.
7	**Better integrate fly-in fly-out workers to increase social cohesion and strengthen local communities** [State Government, PDC and LGAs]	• Improve the co-ordination of industry needs for camps with local and state government plans. This involves aligning potential future camps' needs with land use and development plans. • Develop common standards with communities and industry that define how an effective FIFO camp is designed, operates and is decommissioned or reused. • Integrate FIFO worker accommodation within existing residential communities (where possible) and incentivise their participation in the local economy in consultation with communities.
III.	**Diversifying the economy inside and outside the mining sector with a greater focus on green-related activities**	
9	**Facilitate projects on critical minerals** co-developed with First Nations people and the industry. [State Government, LGAs First Nations leaders and industry]	• Improve co-ordination between the state and local strategies and Australia's Critical Minerals Strategy to ease conditions for companies interested in producing or processing critical minerals with high sustainable standards. For example, by facilitating access to suitable land and infrastructure. • Promote the Pilbara as a destination for downstream projects of critical minerals with improved information on the potential of the Pilbara's value chains to support these projects.
10	**Promote renewable energy projects with the participation of First Nations communities and local businesses** [State Government, First Nations leaders, industry and Local Government Authorities (LGAs)]	• Prioritise incentives for the deployment of renewable energies and hydrogen production in the Pilbara. It involves setting up a one-stop shop that co-ordinates state ministries' policies and regulators to expedite permits and collaboratively work with First Nations communities to ease access to land and the labour force. • Enabling First Nations equity ownership in renewable energy projects via federal or state public loans and debt guarantee programmes for greater access to finance and grants to enhance First Nations business capabilities. • Promote shared renewable energy infrastructure and facilities (e.g. energy transmission networks) to expand access to clean energy beyond mine sites, including towns and ports.
11	**Accelerate circular economy practices in the mining value chain** in co-operation with local businesses and First Nations [State Government, First Nation leaders, industry and LGAs]	• Establish a networking platform that gathers providers, mining companies, First Nations and academia to explore opportunities around circularity and define projects of common interest. • Evaluate the development of regulations and public-private agreements to incentivise circular practices in mining, accompanied by a public progress report on the adoption of circular practices in the region. • Improve the mapping and geological information on abandoned mines to enable opportunities in waste mining and the rehabilitation of mine sites.
12	**Promote a more sustainable mining with greater transparency on environmental impacts**. [State Government, First Nations leaders, industry and LGAs]	• Improve public reporting of greenhouse gas emissions in the Pilbara and work with extractive companies to better monitor emissions from energy production. • Encourage monitoring control of environmental impacts by First Nations communities and universities through the provision of environmental monitoring systems to citizens or the establishment of environmental citizen boards using public-private company funds. • Establish a public and easily accessible compendium of international standards or due diligence carried out by mining companies in the region.
13	**Increase the support to local entrepreneurs, SMEs and social enterprises (NGOs, First Nations corporations)**. [State Government, industry and LGAs]	• Co-create or co-adapt existing entrepreneurship programmes with First Nations people to advance First Nations entrepreneurs and foster strong partnerships with industry. • Establish a one-stop-shop mechanism to connect local businesses with government programmes, large firms, financing companies and research centres. • Support entrepreneurship programmes for people already working in mining companies (intrapreneurship) for employee-driven businesses. • Improve the capacity of not-for-profit organisations with long-term funding and advice, together with better connections with industry's social responsibility programmes and impact-driven investors outside the region.
IV.	**Establishing a coherent place-based strategy with a long-term vision for development**	
14	**Create a coherent long-term vision for the Pilbara's development** [State Government and PDC]	• Clarify the vision and the priorities for the development of the Pilbara's communities in the long term. It involves setting clear long-term goals in pressing well-being areas, including First Nations empowerment or housing provision. • Define the Pilbara's role in Australia and Asia's net zero transition, placing the region

	Recommendations [main responsible entity]	Actions
		as a benchmark in "responsible sourcing" of raw materials and clean energy.
15	**Adopt a place-based development strategy with improved participation of local governments and First Nations** people [State Government, First Nations leaders and LGAs]	• Adopt a proactive approach to integrate views of First Nations communities and local governments in the policy-making process and improve government accountability. This can involve using stakeholders or citizen platforms for decision-making. • Involve LGAs and local government structures in the modernisation of state agreements. This entails considering local visions in the amendments of state Agreements. • Conduct a foresight analysis to plan with regional stakeholders for different futures in the region, including strategies for a future without mining.
16	**Establish a formal co-ordination mechanism to implement and monitor development policies in the Pilbara** [State Government, PDC and LGAs]	• Establish a formal co-ordination mechanism to support the implementation and monitoring of strategic policies in the Pilbara across state departments. It can be a task force or decision council with strong political support and representation of regional stakeholders. The 4-Helix model in Eindhoven, the Netherlands or the governance structure of Antofagasta's mining strategy can be a guide. • Improve the linkage between the resource industry's CSR strategies in the region and state and local government plans. It involves mapping these private strategies and disseminate them for public awareness. and link them with public policies. • Enhance local government's capacity through technical guidance, promotion of synergies among local plans and information exchange It involves strengthening the links of PDC and LGAs' needs and actions. The role of the inter-municipal agency, Business Joensuu, in North Karelia, Finland, can provide valuable guidance.

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Notes

[1] Aboriginal and Torres Strait Islander (First Nations) people are the first peoples of Australia. They are not one group, but rather comprise hundreds of groups that have their own distinct set of languages, histories, and cultural traditions (Australian Institute of Health and Welfare, 2023[15]).

[2] The share of First Nations people within the total population has been calculated by combining 2021 Census data from East and West Pilbara (Australian Bureau of Statistics, 2021[3]). Based on the place of usual residence, this serves as the most updated and closest approximation to identify the number of First Nations individuals in the region.

[3] The OECD *Toolkit to Measure Well-Being in Mining Regions* (OECD, 2023[16]) identifies 50 OECD mining regions with a high specialisation in mining activity relative to their respective countries to better benchmark well-being trends relative to other OECD regions, as well as challenges and strengths.

2 Strengths and challenges for regional development in the Pilbara

The Pilbara region, located in the northwest of Australia, is characterised by remoteness, a high degree of specialisation in mining and other extractive activities and as being home to an important share of First Nations peoples. This chapter compares the performance of the Pilbara across a number of economic, social and environmental indicators with other similar OECD regions. This comparison provides a good basis for identifying strengths and bottlenecks in the region.

Assessment and policy takeaways

The Pilbara, located in the northwest of the state of Western Australia, is a large region known for its environmental amenities, a significant proportion of First Nations population with cultural, spiritual and kinship ties and its thriving mining and resource extraction industries, which have played an important role in the development of the Australian economy. The region's geographic size broadly corresponds to the size of Spain but with 780 times less population (a total of approximately 58 000 inhabitants in 2021). These features place the Pilbara as one of the lowest densely populated regions amongst the OECD, with 0.17 persons per square kilometre (km²) against an average of 30 for OECD rural regions. The cities of Karratha, Newman and Port Hedland are home to most of the residents and services in the region.

Despite its low population and density, the Pilbara is an economic powerhouse in the state of Western Australia and the country. The regional economic output represents 19.2% of Western Australia's and 3.4% of Australia's output; this is about 15 times higher than its population share (0.2% of the country). The regional output is driven by an extractive and export-oriented economy (86.9% of the total), contributing to 31.5% of Western Australia's exports. This makes the Pilbara one of the largest contributors to the state tax revenue, providing 91% of the royalties received by Western Australia. This economy's strong performance is coupled with an unemployment rate that is almost 3 times lower (1.8% in December 2022) than the average across the OECD (4.9%), mainly driven by strong mining labour demand.

However, the Pilbara's economic wealth mainly relies on a single economic activity, the mining and extractive industry, which is vulnerable to changes in international commodity prices. Thus, its regional economy is highly volatile, which is reflected in marked periods of boom and bust in gross domestic product (GDP) growth over the last two decades. Such volatility has nurtured a significant reliance on the fly-in fly-out (FIFO) workforce, which has exacerbated a number of well-being challenges locally, including access to affordable housing, quality education and childcare provision, and high shares of greenhouse gas (GHG) emissions derived from transportation and mining operations.

The analysis in this chapter compares economic, social, and environmental trends in the Pilbara to other Western Australian regions and the Australian average. To make meaningful comparisons, the chapter also identifies three groups of selected OECD regions with similar characteristics to the Pilbara to identify challenges and untapped opportunities in the region.

Main takeaways

Economy

- The Pilbara is of economic relevance both for the region and the country, representing 19.2% of Western Australia's gross state product and 3.4% of Australia's GDP in 2021.
- During 2012-20, the Pilbara's economy grew (4%), almost twice as fast as the national average (2.2%). This growth is driven primarily by mining activities, which have created about 30 000 direct jobs (52% of the total in the region) to this date. The Pilbara accounts for 94% of Australia's iron ore export (total valued at AUD 60.2 billion) and 60% of the country's natural gas production.
- The Pilbara is the region with the highest single contribution to Western Australia's exports (31.5%) and a high contributor to total regional exports generated in Australia (11.5%). The region's strong economic performance also exhibits a significantly lower unemployment rate (1.8% in December 2022) than compared to the OECD average (4.9%).

- Mining is the Pilbara Region's largest output output-generating sector, supporting an estimated annual output of AUD$ 88.055 billion and provides providing employment to approximately 31 500 people as of 2022. Its iron ore and liquefied natural gas industries are valued at over $70 billion, representing more than 70 per cent of mineral and energy production in Western Australia.
- However, the Pilbara's growth performance has experienced high levels of volatility (deviation coefficient of GDP growth of 40% between 2008 and 2020), 4 times above the national average (10%).
- Such volatility is explained by limited economic diversification in the region inside and outside mining activities. The mining exports rely on a few trade partners and one main product, iron ore, making the region vulnerable to fluctuations in global commodity prices. Furthermore, value-added manufacturing or service activities are marginal in the region. It places the Pilbara as the least diversified region across the sample of the 50 OECD regions specialised in mining (2 042 on the Herfindahl-Hirschman Index which corresponds to a low-diversified region).
- After the direct contribution of the mining sector, other sectors that generate wealth and jobs in the region that are also linked to mining include construction (AUD 3.2 million, 6.8% of the total and 6 569 jobs) and logistics (AUD 705 000, 1.5% and 2 872 jobs).
- Non-tradeable service businesses have experienced growth over the last decade, especially in the tourism sector, which already contributed AUD 249 million to the regional economy in 2021 (0.5% of the total). However, although there are other sectors that have the potential to involve local and Aboriginal communities, they currently represent a small share of the labour market. These sectors, such as arts and recreation, have lower productivity compared to mining and generate only 176 jobs.
- The Pilbara region has 73 mining companies operating in the region but only 31 are locally registered. However, most of the mining companies registered in the region employ fewer than four employees, indicating that most of the big companies are registered elsewhere, which means missed opportunities for fiscal income locally. Further, research and development (R&D) is concentrated in big companies, while the other 9 200 businesses are small and medium-sized enterprises (SMEs) with a lower capacity to innovate.

Social

- The Pilbara population has a median age of 33 years. It has grown an annual average of 0.7% between 2010 and 2020, higher than the OECD mining region benchmark (0.2%), similar to the OECD average and relatively lower than Australia (1.6%).
- There are a great number of young, mining-focused FIFO workers. Since 2011, FIFO has increased by around 400%[1] (from 3 261 to 13 384), much faster than the share of permanent residents. This FIFO working culture has allowed extractive companies access to a diverse pool of skilled workers from elsewhere but has brought a number of challenges for local well-being standards, particularly in the domains of affordable housing and service provision. Further, there is also a significant imbalance in the proportion of men to women in the workforce (60-40), with women playing a smaller economic role.
- A main challenge for permanent living in the Pilbara region is the shortage of affordable housing, with cost pressures similar to those in some densely populated metropolitan OECD regions. The challenges in the Pilbara's housing market are associated with the cyclical economic growth that leads to a volatile residential property market with high construction costs and a complex land tenure. This scarcity of affordable housing is accentuated by the FIFO working culture, with

extractive companies owning many of the houses in the region for the itinerant workforce, with only 16 000 people privately owning their homes.

- Health, education, and income inequality is relatively high in the Pilbara, particularly among First Nations peoples, who make up 14% of the total population and face considerable social and economic disadvantages. The life expectancy of First Nations people in the region is, on average, ten years shorter than non-First Nations people, partly due to a preventable hospitalisation rate that is more than five times higher than that of non-First Nations residents. These disparities suggest that First Nations people in the Pilbara may face challenges in accessing adequate healthcare and other essential services.

Environment

- The level of commuting is high in the region, which implies high GHG emissions from the transport sector. Approximately 30 000 workers commute between Perth and the Pilbara for 2-week shifts in the mines. This has a significant environmental impact due to the carbon footprint of their travels, which typically involve an average of two hours of air travel each way. This highlights the need for addressing the environmental consequences of such a carbon-intensive commuting system in the region.
- The Pilbara generates higher GHG emissions from electricity generation and from its mining value chain (power, industry, and transport sectors) than the benchmark of OECD mining regions. Therefore, developing renewable energy sources is a great opportunity to create new industries while reducing GHG emissions and supporting sustainable development.
- In recent years, efforts have been made to implement green mining initiatives in the Pilbara, including recycling rubber and other waste on site and electrification. The next chapter will discuss these initiatives.

Overall, the Pilbara region of Western Australia stands out with its economic performance, competitive mining sector and port infrastructure, playing a crucial role in the country's economy. However, the regional economy faces diversification challenges, with a slender internal economy in terms of SMEs, women's participation in the workforce and entrepreneurship. This is coupled with well-being challenges, including housing affordability, quality service provision and important inequalities with First Nations peoples in income and others dimensions of well-being. The Pilbara also faces environmental challenges, such as high GHG emissions.

In the upcoming chapters, the report will provide policy recommendations to leverage the region's strengths while addressing the bottlenecks and challenges. The aim of the report is to ensure that the Pilbara continues to thrive economically, socially, and environmentally while creating more diverse and sustainable opportunities for its residents.

Introduction

This chapter offers a comprehensive diagnosis of the Pilbara region in the state of Western Australia. The chapter compares the Pilbara's development against national trends and a benchmark of other OECD mining regions at Territorial Level 2 (TL2) and Territorial Level 3 (TL3) (see OECD Toolkit to measure well-being in mining regions (OECD, 2023[1])). Based on these comparisons, the analysis identifies major strengths and bottlenecks in the Pilbara's development and well-being. While mining is the main contributor to the region's gross regional product (GRP) and employment, this diagnosis reveals the relevance of leveraging the Pilbara's mining potential to create a prosperous and sustainable future.

The chapter first describes the mining sector in the Australian and Pilbara context. It then examines the demographic patterns in the region, followed by its main economic trends. The final section of the chapter examines the main factors for regional development, including the quality of life of its citizens.

The Pilbara region is a crucial component of the Australian economy, as it possesses an array of mineral and hydrocarbon resources, such as iron ore, natural gas, lithium, and gold. Nevertheless, the area's economic fortunes are tied solely to the mining and extractive industry, which is exposed to fluctuations in global commodity prices. This sector is also heavily reliant on FIFO workers, which has resulted in significant challenges concerning access to affordable housing, quality education and childcare, as well as high levels of GHG emissions from transportation.

The region also has opportunities emerging from these challenges, including the potential for infrastructure development and innovative solutions to address inequality. In this context, this chapter explores the key challenges and opportunities facing the Pilbara region and provides takeaways for sustainable development.

Megatrends affecting regions specialised in mining and extractive activities

The geographically concentrated nature of mining leads to a highly specialised economy, bringing with it challenges and opportunities to mining regions and the well-being of its inhabitants. Global megatrends, including demographic change, climate change and the transition to a low-carbon economy, as well as digitalisation and automation, are transforming industries and societies. These megatrends are also bringing new challenges and opportunities to the development of mining regions (Table 2.1).

Table 2.1. Opportunities and challenges of megatrends for mining industry and regions

	Opportunities	Challenges
Changes in demographic trends (population ageing and migration)	• Successful integration of migrants may enhance labour supply. • Lifelong learning can enable the old workforce to keep adding value.	• Ageing population/local demographic decline leads to a shortage of labour. • Unsuccessful migrant integration may lead to social problems. • Many migrants tend to reside only temporarily and eventually move south to larger cities.
Climate change and environmental pressures	• Competitive advantage from high environmental standards in mining. • New jobs from the development of environmentally friendly technologies.	• Pressures for the mining industry to improve its performance and reduce its environmental footprint. • Harder policies and regulations in issuing permits for future operations. • Higher public reticence to accept mining explorations and openings.

	Opportunities	Challenges
Technological innovation (e.g., digitalisation, automation, decentralised energy)	• Digitalisation/automation may compensate for shortages of labour in some sectors. • Can make mining regions more attractive to live in by providing quality public services, including remote healthcare solutions. • Creation of new jobs by involving regional actors in the development of new digital and automated solutions. • Offers greater labour opportunities for women and various segments of the population.	• Displaces certain workers in the mining sector, mainly the ones that perform more repetitive tasks. • If technological innovation is produced outside the region, it can affect the competitiveness of the region. • Can reduce the need for certain minerals by replacing them with laboratory products or extracting them from the recycling process.

The article discusses the challenges faced by mining environments in the Pilbara region, including demographic challenges and environmental concerns. However, the region's mining sector has the potential to address these challenges through workforce availability, gender balance, high retention capacity and the supply of minerals and materials needed for green technologies. Technological change and digitalisation can also increase productivity and sustainability in mining activities. The impact of these megatrends on mining municipalities in the Pilbara will depend on policy responses to address changes and prepare firms and communities for the future.

First Nations communities and mining coexisting in the Pilbara and shaping the region's future

The Pilbara is a vast area located in the northwest of the state of Western Australia. Home to First Nations communities for likely over 50 000 years (Webb, 2003[2]), it remains relatively unknown to many. However, its rich natural resources – particularly an abundance of iron ore – have attracted the attention of miners since the early 1960s. Covering 507 896 km² (around 20% of Western Australia or equivalent to Spain's total land mass), the Pilbara has a residential population of around 58 000 people. The Pilbara is one of the least densely populated regions of the OECD and the world (UN, 2021[3]; OECD, 2021[4]) and in the country (RAI, 2016[5]). In fact, the Pilbara has a population density of 0.17 people per km², even fewer than the Northern Territory of Australia (0.18), putting it in line with regions such as Greenland (Denmark) or the Yukon (Canada).

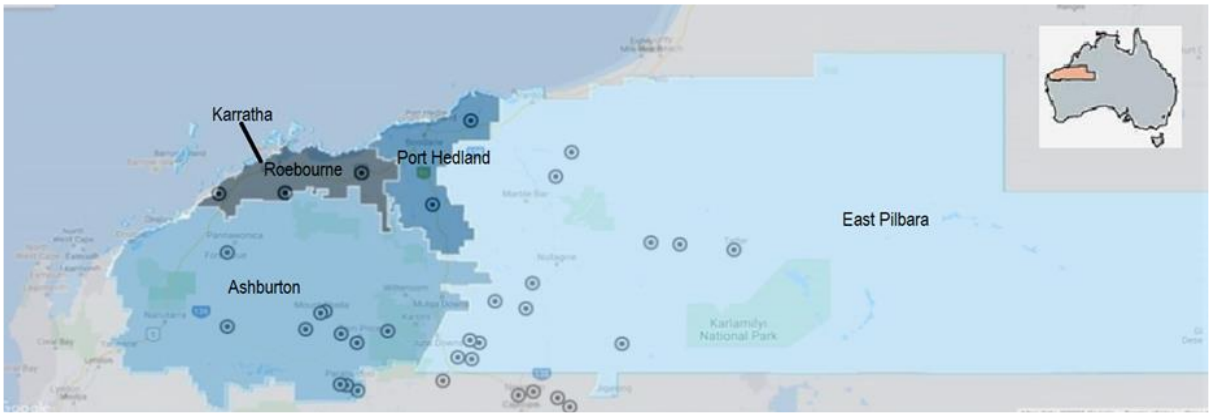
Australia is a federal country comprised of six federated states and two territories that are governed by delegation under the jurisdiction of the federal government. Each state has its own constitution, laws and a bicameral parliament with directly elected representatives (except for the state of Queensland, which only has one chamber). The state governance structure relies on a two-tier subnational government system: state and local governments, where the state government has the primary role in regional development. The Pilbara is one of the nine regions in the state of Western Australia and has four local government areas (LGAs): the Shire of Ashburton, the Shire of East Pilbara, the City of Karratha and the Town of Port Hedland, each of whom has a locally elected council and budgets for certain local decisions that are delegated by the Government of Western Australia under state legislation. The region also has the Pilbara Development Commission, the institution in charge of co-ordinating and promoting economic development and the vision and main priorities of the region in the medium and long terms. Overall, the development of the Pilbara is mainly guided by Western Australia state policies and strategies (see Chapter 3 for more information on the institutional framework).

Figure 2.1 maps these LGAs, with points showing the location of major mines across the region and the shades representing population shares. They highlight that the vast majority live in the western third of the region. Historically, iron ore companies, with the help of the state government, built new miner-focused settlements in Karratha, Pannawonica, Paraburdoo, Tom Price and Wickham for the population. The greatest onshore value of minerals and petroleum is produced in East Pilbara (50% of the total value of

minerals and petroleum in the Pilbara by 2021-22), followed closely by the Shire of Ashburton (47% of the total value in the Pilbara by 2021-22). This does not account for the offshore petroleum value, which occurs on the coast of Karratha and Port Hedland and represented 38% (AUD 51.76 billion) of the total onshore mineral and petroleum value during 2021-22 (WA Goverment, 2022[6]).

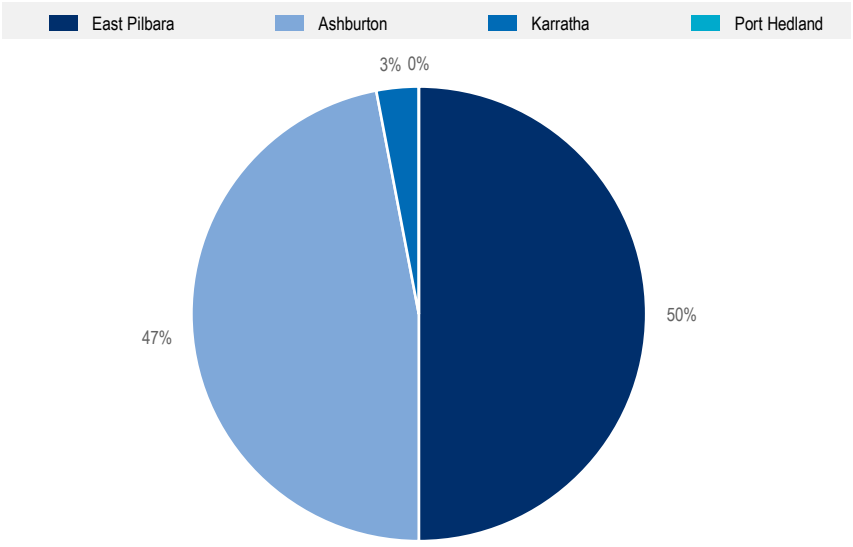
Figure 2.1. Settlement patterns and active mining

Population density and the location of active mines in the region of the Pilbara



Note: Population as of 2020: 13 331 in Ashburton, 10 921 in East Pilbara, 23 118 in Karratha and 15 471 in Port Hedland. Points represent active mines.
Source: ABS (2020[7]), *June 2020 Gross State Product*, http://www.australianminesatlas.gov.au/ (Accessed on 5 June 2022)

Figure 2.2. Onshore value of minerals and petroleum by local government area in the Pilbara, 2021-22



Source: WA Goverment (2022[6]), *Western Australia Mineral and Petroleum Statistics Digest for 2021-22*, http://www.dmp.wa.gov.au/Documents/About-Us-Careers/Stats_Digest_2021-22.pdf.

The Pilbara, a key mining hub that relies on a strong FIFO workforce culture

The Pilbara region of Western Australia is a significant mining region in the world, known for its vast reserves of iron ore (as well as other minerals such as gold, nickel and lithium) and its offshore production of natural gas and export of liquified natural gas (LNG). The region is home to some of the largest iron ore mines in the world and the iron ore industry is a major contributor to the Australian economy. According to data from the Western Australian government (WA Government, 2022[8]), in 2020, the Pilbara region produced 835 million tonnes of iron ore, which represented over 90% of Australia's total iron ore production and places the region as the largest iron ore supplier in the world. Western Australia accounts for 38% of global supply in 2021, followed by Brazil (17%) (WA Government, 2022[8]). The iron ore mining value in the Pilbara region that year was around AUD 150 billion, making it a key contributor to the Australian economy (approximately 2.3% of total GDP). Furthermore, the Pilbara region also has a high potential for rare earths and other minerals such as lithium, copper and cobalt. This, combined with the existing mining industry and infrastructure, makes the region an attractive destination for mining investment.

The Pilbara, a key mining hub, is characterised by a strong FIFO workforce culture. Approximately 30 000 workers commute between Perth and the Pilbara for 2-week shifts in the mines, playing a vital role in sustaining the region's thriving mining industry. This large FIFO workforce has become essential to the Pilbara's economic success and development, contributing to the significant production figures and global market share. While crucial to the region's mining operations, the FIFO culture presents unique challenges, such as the environmental impact of regular long-distance commuting (carbon emissions from air travel) and disruptions in local housing and labour markets, among others (see Chapter 4). The balance between the benefits of this workforce and the social and environmental considerations is an important aspect of understanding the region's long-term sustainability and success.

The region is home to numerous First Nations communities

Further detailed in Chapter 4, the Pilbara region of Australia has been home to several First Nations communities with a deep connection to the land and its resources. A total of 12.9% of Pilbara's population identifies as First Nations people[2], which includes individuals who identify as Aboriginal, Torres Strait Islander, or both. To break down these figures: 12.1% identify as Aboriginal, 0.4% as Torres Strait Islander, and an additional 0.4% as both Aboriginal and Torres Strait Islander (Table 2.2). Within the Pilbara region, East Pilbara has a notably higher proportion at 17.9%, compared to West Pilbara's 11.4%. The demographic profile of the Pilbara underscores its deep-rooted First Nations heritage, with a higher share of First Nations people than both the broader state average of Western Australia (3.2%) and the national average of Australia (2.9%).

Table 2.2. First Nations status in the Pilbara, Western Australia, and Australia, 2021

	Pilbara	% Pilbara	Western Australia	% Western Australia	Australia	% Australia
Aboriginal	4,770	**12.1%**	85,004	3.2%	742,882	2.9%
Torres Strait Islander	173	**0.4%**	1,625	0.1%	33,765	0.1%
Both Aboriginal and Torres Strait Islander	171	**0.4%**	2,068	0.1%	36,083	0.1%
Non-Indigenous	27,154	**69.0%**	2,431,204	91.4%	23,375,949	91.9%
Not stated	7,084	**18.0%**	140,128	5.3%	1,234,112	4.9%

Note: The data in the table, obtained by combining the 2021 Census data from East and West Pilbara and based on the place of usual residence, serves as the most updated and closest approximation to identify the number of First Nations individuals in the region. While the table reflects a total of 39,352 inhabitants, other sources suggest a population of 58,904 for the region (REMPLAN, 2022[9]).
Source: Data for East Pilbara (ABS, 2022[10]), and Data for West Pilbara (ABS, 2022[11]).

These communities have lived in the region for millennia and have a unique relationship with the environment and its resources. They have a wealth of knowledge and experience when it comes to managing the land and its resources sustainably, which is of great importance in the context of mining and resource extraction. First Nations communities also play a role in preserving the cultural heritage of the region. However, the situation of First Nations people is quite unequal to that of non-First Nations people as they rank lower on many well-being indicators (see final section on First Nations well-being).

The next Sections of the report compare the Pilbara to a variety of OECD regions. Box 2.1 explains what these regions are and how they were identified.

Box 2.1. International comparisons: OECD mining region benchmark

The OECD territorial grid classifications were designed to divide regions based on a range of characteristics, including population and degree of rurality (Fadic et al., 2019[12]). OECD defines two types of regions at different geographical levels and for which comparative data are collected. The first type of region is classified as Territorial Level 2 (TL2), which is the first administrative tier of subnational government (i.e. states in the United States, *estados* in Mexico or *régions* in France). Smaller regions are classified as Territorial Level 3 (TL3), smaller territorial units that make up each TL2 region.

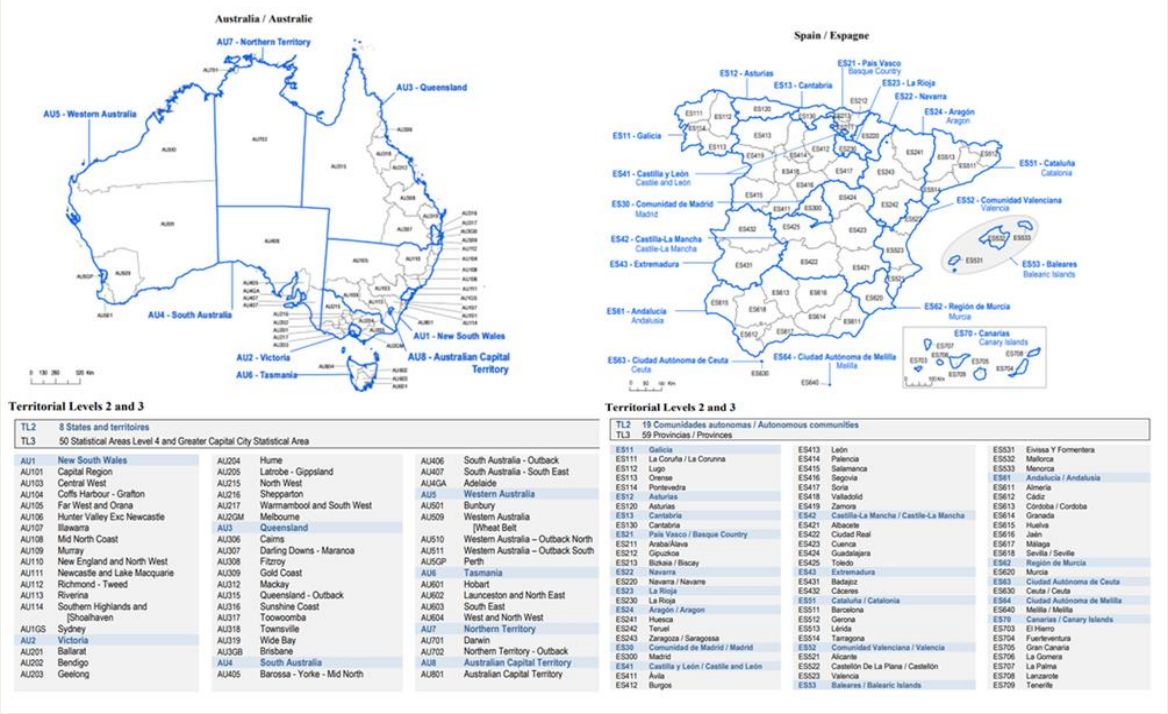
Whilst this is helpful guidance for comparison in many cases, the geographic extension and population density of the Pilbara calls for a particular approach to select the OECD regions for comparison. Given the OECD territorial classification, the Pilbara is still one territorial level below TL3 despite being almost its size. For example, relative to Spain, the Pilbara covers a geographic extension as large as the sum of all of the TL3 Spanish regions (Figure 2.3). The TL3 region under which the Pilbara falls is relatively large (referred to as the Western Australia Outback). Above this tier, there is the TL2 state of Western Australia. Many variables of interest do not have data available at TL3 level for a large number of countries, while most international comparable data are found at TL2 level.

To work around this issue, a proxy TL2 region was created, which contained the characteristics of the Pilbara (information gathered from data platform REMPLAN (REMPLAN, 2022[13])). This proxy TL2 was then compared to existing OECD TL2 regions to find regions that were economically similar and regions that were demographically similar. The two other Australian regions were excluded and comparisons to these were conducted using the REMPLAN database, not OECD statistics. However, for the OECD mining region benchmark, various TL3 data were combined to create a composite indicator, which was then compared against the Western Australia Outback.

1. Economically **TL2 comparable regions**: This group of regions was identified using a simple absolute measure of industrial specialisation, i.e., a region is considered economically specialised if a small number of industries exhibit high shares of the overall economic activity of the region. Industries are grouped into OECD classification of sections based on International Standard Industrial Classification of All Economic Activities (ISIC) rev 4 (UN, 2008[14]). Thus, the TL2 region is included in the grouping if the value-added in 1 section grouping is 40% or more of the total regional gross value added (GVA).[3] The selected regions can be found in Annex Table 2.A.1.
2. **Demographically comparable regions**: The second grouping is formed based on population density. The Pilbara is more sparsely populated than all of the OECD regions. Therefore, this grouping was formed by taking the top 100 most sparsely populated OECD TL2 regions (see Table 2.3 for shares by country). As with the previous benchmark, Australian regions were excluded because comparisons with them are made separately using Australian databases.

3. **OECD mining benchmark**: The OECD toolbox has developed a benchmark of 50 TL3 mining regions to identify main trends and well-being performance at the most granular level. It allows international comparisons across a number of OECD regions that stand out thanks to their high level of mining specialisation. This benchmark intends to create a geographically balanced reference of regions that are relevant to mining activities in their own countries. Annex 2.A presents the methodology used to build this benchmark and the OECD TL3 mining regions that are part of it.

Figure 2.3. Territorial Grids Australia and Spain, TL2 and TL3



Source: OECD (2021[15]), *OECD Territorial Grids August 2021*, https://stats.oecd.org/. (Accessed on 10 January 2023)

Table 2.3. The countries in which the 100 least densely populated regions fall

Number of TL2 regions by country used in the benchmark

Country	USA	CAN	NZL	COL	CHL	MEX	NOR	ESP	SWE	FIN	TUR	FRA	GRC	ISL	LVA	PRT	EST
Number of regions	22	13	12	11	10	7	6	4	4	3	2	1	1	1	1	1	1

Note: TL2 OECD regions when excluding Australian regions.
Source (table): OECD (2022[16]), *OECD Regional Statistics (database)*, https://doi.org/10.1787/region-data-en.
Source (box): Fadic, M. et al. (2019[12]), "Classifying small (TL3) regions based on metropolitan population, low density and remoteness", https://doi.org/10.1787/b902cc00-en; OECD (2023[1]), "Toolkit to measure well-being in mining regions", https://doi.org/10.1787/5a740fe0-en.

Mining as a great opportunity for sustainable regional development in the Pilbara

Over time, the Pilbara region in Western Australia has experienced a significant evolution in its mining landscape, with mining now playing an indispensable role in the region's economy (Box 2.2). Mining is the Pilbara region's largest output-generating sector, supporting an estimated annual output of AUD 88 055 billion and providing employment to approximately 31 500 people as of 2022 (REMPLAN, 2023[17]). These figures represent a significant portion of the region's economic activity and employment, highlighting the essential role mining plays in the region's development.

Box 2.2. A timeline of the mining development in the Pilbara

From the establishment of the Swan River Colony in 1829 up until the 1960s, the sparse, arid lands of the Pilbara region were of limited interest to settlers, released convicts and subsequent generations of non-First Nations Western Australians, with local industry limited to some pastoral, pearling, fishing, gold exploration and mining activity. The following timeline sets out key policy initiatives and iron ore and petroleum development that have driven the industrialisation of the Pilbara region (Table 2.4).

Table 2.4. Timeline of key policy initiatives and iron ore and petroleum development

Period	Policy initiatives	Iron ore developments	Petroleum developments
1950-62: Regulatory reform and first discoveries of iron ore	• Australian government reduces national restrictions on iron ore exports and the Western Australian government allows exploration permits	• Lang Hancock conducts an aerial survey of the Pilbara region and iron ore deposits identified at Mount Tom Price	
1963-69: First wave of iron ore state agreements, iron ore project construction and first iron ore production, as well as first offshore oil discovery	• Iron Ore (Hammersley Range) Agreement Act (1963) • Iron Ore (Robe River) Agreement Act (1964) • Iron Ore (Mount Newman) Agreement Act (1964) • Iron Ore (Mount Goldsworthy) Agreement Act (1964) • Second Hamersley Range Iron Ore State Agreement (1968)	• Construction commences in the town of Goldsworthy • Construction commences on Tom Price railway • Production commences at Mount Tom Price • First iron shipment from Dampier • Iron ore discovered at Mount Whaleback • Production commences at Mount Whaleback • Development of Karratha town site commences	• Western Australian Petroleum (WAPET) discovery
1970-72: Second wave of iron ore state agreements, iron ore infrastructure expansion and town site development	• Goldsworthy-Nimingarra Iron Ore State Agreement • McCarney's Monster Iron Ore State Agreement • Mount Bruce Iron Ore State Agreement • Rhodes Ridge Iron Ore State Agreement • Wittenoom Iron Ore State Agreement	• Causeway to East Intercourse Island constructed • Cape Lambert Port opening • Town sites of Newman, Pannawonica, Paraburdoo and Wickham gazetted	

1973-78: Further state infrastructure development	• Geraldton to Port Hedland section of Northwest Coastal Highway sealed • Meekatharra to Newman section of the Great Northern Highway upgraded		
1979-84: First offshore gas discovery, first gas state agreement and first offshore gas production	• Northwest Gas Development State Agreement (1979)		• WAPET Gorgon-1 well discovers gas • North Rankin: Gas platform commissioned
1985-94: Third wave of iron ore state agreements, significant new mine development	• Channar Iron Ore State Agreement (1987) • Newman-Port Hedland section of the Great Northern Highway upgraded • Marrillana Creek Iron Ore State Agreement (1991) • Hope Downs Iron Ore State Agreement (1992) • Yandicoogina Iron ore State Agreement (1992)	• Jimblebar mine commences production • Channar mine commences production • Brockman 2 mine commences production • Yarrie mine commences production • Marandoo mine commences production	
1995-2000: Second offshore gas platform commissioned			• Goodwyn: Platform commissioned
2001-05: Fourth wave of iron ore state agreements	• Mineralogy Iron Ore State Agreement (2002) • Chichester Iron Ore State Agreement (2002) • Barrow Island Gas State Agreement (2003) • Pilbara Infrastructure State Agreement (2004)	• Eastern Range mine commences production	
2005-10: Major new iron ore project commissioning		• Hope Downs mine commences production • Chichester mine commences production • Christmas Creek mine commences production • FMG railway commissioned • Brockman 4 mine commences production	
2011-15: New iron ore project commissioning and second LNG project		• Solomon Hub commences production • Jimblebar 2 mine commences production • Mount Webber mine commences production	• Pluto LNG commissioned

The mining industry in the Pilbara region is marked by its considerable concentration, evidenced by a small number of operational companies that employ a large workforce. As of June 2022, there are 31 enterprises officially registered as mining companies within the Pilbara. Among these 31 entities, 24 reported having no employees, while 7 reported employing less than 5 individuals (REMPLAN, 2023[17]).

Beyond the sphere of these locally registered companies, the region's mining industry is further supplemented by the operations of a larger number of companies. While not formally registered within the Pilbara, 73 such companies are actively engaged in mining operations within the region. Collectively, these companies employ over 31 500 workers, indicating their significant influence on the regional economy. This operational footprint underscores the pivotal role that these entities, although not locally registered, play in the region's mining sector (REMPLAN, 2023[18]).

Further, investment in the mining sector transcends mining-specific competencies, like extraction and processing, catalysing a transfer of skills to a myriad of sectors (e.g., IT, Consulting). For instance, the mining sector not only serves as a pivotal job creator but also emerges as a catalyst, spurring economic advancement and diversification across other industries. Research indicates that each job birthed directly within mining engenders an additional 1.5 jobs other sectors, effectively dispersing wealth and propelling multifaceted development at the grassroots level (Deloitte, 2016[19]) (Fleming and Measham, 2014[20]). The case of Antofagasta's mining industry exemplifies this dynamic, where its ripple effects potentially augment the national GDP by an impressive 20%, when considering its multiplier effects on various sectors (Cardemil Winkler, 2023[21]).

The structure of the Pilbara region's economy is underscored by the diversity of sectors and businesses that contribute to it (Table 2.5). According to REMPLAN's 2023 data, mining enterprises dominate employment in the region, with more than 31 400 jobs, but they constitute only a small fraction of the total registered businesses (REMPLAN, 2023[18]). A closer look at the region's economic profile reveals a contrast in the proportion of businesses and employment within each sector. For example, while mining is the region's largest employer, it represents just 1% of operating businesses. Conversely, sectors like construction, which provides 11% of jobs, and accommodation and food services, which accounts for 5% of employment, have a larger number of operating businesses in the region, 15% and 3% respectively.

Table 2.5. Workers and businesses operating and registered by sector in the Pilbara region, 2022-23

Sector	Jobs in total	%	Businesses operating	%	Businesses registered	%
Mining	31 414	53	73	1	31	1
Construction	6 569	11	1 377	15	475	14
Accommodation and food services	2 972	5	301	3	132	4
Transport, postal and warehousing	2 872	5	435	5	207	6
Healthcare and social assistance	2 259	4	427	5	118	4
Education and training	2 141	4	283	3	38	1
Administrative and support services	2 098	4	919	10	185	6
Public administration and safety	1 691	3	38	0	4	0
Retail trade	1 573	3	674	7	151	5
Other services	1 205	2	1 042	11	211	6
Manufacturing	987	2	308	3	84	3
Wholesale trade	976	2	116	1	39	1
Professional, scientific and technical services	932	2	755	8	213	6
Rental, hiring and real estate services	729	1	764	8	282	9
Electricity, gas, water and waste services	702	1	33	0	16	0
Agriculture, forestry and fishing	256	0 4	192	2	107	3
Arts and recreation services	236	0 4	331	4	20	1
Information media and telecommunications	99	0 2	73	1	6	0

Financial and insurance services	71	0 1	1 100	12	55	2
Other			99	1	3	0
Total	**59 782**	**100**	**9 241**	**100**	**3 277**	**100**

Source: REMPLAN (2023[17]), *REMPLAN Economy*, https://app.remplan.com.au/?pt=EconomyProfile.

Moreover, a noteworthy distinction exists between businesses operating and those officially registered in the region. For instance, in the mining sector, only 31 businesses of the 73 operating are registered in the region. Likewise, in the construction sector, 1 377 businesses are actively operating, employing over 6 500 workers, but only 475 businesses are officially registered. This trend is similar in other sectors, such as transportation (435 operating businesses for 2 872 workers vs. 207 registered) and healthcare and social assistance (427 operating for 2 259 workers vs. 118 registered). This reflects that a high share of companies that operate in the Pilbara have headquarters elsewhere, oftentimes relying on FIFO workers, which has implications for the dynamism of the local economy and link with the communities (see Chapters 3 and 4).

High value-added and less volatile sectors, such as professional, scientific, and technical services, play less relevant roles in the regional economy. These sectors, comprising 8% of operating businesses contributing 2% of jobs, promote innovation and contribute valuable services to the community. Fostering these sectors can spur sustainable economic growth, diversify the economy and job opportunities, and reduce reliance on traditional industries like mining.

Indeed, the diversity of businesses operating in the Pilbara is significant and extends beyond those officially registered but many are linked to mining activities, such as the construction and accommodation businesses. The regional economic profile is shaped not only by the number of operating businesses but also by their distribution across various sectors, employee count and formal registration status.

Under both terms of state agreements and under their own volition, the mining companies in the region also invest heavily in community development and infrastructure. This includes funding for education, health and community services, as well as the construction of housing, roads and other infrastructure. Generally, the positive economic sectoral performance of mining presents a significant opportunity for regional development in the Pilbara. It provides not only direct employment and revenue but also significant flow-on effects on other industries and investment in community development and infrastructure. This makes mining essential to the region's economic growth and development.

Some of the principal mines and the companies that operate them in the Pilbara include:

- The Hamersley Basin, owned by Rio Tinto, home to some of the world's largest iron ore mines, including the Channar, Mount Tom Price and Paraburdoo mines.
- The Yandicoogina mine, also owned by Rio Tinto, another significant iron ore mine in the Pilbara region, producing millions of tonnes of iron ore per year.
- BHP's Mount Whaleback mine, located in the town of Newman, one of the largest iron ore mines in the world, with reserves estimated at over 1 billion tonnes.
- The Pilgangoora mine, owned by Pilbara Minerals, a significant lithium mine in the region producing high-quality spodumene concentrate for export to customers in Asia.

These mines are some of the largest iron ore and lithium producers in the world and are responsible for the majority of material mined in the Pilbara. The mining companies operating in the Pilbara also produce other minerals, such as gold and copper, but in smaller amounts compared to iron ore. Right after iron ore, gas and LNG are the second-largest sub-sector (see Chapter 3 for further information on the mining ecosystem).

Economic growth is strong, especially over the last decade

The Pilbara region of Western Australia is heavily dependent on the mining industry, particularly the production and export of iron ore. The income generated from mining in the Pilbara is closely correlated with the international prices of commodities, particularly iron ore.

The correlation between the international price of iron ore and the income generated from mining in the Pilbara can be quantified using econometric techniques. For example, a study by the Reserve Bank of Australia found that a 1% increase in the international price of iron ore leads to a 0.13% increase in the real GDP of Western Australia (RBA, 2016[22]). Conversely, a study by the Commonwealth Scientific and Industrial Research Organisation found that a 1% decrease in the international price of iron ore leads to a 0.09% decrease in the real GRP of Western Australia (CSIRO, 2015[23]). This suggests a strong positive correlation between the international price of iron ore and the economic activity in the Pilbara region.

This large share of mining activity has supported significant economic growth in the region. Figure 2.4 shows the economic growth rate of the Pilbara surpassing the Western Australian and Australian averages. By the LGAs of the Pilbara, those with a higher share of mining saw the highest rates of growth from 2008 to 2020. Comparing the growth rate of specialised regions to the OECD average, the specialised regions tend to marginally outperform the others.

Figure 2.4. GDP over time in the Pilbara, Western Australia, Australia and OECD comparable regions, 2008-20

Note: Index to 2008 = 100.
Source: Australian Bureau of Statistics via REMPLAN; OECD (2023[24]), *Gross Domestic Product (GDP) (indicator)*, https://doi.org/10.1787/dc2f7aec-en. (Accessed on 2 May 2023)

This economic growth must go hand in hand with efforts to equalise the inequality generated in the territory

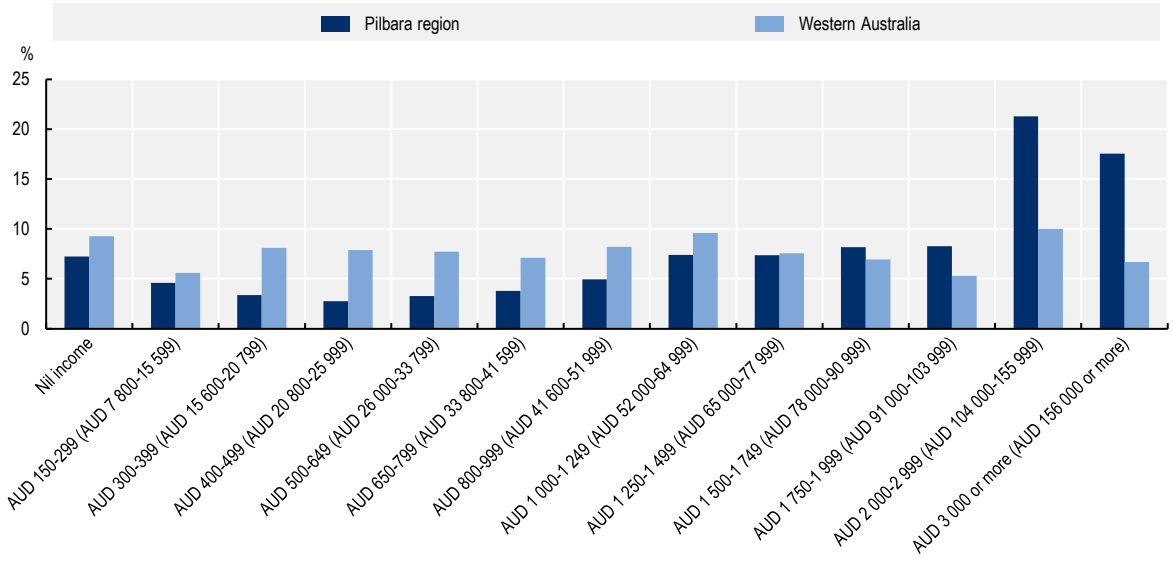
The Pilbara region presents an unequal portrait of wealth distribution. The income values suggested by income data – 21.3% of residents earn between AUD 2 000 and AUD 2 999 per week, with an additional 17.5% earning AUD 3 000 or more – lack the big picture of the region. A closer examination of the data unveils contrasts in socio-economic conditions, both within and across communities.

In regions like Karratha and Port Hedland, the Socio-Economic Indexes for Areas (SEIFA) scores exceed 1,000. A high score indicates a relative absence of disadvantage overall. Yet, juxtaposed against this

affluence, areas like Roebourne and eastern Wickham fare poorly, underscoring pockets of poverty in an otherwise prosperous region (Pilbara News, 2018[25]). A broader perspective further underscores these discrepancies. The Pilbara's wealthiest residents are far more affluent than their counterparts in Western Australia as a whole. For instance, 21.3% of the Pilbara residents earn between AUD 2 000 and AUD 2 999 per week, and 17.5% earn AUD 3 000 or more, compared to 10.0% and 6.7% respectively, across Western Australia (Figure 2.5).

Yet, at the same time, the percentage of residents with no income in the Pilbara is nearly as high as that of Western Australia – 7.2% versus 9.3% – an indicator of the socio-economic gaps that persist even amid regional affluence. Data show that some areas, like Cowrie Court, Ridley Street and Warrier Street in Bulgaria, are among the most disadvantaged in Australia. On the other hand, towns like Dampier and Tom Price, linked to Rio Tinto, are in the top level for socio-economic advantage in the country.

Figure 2.5. Income per capita in the Pilbara region and Western Australia, 2021



Source: REMPLAN (2023[17]), *REMPLAN Economy*, https://app.remplan.com.au/?pt=EconomyProfile. (Accessed on 27 May, 2023)

The Pilbara mining industry bucks the trend with significant employment growth despite a nationwide decline in mining jobs

The trend of increasing employment in the mining industry in the Pilbara region of Western Australia is not necessarily reflective of a broader trend across the rest of Australia and OECD member countries. With regards to employment, the number of people employed in the mining industry in the Pilbara has increased from around 18 500 in 2011 to around 31 414 in 2022 (Australian Government, 2016[26]) and (REMPLAN, 2023[18]). This represents a 70% increase over the past decade.

This growth in employment in the mining industry in the Pilbara has been driven by a combination of factors, including increasing global demand for iron ore, the development of new mining projects and the expansion of existing mines. The mining companies operating in the Pilbara, such as BHP, Fortescue Metals Group and Rio Tinto, have invested heavily in expanding their operations in the region to meet growing demand.

In fact, the trend of increasing employment in the mining industry in the Pilbara region of Western Australia is not necessarily reflective of a broader trend across the rest of Australia. The mining industry in Australia as a whole has experienced a decline in employment in recent years (ABS, 2021[27]). The number of people employed in the mining industry in Australia decreased from around 212 000 in 2014 to around 164 000 in

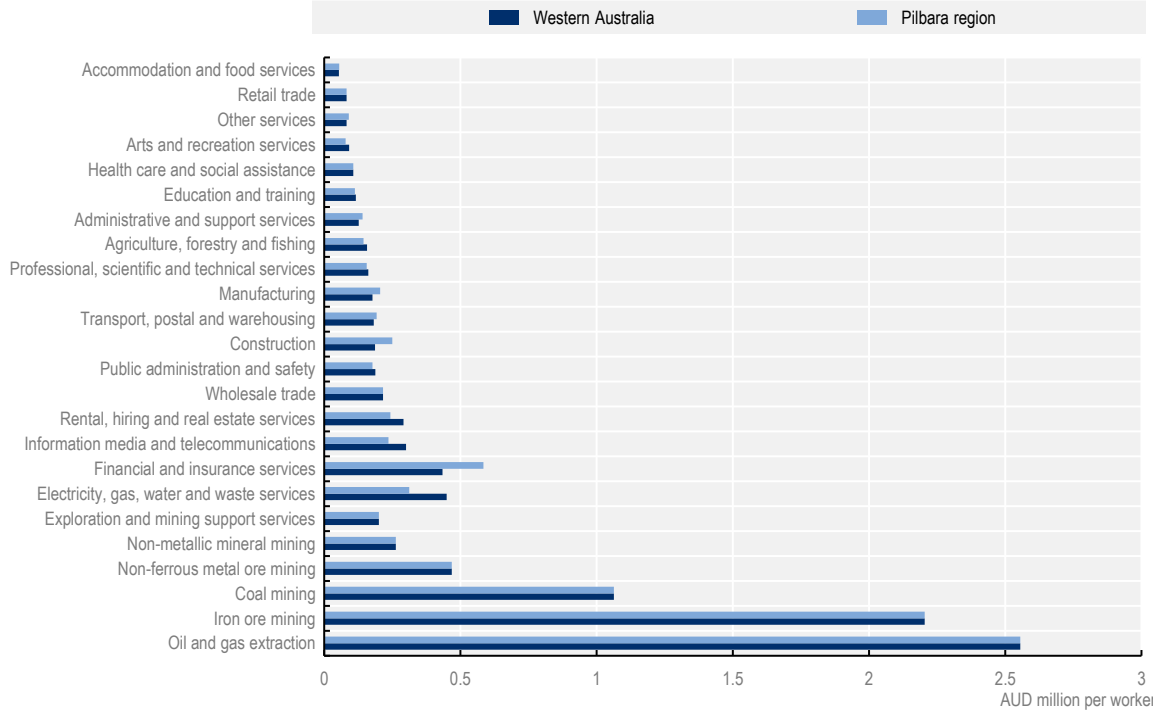
2020, a decline of around 22%. This has been driven by a combination of factors, including a fall in commodity prices, the phase-out process of coal mines, a decline in investment in new mining projects and increased automation in some mining operations.

To put efforts into economic diversification beyond mining and to promote growth in agriculture, tourism, and other industries

The economy of the Pilbara is not solely dependent on mining. Other industries, such as agriculture, tourism and construction, also contribute at a lower scale to the region's economic growth. Additionally, the Pilbara is a major centre of natural gas, which is an important source of energy for the region and the wider state. Furthermore, the Pilbara also has a diverse and growing population, with a range of businesses and services catering to residents and visitors. In recent years, the government and private sector have invested in infrastructure and development projects that aim to diversify the Pilbara's economy and create new opportunities for growth.

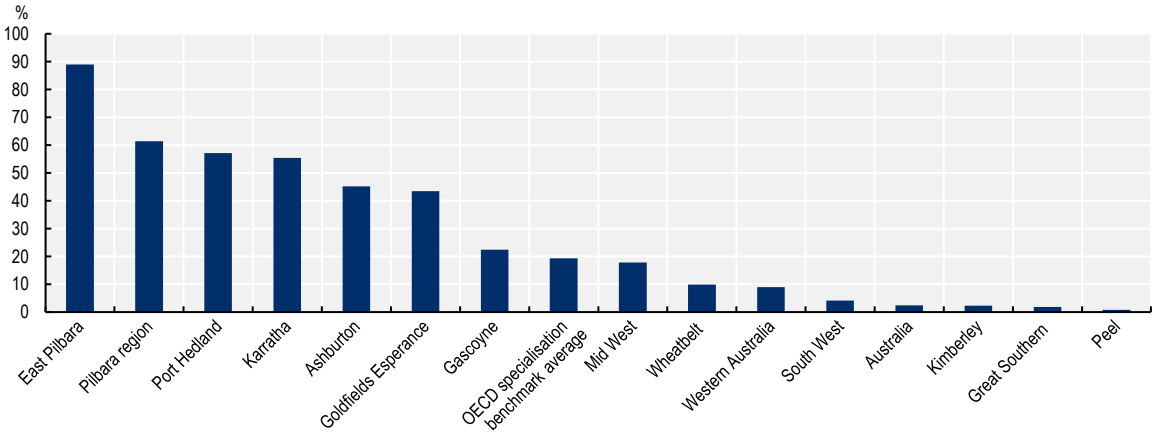
Around 73% of the Pilbara's GVA comes from the mining sector and this share within East Pilbara is a staggering 91%. When compared to neighbouring Western Australian regions, this degree of specialisation cannot be found (Figure 2.6). For example, the closest similarity is in the Goldfields-Esperance region, where over half of its GVA is derived through mining and, therefore, would be considered a specialised region;[4] however, the gap between this and its next largest sector – manufacturing – is smaller than can be found throughout the Pilbara (Figure 2.7). In many regions, the dominant sector contributed significantly more to the local economy than the second-largest industry. In other regions, specialisations were spread across both the wider industry and manufacturing sectors. Notably, the mining sector has seen an increase in its share of the economy over time, with statistics from 2010/11 showing it accounted for around 60% (RDA, 2012[28]).

Figure 2.6. Share of GVA by sector in the Pilbara, Western Australia and Australia, 2020



Source: Australian Bureau of Statistics June 2020 GVA via REMPLAN; REMPLAN (REMPLAN, 2023[18]), *Economy, Jobs and Business Insights - Pilbara*, https://app.remplan.com.au/pilbararegion/economy/trends/business-counts-staff?state=Kp9MIN!Xr3pFPxObU1GnJvuGlDMZHwtmhpkWIwSjhX9wsQhQSLHgSOf4zG.

Figure 2.7. Difference in GVA share between the largest and second-largest industry sector



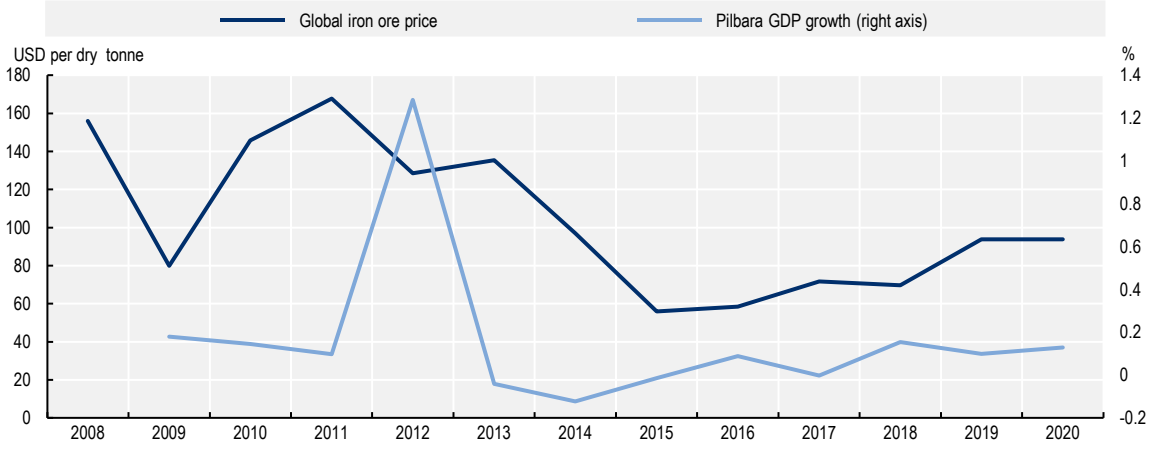
Note: For Australian regions, the difference was determined using industry sectors from the Australian Bureau of Statistics for June 2020. For OECD benchmark countries, the difference was based on OECD SNA 2008 sectors using 2017 data
Source: Australian Bureau of Statistics June 2020 Gross State Product via REMPLAN; OECD (2022[16]), *OECD Regional Statistics (database)*

The economy is subject to volatility driven by low diversification levels

The Pilbara region's economic growth is highly volatile. Whilst the GRP has on average grown at 17% per year from 2008 to 2020, this growth has been inconsistent. Between 2011 and 2012, the economy grew a noteworthy 128%, while the year after, the GRP contracted by 12%. Overall, economic growth in the Pilbara comes at the price of extreme volatility.

Part of this volatility is due to international prices of minerals, mostly iron as this is what is mainly mined in the Pilbara, and diversification of the economy is low. Mapping the Pilbara GRP growth alongside world iron ore prices shows a substantial correlation (Figure 2.8). This reflects the dependence of these global trends on regional income. In addition, the University of Queensland (University of Queensland, 2019[29]) refers to iron ore as more volatile than other commodities, as prices, in part due to transactions between buyers and sellers, are more likely to be conducted in closed-door negotiations and, therefore, lack transparency.

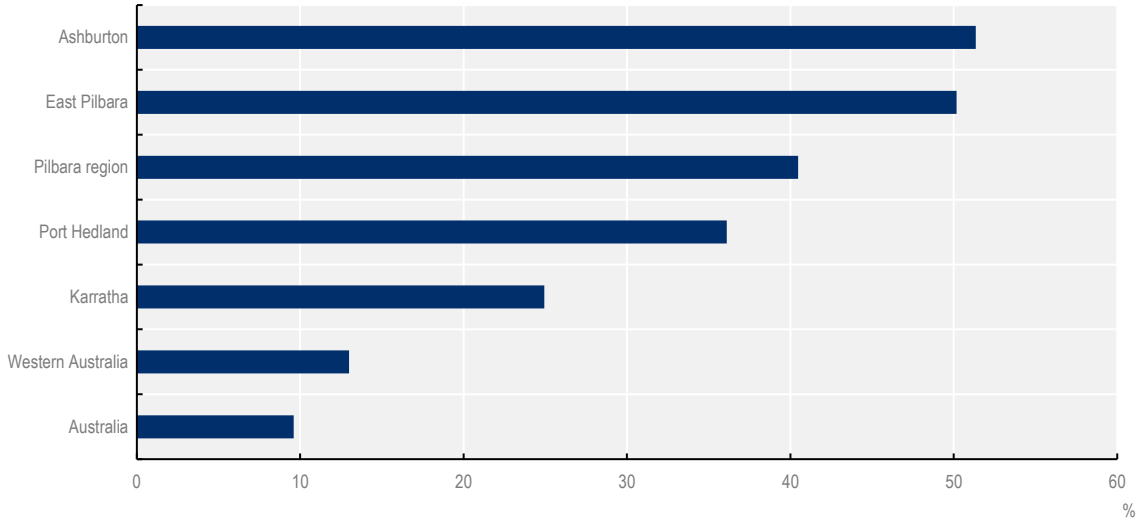
Figure 2.8. The Pilbara GRP and global iron ore prices



Note: GRP data are in June 2018 AUSD prices. Yearly iron ore prices are calculated as an average of monthly prices in USD.
Source: Australian Bureau of Statistics via REMPLAN, Index Mundi monthly iron ore. (IndexMundi, 2022[30]) (Accessed on March 15th, 2022)

The Pilbara region's economic growth is highly volatile, with a coefficient of variation of 40% in the GRP growth rate between 2008 and 2020, which is about 4 times higher than the average degree of volatility for the rest of the country. Within the region, Karratha (25%) and Port Hedland (36%) rank below the Pilbara average, with Ashburton (51%) and East Pilbara (50%) above the Pilbara average level of coefficient deviation. The whole TL2 Western Australia region performs markedly lower at 13% (Figure 2.9).

Figure 2.9. GRP coefficient of variation, 2008-20

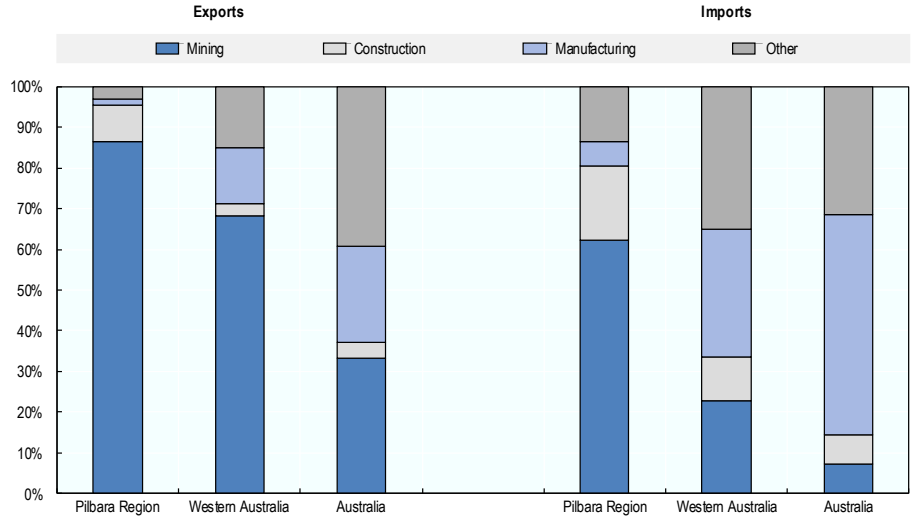


Note: GRP coefficient of variation calculated with USD per capita, constant prices, constant purchasing price parity (PPP) and base year 2015.
Source: GRP per capita calculations based on OECD (2022[16]), *OECD Regional Statistics (database)*, https://doi.org/10.1787/region-data-en.

There is also a high dependency on a single external market. The vast majority (96%) of what is mined is exported (Figure 2.10). Imports to the region are also concentrated in the mining sector, with only some relating to manufacturing and construction. The small internal markets of the Pilbara with limited diversification increase the vulnerability from openness. The largest consumer of iron ore is China and economic analysis shows Chinese economic growth and policy decisions to be the most influential factor determining international iron ore prices (Wårell, 2018[31]). In 2019, of the USD 124 billion exported, China imported 66.8%, mainly to make steel, which is then used in infrastructure and construction projects (OEC, 2019[32]). Thus, the Pilbara is severely exposed to this demand from China (Figure 2.11), which is influenced by broader global economic growth (demand for steel for construction, etc.).

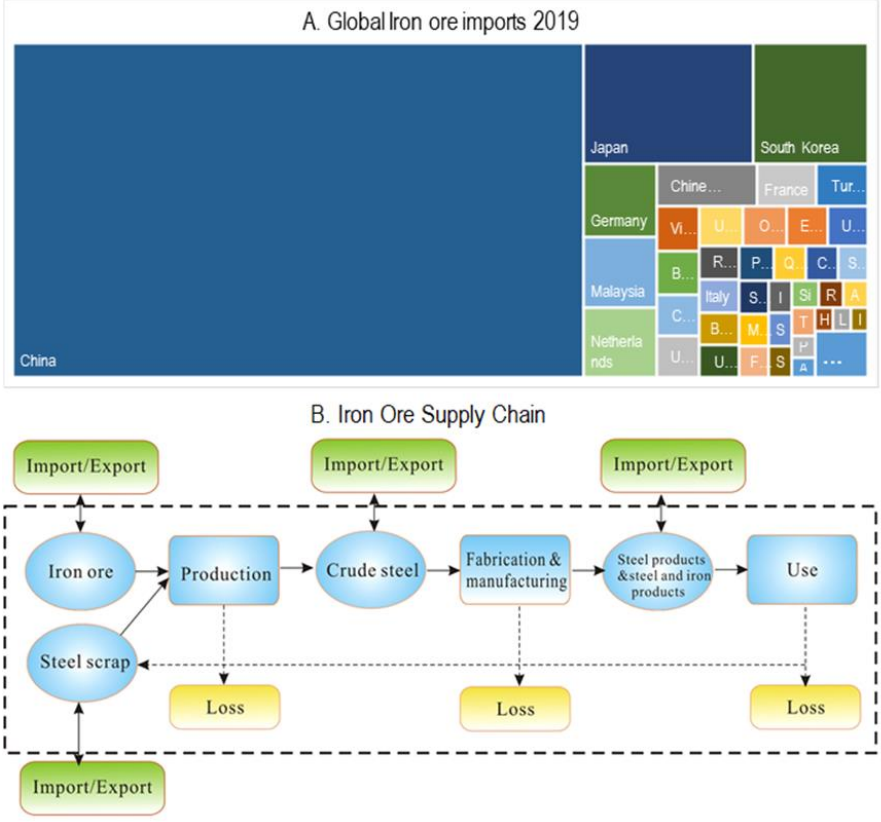
In addition, mining iron ore is the least value-adding element of this supply chain. In 2019, iron ore sold for USD 92 per tonne, pig iron for USD 309, steel pipes and tubes for USD 960 and structural grade steel for USD 3 000 (Steelnet, 2021[33]). These statistics point to theoretical avenues for diversification by exploring downstream processing – discussed in more detail in later chapters through the concept of smart specialisation (BCEC, 2019[34]).

Figure 2.10. Export and import shares by sector



Note: Regional imports data represent the value (USD) of goods and services imported into the defined region by businesses/organisations in each of the industry sectors. Another way of defining imports is as an outflow of money from the region, i.e. a local business outsourcing accountancy services to a firm in another region, which results in an outflow of money; thus, they are importing services. No distinction is made between domestic and international imports.
Source: ABS 2017/2018 National Input Output Tables. (ABS, 2019[35]) (Accessed on 20 November, 2022)

Figure 2.11. Iron ore global import and supply chain

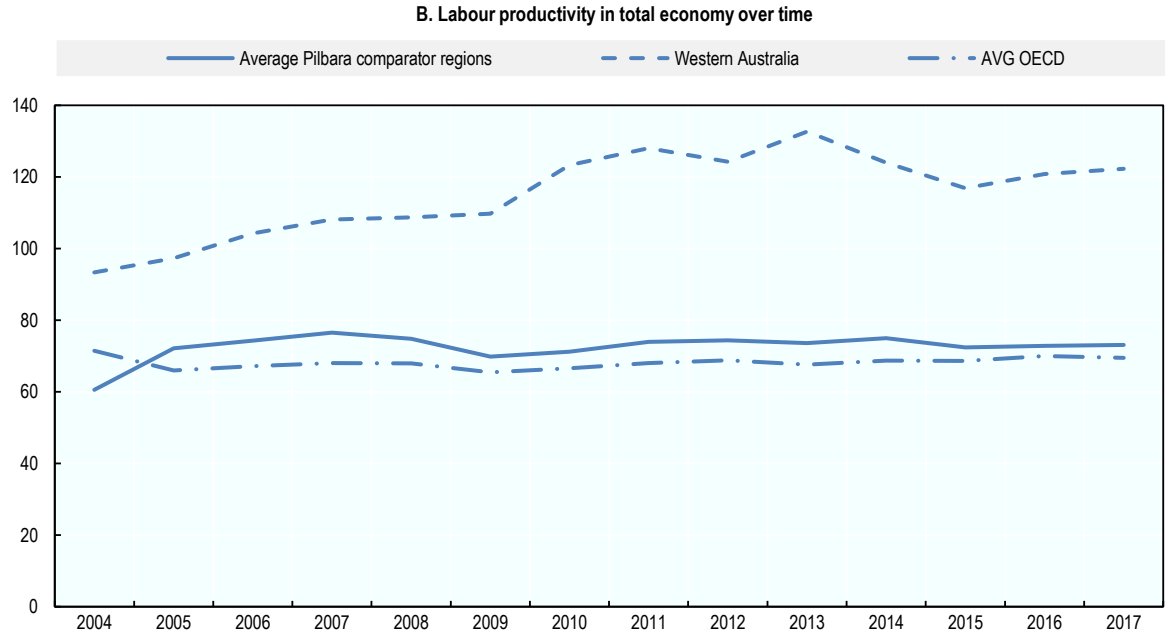


Note: The dotted black box in Panel B represents the system/internal economy.
Source: Liu, J. et al. (2017[36]), "Implications from substance flow analysis, supply chain and supplier' risk evaluation in iron and steel industry in Mainland China", https://doi.org/10.1016/j.resourpol.2017.01.002.

High productivity can be attributed to trade openness and high capital intensity of production

The OECD finds a clear positive correlation between a region's openness to trade and regional labour productivity growth (OECD, 2020[37]). The Pilbara is no different in this regard, with higher levels of productivity (AUD 714 395 per worker in 2016) than the Western Australian (AUD 234 126) and Australian (AUD 133 830) averages. In fact, the productivity gap has been increasing between Western Australian regions and the rest of Australia as, since 2000, productivity has increased by 2.5% per year, substantially more than the least productive region of Tasmania at 1% per year (OECD, 2020[37]). In fact, Western Australia and, in turn, the Pilbara, are far ahead compared to other OECD regions (Figure 2.12). Even within the comparators of specialised regions, only a fifth had productivity levels greater or equal to Western Australia.

Figure 2.12. Labour productivity in Western Australia and OECD comparable regions, 2004-17



Note: Values are standardised to USD in 2015 prices.
Source: TL2 regional productivity based on OECD (2022[16]), *OECD Regional Statistics (database)*, https://doi.org/10.1787/region-data-en.

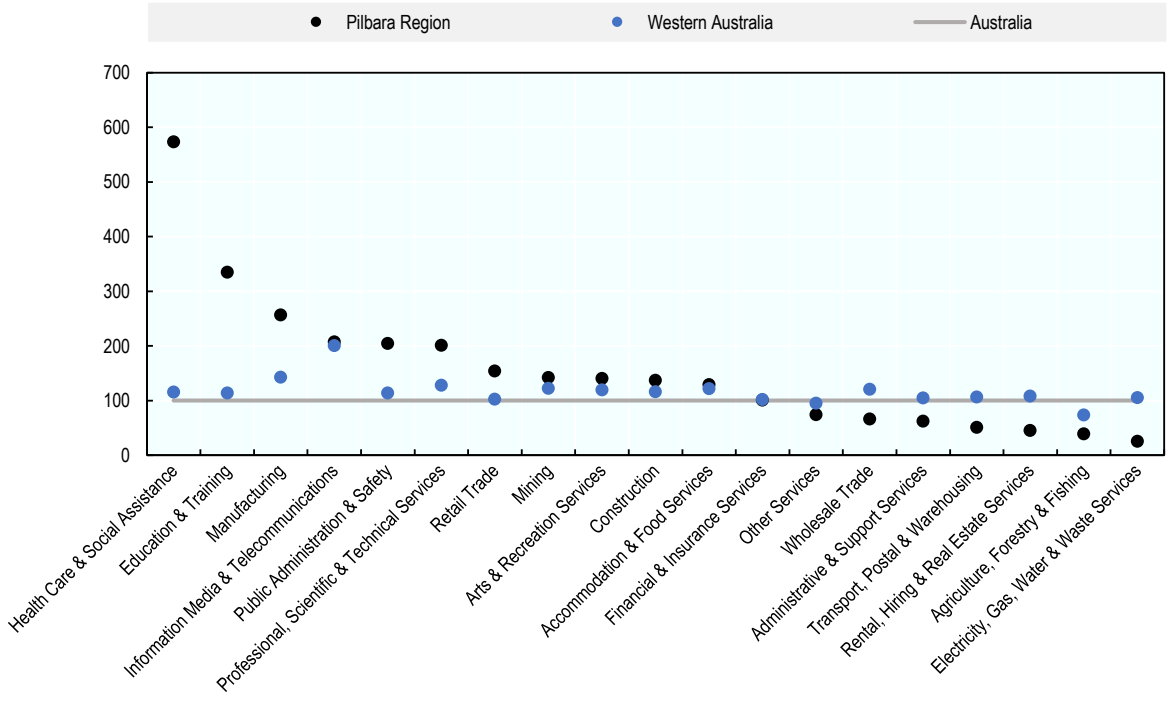
When breaking down productivity by sector, workers in the Pilbara region are found to be as productive as those in other parts of Western Australia and Australia. However, there are important differences between the sectors (Figure 2.13). The mining sector in the Pilbara is found to be more productive than other sectors and the manufacturing sector's productivity in the Pilbara is two and a half times higher than the Australian average. In contrast, service productivity is higher in other parts of Western Australia and Australia. Therefore, the overall higher productivity in the Pilbara region is largely driven by the mining sector, which is more productive than other sectors and may also contribute to the productivity of other nearby industries by sharing income sources.

Mining is often considered productive because it is classically capital-intensive, requiring fewer workers per output. In comparison, across the OECD, many firms at the productivity frontier rely more intensively on highly skilled workers, particularly in the service sector, such as the financial service industry (OECD, 2019[38]).

The value-added per worker in the mining sector is markedly higher than in the other sectors. Regardless of the Pilbara or Western Australia as a region, mining-related industrial activities such as iron ore (AUD 2 556/worker), coal (AUD 1 063/worker) or non-ferrous metal ore (AUD 468/worker) experience a relative larger productivity than activities with a greater presence in other parts of Australia not as specialised as the Pilbara, such as financial and insurance services (AUD 584/worker), wholesale trade (AUD 216/worker) or manufacturing (AUD 205/worker) (Figure 2.14). Yet, within the mining sector, not all activities are as productive as others. For instance, the productivity of the financial service or real estate sector is greater than that of non-metallic mining. This points to the possibility of better allocation of resources from a productivity standpoint (Economy Watch, 2021[39]).

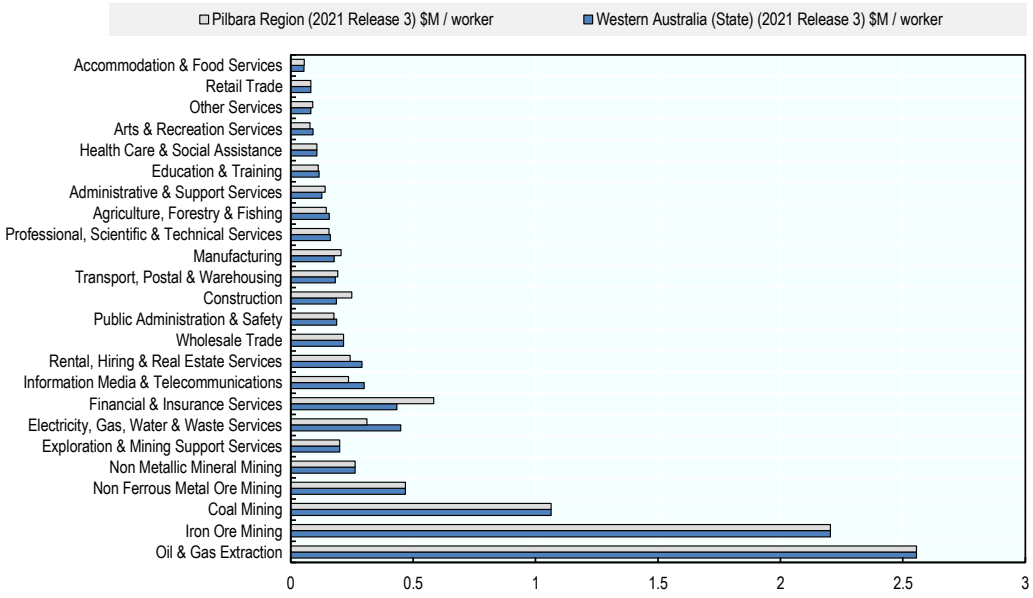
Figure 2.13. Variations in sectoral labour productivity in the Pilbara, Western Australia and Australia, 2016

Unweighted, 100=Australia



Source: Australian Bureau of Statistics 2016 Census via REMPLAN (REMPLAN, 2023[17]) (Accessed on 5 June 2022)

Figure 2.14. Productivity by subsector in the Pilbara and Western Australia, 2021



Note: Values are in AUD.
Source: Australian Bureau of Statistics 2016 Census via REMPLAN (REMPLAN, 2023[17]) (Accessed on 5 June 2022)

There are indications of large productivity gaps within the business demography

In June 2019, three multinational mining firms accounted for almost two-thirds of employment in the Pilbara region. Firms with 250 or more employees are defined as large and those below as SMEs. Within the Pilbara, 98% of all firms were SMEs (OECD average of 99%) (OECD, 2021[40]). However, the total number of firms in the region is much lower per km² or per capita than across the OECD or Australia. square kilometrekm² and per number of inhabitants er population than across the OECD or even acrossthan across the OECD or Australia. Compared to the economic comparator regions, the Pilbara has 3 times fewer firms per 1 000 population (34 across the Pilbara, even below the lowest proportion in the benchmark Northern Hungary at 44 firms).

At the same time, the rate of business churn is much higher than in other OECD regions. Calculated as the proportion of entry plus exits to total firms in any given year, OECD economic comparator regions tend to have a lower churn rate[5] than the OECD average. In contrast, almost a third of businesses in the Pilbara have changed each year. This may be partially driven by country-specific factors, as the churn across Australia is higher than the OECD average. On the one hand, the rate is an indicator of "creative destruction" and business dynamism (OECD, 2017[41]); on the other, it may reflect difficulties for viable incumbents to expand (OECD, 2009[42]). Given, on average, the largest churn is seen amongst SMEs (Calvino, Criscuolo and Verlhac, 2020[43]) and in several longstanding mining companies, it could be inferred that large employers dominate the region and have a small and underdeveloped small and medium business sector. This is backed by having a much smaller share of non-employing businesses, typically associated with start-ups and entrepreneurial activities.

Across Australia, 9.1% of mining firms are SMEs but this varies significantly by sector. Within the agricultural sector, this is 80.2%; half of all construction firms are SMEs and over 40% of all accommodation and food businesses (Snabel et al., 2012[44]). Following this trend, it is not the Pilbara mining industry that houses the regional SMEs. Business demographics in the region (Table 2.7) show an increase in the number of businesses in the more productive sectors outlined above, such as research, science, accommodation and food services. This points to the growing tourism sector over the last few years, partly

driven by the Pilbara Development Commission leveraging the acclaimed Karijini National Park and a number of coastal attractions. The substantive degree of agriculture, predominantly in the form of cattle stations, seems to have seen a slight decline in terms of the number of businesses in the last few years.

Table 2.6. Business demography indicators in the Pilbara, Western Australia, Australia and OECD comparable regions, 2020

Indicator	The Pilbara	Western Australia	Australia	Average OECD region (specialised region benchmark)	Average OECD region (all regions)
Number of all active firms (including non-employers)	2 123	230 214	2 304 258	168 591	180 145
Density of all active firms (number of actives firms by 1 000 population)	33.8	86.4	89.7	82.4	69.2
Churn rate (entries plus exits in % of all firms – same sector, same size class)	32.2	26.0	26.9	20.9	19.1
Patent applications (2015)	18	202.319	1 867.07	481.7448	611.3006
Active firm-to-patent application ratio	117.94	1 137.88	1 234.16	349.96	294.69

Note: There are small differences between the data provided by REMPLAN and the OECD business demographics database. “Firms” as identified by the OECD corresponds to ”businesses'” in REMPLAN and, in both cases, the table refers to firms registered in the region, which are fewer than those operating in the region'. Australian firm activity statistics are an average of 2017-20 values; OECD statistics are average 2015-17 values. OECD values do not include all OECD regions, only those for which data were available. This accounts for 15 of 33 benchmark regions and 56% of all OECD TL2 regions.
Source: Australian Bureau of Statistics Regional Summaries (ABS, 2021[27]); TL2 regional statistics based on OECD (2022[16]), *OECD Regional Statistics (database)*, https://doi.org/10.1787/region-data-en.

SMEs are primary sources of innovation across OECD regions (OECD, 2019[45]). However, Australia’s SMEs rank in the bottom five OECD countries for practical intelligence, innovation, and adaptability (OECD, 2021[40]). Assistance for SMEs is therefore required and needs to go beyond access to public financial support (as Australia already ranks far above the OECD average on this indicator).

Another measure of economic innovation is the number of patent applications, typically registered by larger, more established companies. In 2015, firms in the Pilbara applied for 18 of the 202 applications by Western Australia (i.e. around 10% or 1 patent for every 117 businesses in the region). In comparison, OECD economic comparator regions saw 1 patent for 349 firms on average and 1 in 294 across all OECD regions. Alternatively, compared to specific mining regions, the Pilbara saw 7 patents per million inhabitants in 2018 versus 51. One reason for higher-than-average statistics may relate to pressures within the mining sector to find cost-effective solutions (Bain & Company, 2015[46]). Looking across the 55 Australian regions, the Pilbara ranks low or very low on other innovation measures, such as the presence of research organisations or employment in R&D (Australian Government Initiative, 2014[47]) (Tables 2.6 and 2.7).

Table 2.7. Business size in the Pilbara, Western Australia and Australia, 2020

Number of (registered) businesses and share of total.

	The Pilbara		Western Australia		Australia	
No employees	1 252	58%	153 310	65%	1 559 000	64%
1-19 employees	816	37%	74 334	32%	821 237	34%
20-199 employees	104	5%	5 972	3%	56 562	2%
More than 200 employees	5	0.23%	487	0.21%	4 326	0.18%
Average number of employees of active enterprises (all firms) Average number of employees per active enterprises (all firms) – Employees/firm	Average OECD region (specialised region benchmark)				3.7	
	Average OECD region (all regions)				4.2	

Note: There are small differences between the data provided by REMPLAN and the OECD business demographics database. "Firms" as identified by the OECD corresponds to "businesses" in REMPLAN and, in both cases, the table refers to firms registered in the region, which are fewer than those operating in the region. OECD statistics are average 2015-17 values. OECD values do not include all OECD regions, only those for which data were available. This accounts for 15 of 33 benchmark regions and 56% of all OECD TL2 regions.
Source: Australian Bureau of Statistics Regional Summaries (ABS, 2021[27]); TL2 regional statistics based on OECD (2022[16]), *OECD Regional Statistics (database)*, https://doi.org/10.1787/region-data-en.

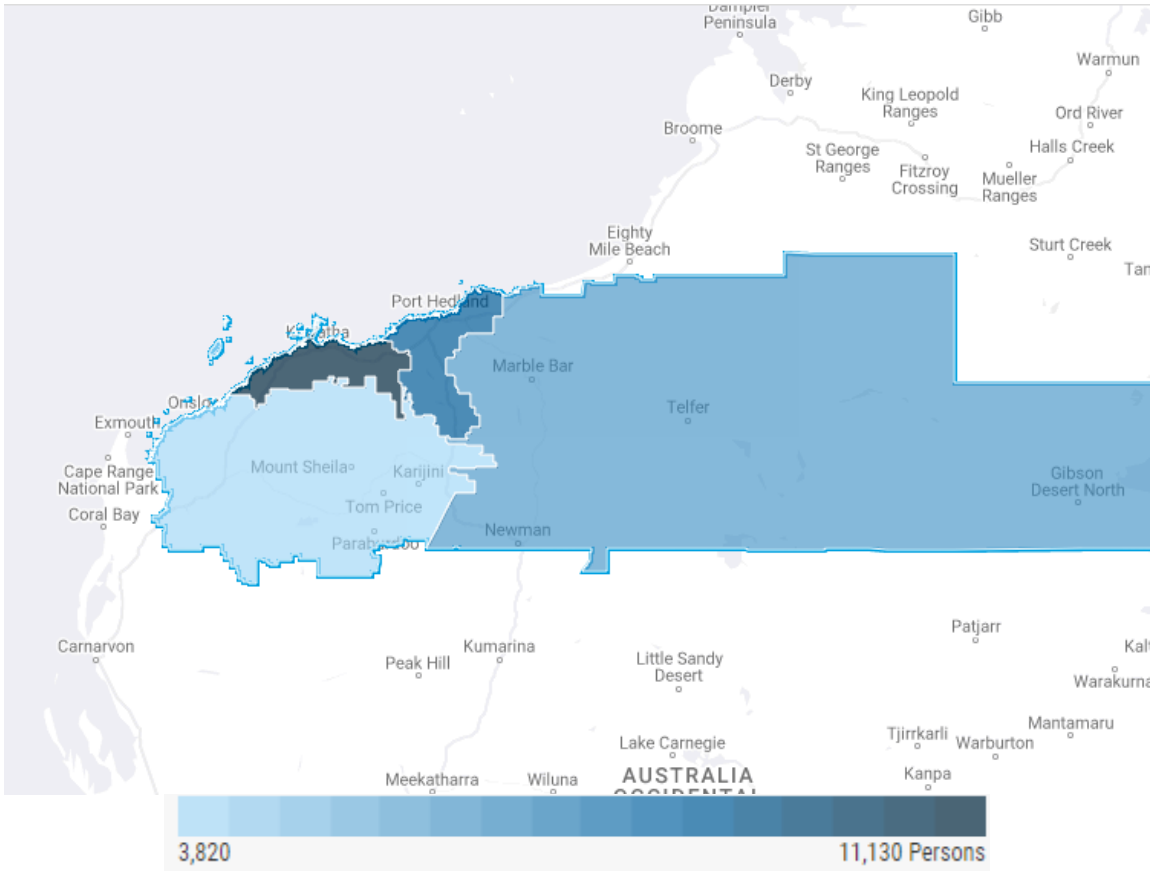
The labour market: Distinguishing between the workforce and resident population

A large proportion of those who work in the Pilbara do not reside there

Before delving into the characteristics of the employed population, it is vital to note an exceptional feature of the Pilbara: the sheer volume of migration. In the 2021 census, a quarter of the Pilbara's population were living elsewhere in Australia and almost 7 p.p. above were elsewhere in Australia ten years prior in 2011. This adds up to a population turnover in 2001-16 of a staggering 68.5%. This shows that population growth trends are correlated to the region's GRP over time; in other words, the population moved to work. This is not a feature identified across wider Australia. The average population growth over the last 10 years has been 1%. This is greater than the Western Australia Outback average of 0.5% and slight growth is in line with population trends in OECD mining regions (0.56%) but far below the OECD regional average (6%). Figure 2.15 shows the usual residence for many is the suburbs of Perth, with other usual residences around other major Australian cities, less than half state their usual residence as the Pilbara. A typical roster ranges from several weeks to several months.

Given many move to the region to work in mining or related sectors, it is not surprising that the employment rate is exceptionally high. With a participation rate of 90% and an unemployment rate of 2.5%, the region is among one of the most employed in the world, like several regions of Iceland and Switzerland. The unemployment rate of the wider Western Australia Outback region (7% in 2019) is lower than the average of OECD regions (7.8%) and the benchmark of mining regions (8.2%).

Figure 2.15. Location of usual residence of people working in the Pilbara in 2016

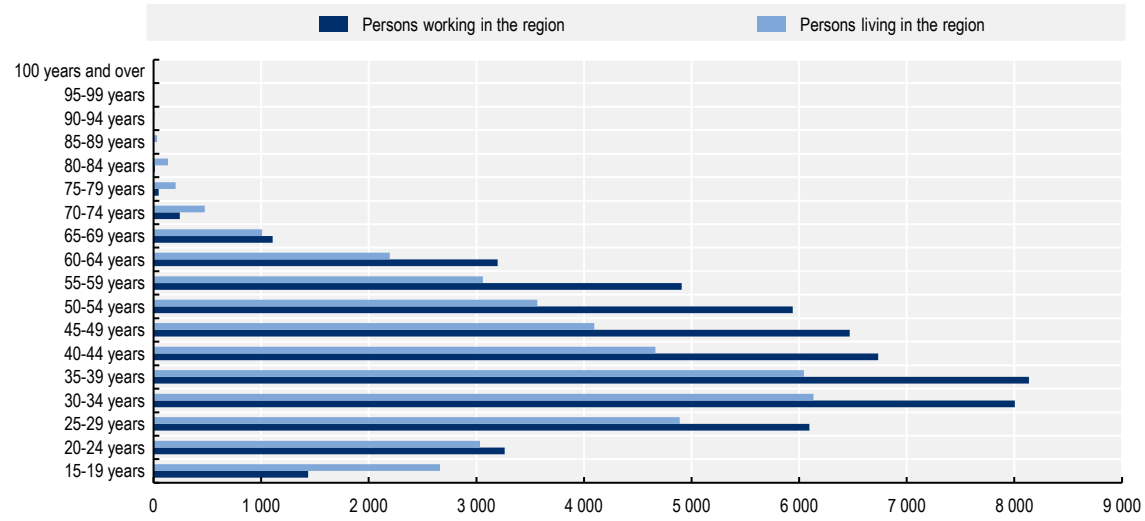


Note: Place of usual residence: this is the place where a person usually lives. It may or may not be the place where the person was counted on Census Night.
Source: 2021 Australian Census via (REMPLAN, 2022[9]) (Accessed on 14 of January of 2023).

The phenomenon known as FIFO, where the working population in the Pilbara region resides outside it, poses significant challenges to the region's economy and society (around 50% of the population). While the younger and older populations tend to reside and work in the Pilbara, the working-age population 25 to 65 years old often chooses to live outside the region. For instance, between the ages of 35 and 55, it reaches its peak, with over 2 000 workers of the region living outside of it (Figure 2.16). This situation has important implications for labour stability and social cohesion in the region.

The increase in daily commuting and long distances travelled by the working population also has environmental and transportation consequences, with increased traffic and pollution on the roads. Additionally, this phenomenon can reduce community participation and social cohesion, as workers residing outside the region are not as involved in the activities and life of the local community. Therefore, it is important that policies and measures be adopted to address these challenges and promote sustainable and balanced development in the Pilbara region.

Figure 2.16. Share of the population working or living in the region of the Pilbara, 2021



Source: ABS 2021 Census Place of Work Employment via (REMPLAN, 2022[9]) (Accessed on 14 of January of 2023).

Over the past decade, the Pilbara region has seen a significant rise in the working-age population working but do not live there. This phenomenon is particularly noticeable among certain age groups, according to Table 2.8. For instance, the 30-34- and 35–39-year-old age groups have seen striking increases in workers who do not reside in the region. The number of such workers in the 30-34 age bracket rose by 2 201% from 2011 to 2021, while the 35-39 age group witnessed an astounding 35 000% increase. Similarly, there is a marked increase of workers who do not reside in the region among the 15-19, 20-24, 25-29, 60-64 and 65-69 age groups.

This change in demographics also points to a trend of FIFO workers. The FIFO percentage for the 30-34 and 35-39 age groups is 50%, indicating a significant proportion of these workers are temporary. This phenomenon is even more prominent for the 20-24, 25-29, 40-44, 45-49, 50-54 and 55-59 age groups, with FIFO percentages ranging from 51% to 59% (Table 2.8).

Table 2.8. Difference between persons living and persons working in the Pilbara, 2011 and 2021

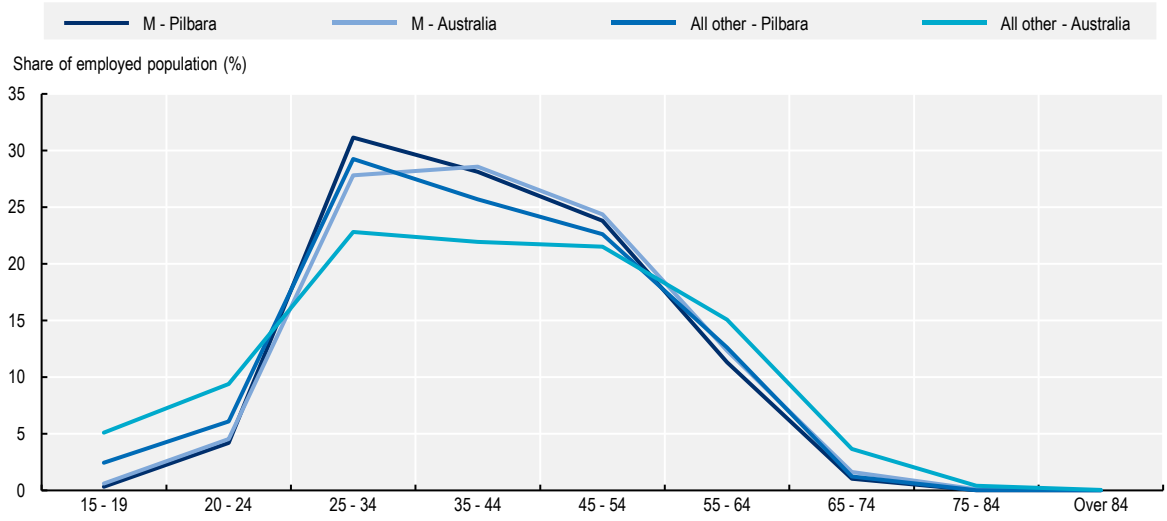
	FIFO percentage 2021 (%)	Growth of Share of FIFO between 2011 and 2021 (%)
15-19 years	30	19
20-24 years	57	77
25-29 years	59	40
30-34 years	50	2 201
35-39 years	50	35 000
40-44 years	56	-77
45-49 years	57	-82
50-54 years	58	-88
55-59 years	51	-1 564
60-64 years	42	270
65-69 years	28	116
70-74 years	12	43
75-79 years	1	21
80-84 years	0	8

Note: Share of Fly-in Fly-out over the total population.
Source: ABS 2021 Census Place of Work Employment (Scaled) via (REMPLAN, 2022[9]) (Accessed on 14 of January of 2023).

The average worker is a young male employed in mining for long hours and high pay

Figure 2.17 looks at the age composition of the region's workforce. Many studies show that the highest probability of migrating is between the ages of 20 and 30 years old (Zaiceva, 2014[48]), which matches the workforce – mainly the mining workforce – age structure in the Pilbara. Compared across Australia, whilst those employed in the mining sector are generally younger anyway, they are particularly younger in the Pilbara.

Figure 2.17. Age distribution by sector of employment in the Pilbara, Western Australia and Australia, 2020



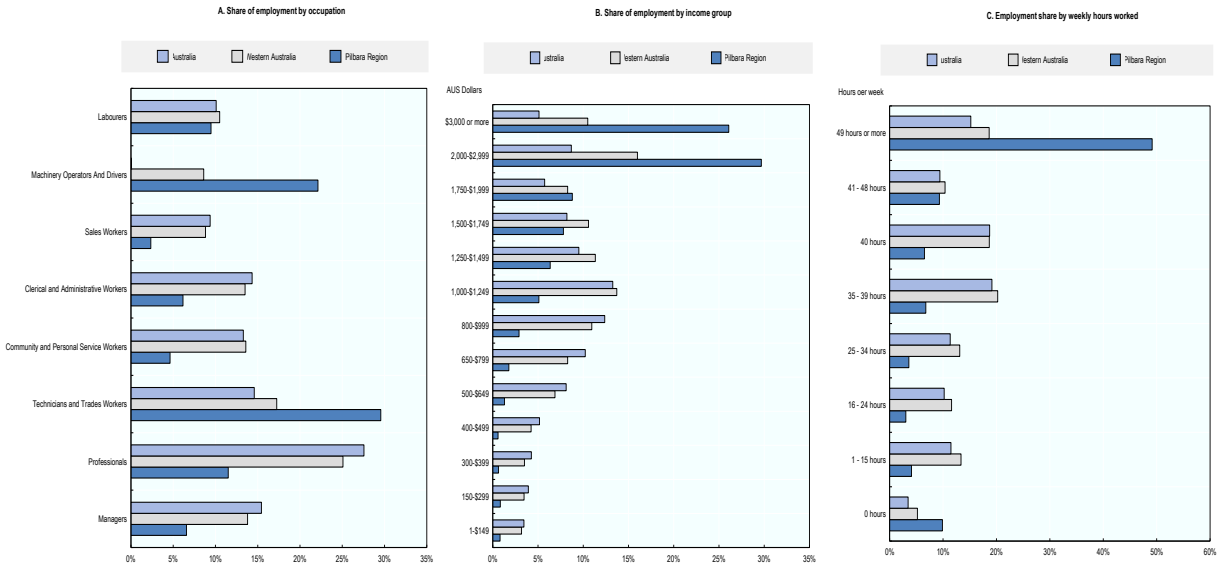
Note: The employment data in this report represent the number of people employed by businesses/organisations in each of the industry sectors in the defined regions. In this report, the employment data are place of work data and represent the total number of employees without any conversions to full-time equivalence.
M: Mining sector compared to all other sectors.
Source: ABS 2016 Census of Population and Housing (Scaled) via REMPLAN (REMPLAN, 2022[9]) (Accessed on 14 of January of 2023).

Workers in the Pilbara are concentrated in specific occupations. Each sector needs an array of workers, from labourers to salespeople, managers to clerics, and, as such, workers are typically distributed relatively evenly across these jobs. Figure 2.18 shows that this is not the case in the Pilbara and, instead, employment is clustered into technicians and trades jobs and machinery operator and driver occupations. Across Australia, a third of the population are employed in managerial or professional occupations, whereas in the Pilbara, this is less than a fifth (with a quarter around Europe). This may be driven by a workforce that, on average, has a lower level of education than the Western Australian or Australian average.[6]

However, perhaps as a reflection of the much longer hours worked, the rate per hour is also higher to compensate for conditions – FIFO, long hours, remoteness, and climate – and to attract skilled workers in a competitive environment. Thus, the average income is much higher than in other Australian regions, with 28% earning more than AUD 3 000 a month (Figure 2.18, Panel C). Most notably, these figures hold for employment in the Pilbara that is outside of the mining sector, indicating a more systematic trend.

Figure 2.18. Characteristics of the workforce, 2021

Occupation, monthly income and weekly hours worked



Source: Australian Census 2021 via (REMPLAN, 2022[9]) (Accessed on 30th March, 2023)

However, the Pilbara's gender disparity in the workforce hinders sustainable development in the region

In the Pilbara, those employed in mining are typically male and, with such a dominance of the sector, this has skewed the labour market of the region to be male-heavy. The wider Western Australia Outback has the highest male-to-female ratio amongst OECD mining regions. In comparison, across the OECD labour market, the ratio is skewed towards women (79 working men for every 100 working women). Mining regions tend to face lower participation of women in the workforce given the masculinisation of the sector (Abrahamsson et al., 2014[49]). In 2020, around 50 000 males worked in the Pilbara comparatively around 15 000 females, 51% and 26% in mining respectively.

While there is limited data on skills and qualifications at the regional level across the mining sector, the majority of mining workers (40%) in the country are mainly Technicians and Trades workers, and Machinery Operators and Drivers with both cases having low female participation. Women in the mining industry with tertiary qualifications appear more in the non-STEM fields of education (Weldegiorgis, 2022[50]).

The mining sector has historically faced challenges to overcome gender-based discrimination with sexual harassment issues that have likely contributed to the lack of female participation in the mining sector. For example, following a series of public reports of sexual assault in the FIFO mining industry, the Western Australian Government released a report in 2022 titled Enough is Enough into sexual harassment and sexual violence amongst FIFO workers (Western Australian Government, 2022[51]). An independent review by Rio Tinto found 28.2% of women had experienced sexual harassment at the workplace (Elizabeth, Broderick & Co, 2022[52]).

Technological progress in mining activities may provide opportunities to increase labour possibilities for women by creating an improved work environment and higher qualification demands that will enable more women to work in the industry. However, such changes may have significant implications on the dynamics of demand for digitally skilled labour, disproportionally impacting women.

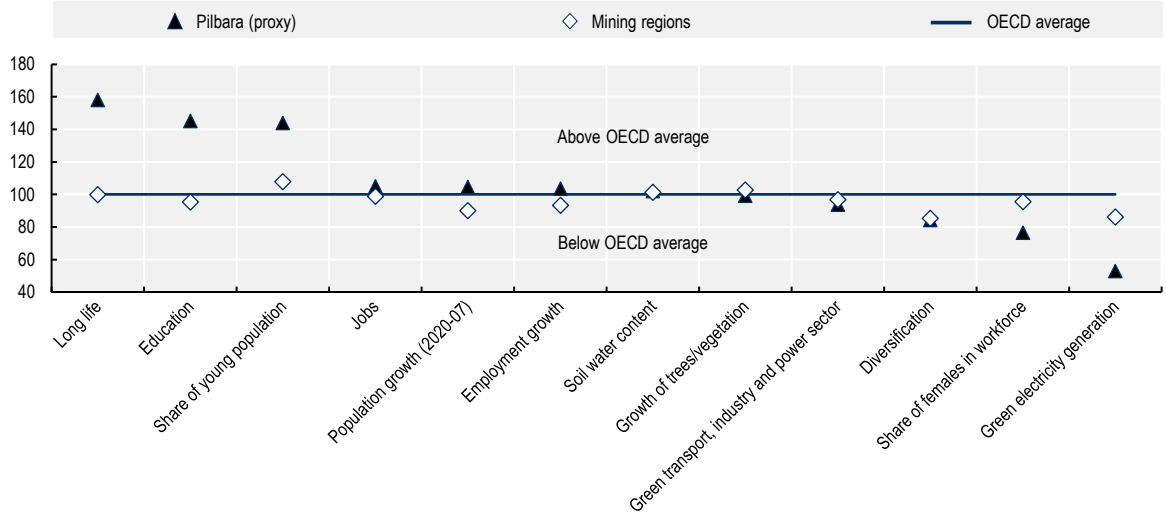
A gender-balanced labour market can promote sustainable regional economic development in a number of ways. In the case of the Pilbara specifically, a more balanced workforce would ensure that the skills and perspectives of both men and women are represented in the mining and resource extraction industries, which are a major driver of the regional economy. This can lead to more efficient and effective decision-making, as well as increased innovation and productivity. Additionally, increasing the participation of women in the workforce can have a positive impact on the local economy by increasing consumer spending and boosting demand for goods and services. This can lead to the creation of new jobs and businesses, which can further support sustainable economic growth, critical for fostering a sense of community and social cohesion, and important for the overall well-being of the population and long-term sustainability of the region. All these factors can lead to sustainable economic development and a better future for all members of the community.

Community: Life in the Pilbara

The quality of life of citizens in Western Australia, including the Pilbara, varies depending on the dimension we observe (Figure 2.19). While the region performs better than the OECD TL3 benchmark in areas such as long life, youth share of population or education, other aspects such as innovation, renewable energy generation or the share of females in the workforce continue to underperform. The following section will explore in more detail some dimensions that make up the citizen's experience of life in the Pilbara.

Figure 2.19. Well-being dimension of the Western Australia Outback, OECD benchmark of mining regions and OECD regional average, 2020

Comparing OECD mining regions with the Western Australia Outback, 100 = OECD average of TL3 regions



Source: Data obtained from the ''Toolkit to measure well-being in mining regions'' (OECD, 2023[1])

Higher wages for some do not equal higher standards of living for everyone

Living in the Pilbara region of Western Australia can be expensive, as shown in the Department of Primary Industries and Regional Development annual cost of living report (WA Government, 2019[53]). The Pilbara region had the highest Regional Price Index (RPI) compared to other regions in the state. Rural areas often face higher costs of service delivery due to lower population density, which means there are no economies of scale and service users, and providers must travel longer distances (OECD, 2020[54]). Even

though the regions of Gascoyne and Goldfields-Esperance have a lower population density than the Pilbara, they are geographically closer to metropolitan areas. Surprisingly, despite being more remote and further away from urban centres, the RPI in the Kimberley region is lower than that of the Pilbara (Table 2.9). However, upon closer inspection, it is evident that this difference is driven by significantly higher costs for housing and healthcare in the Pilbara.

The high cost of living in the Pilbara is a particular challenge for the local population, especially considering the FIFO culture prevalent in the mining industry. FIFO workers earn higher wages, which means they have greater purchasing power for the same goods and services as residents. Moreover, FIFO workers spend out of pocket relatively less than the permanent population, as their employer typically provides their food and accommodation. Instead, they tend to spend their income in their hometowns or elsewhere outside the region. Conversely, local resident mining workers have more spending power in the region and are likely to make a greater contribution to the local economy.

Table 2.9. Population density and cost of living

RPI 2019 Perth = 100

Region	2019 RPI	2020 population	Population density
Gascoyne	107	9 262	0.07
Goldfields Esperance	102.7	54 598	0.07
Great Southern	101.2	61 351	1.57
Kimberley	115.6	36 054	0.09
Mid-West	104.6	52 085	0.11
Peel	101.4	146 239	26.51
The Pilbara	**115.7**	**62 841**	**0.12**
Southwest	102.1	181 801	7.58
Wheatbelt	99.2	73 690	0.48

Note: Population density is defined as people per km². Population data are 2020 estimates. Consumption is weighted to the average patterns of Perth, not of specific region patterns.
Source: Regional price index 2019 Department of Primary Industries and Regional Development, Government of Western Australia (Government of Western Australia, 2020[55]), Australian Bureau of Statistics via REMPLAN.

The Western Australia Outback stands out in terms of job supply but needs to improve economic diversification and inclusion of women in the labour market

As mentioned before, the Western Australia Outback performs relatively well in economic terms, especially where mining operations take place. Employment growth has also faced a positive trend in the last decade (4.7% between 2007 and 2019), far above the growth in the benchmark of mining regions (2.6%) and just slightly below the OECD average (5.7%).

However, the region has scope for improvement in terms of diversification, share of female labour force (40% women to 60% men) and innovation activity. The region has a lower diversification level than other OECD regions and even than other mining regions such as those in the OECD benchmark. Diversification here is measured based on employment distribution across economic sectors. Innovation levels in the Pilbara are far lower than in the benchmark of OECD mining regions. While patents do not depict the entire innovation activity in rural regions, comparing patent levels among comparable rural regions can reveal action for improvement.

Demographically, the Pilbara differs from the wider Western Australia Outback

The Western Australia Outback stands out for its greater share of young people (21.7% of children between 0-14 years old in the population) than the OECD regional average (17%) and the OECD mining region benchmark (17.8%). However, this share is much lower across the Pilbara (16.8% for 0-19 year-olds in 2018). Young people are an important asset for the future of the local economy. Investing in opportunities to open up economic activities locally to this young population can help diverse economic activities. Educational attainment across the Western Australia Outback is higher than across Australia and the benchmark of OECD regions, but the Pilbara sees a significant share of the population with below upper secondary level of education.

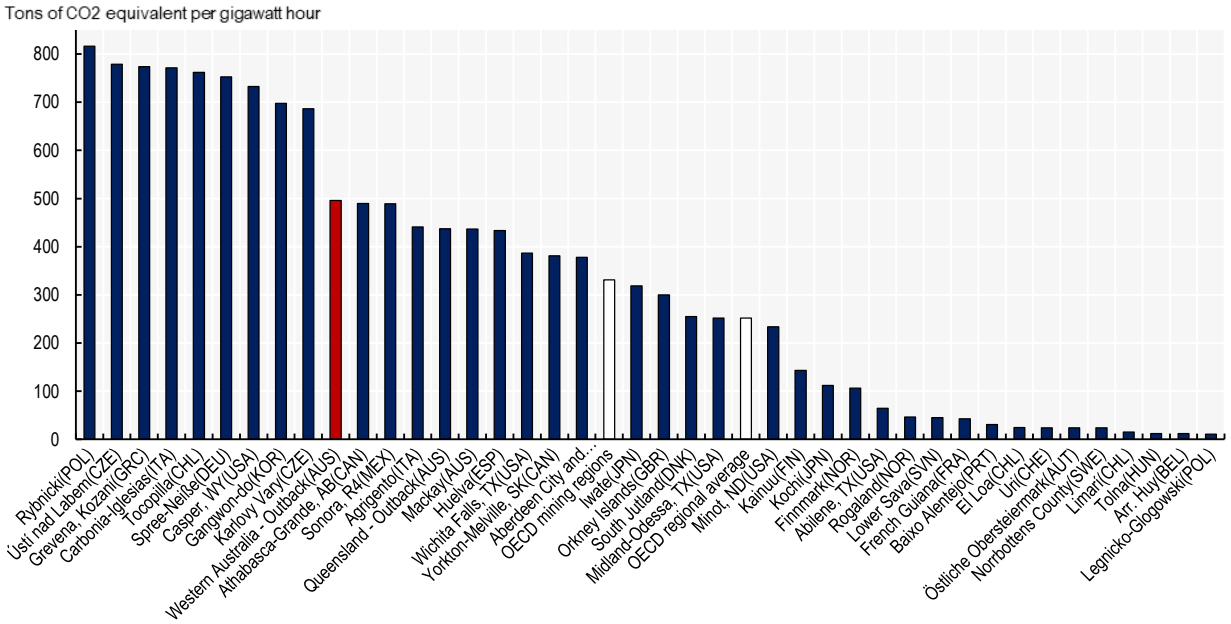
The Western Australia Outback benefits from a lower death rate (4.6% in 2015) than the average of OECD mining regions (9.7%) and even the regional average in Australia. It might be linked to greater access to healthcare in the region in comparison to other mining regions. In comparison, as mentioned above, healthcare provision in the Pilbara is amongst the lowest in Australia.

The Western Australia Outback generates higher GHG emission than the benchmark of mining regions and faces a decrease in green land cover

The Western Australia Outback is among the top ten regions with highest GHG emissions per capita within the 50 OECD mining regions benchmark. The industry sector produces most of the emissions in the region (31% of the total GHG emissions in 2019), ranking 7th within the OECD mining regions benchmark (OECD, 2023[1]). The large LNG projects in the Pilbara, which require substantial amounts of energy to operate and to liquefy gas and export it, along with dispersed mining operations that are mainly powered by fossil fuels, represent a significant source of the industrial GHG emissions in the region (The Australia Institute, 2023[56]). The second-largest source of emissions is the transport sector (28%), which is partly explained by long commuting times of freight and people through fuel-powered vehicles due to the geographical extension of the region, the low population density and marginal use of public transport for passengers. The agriculture sector (21%) is the third-largest source of emissions (OECD, 2023[1]).

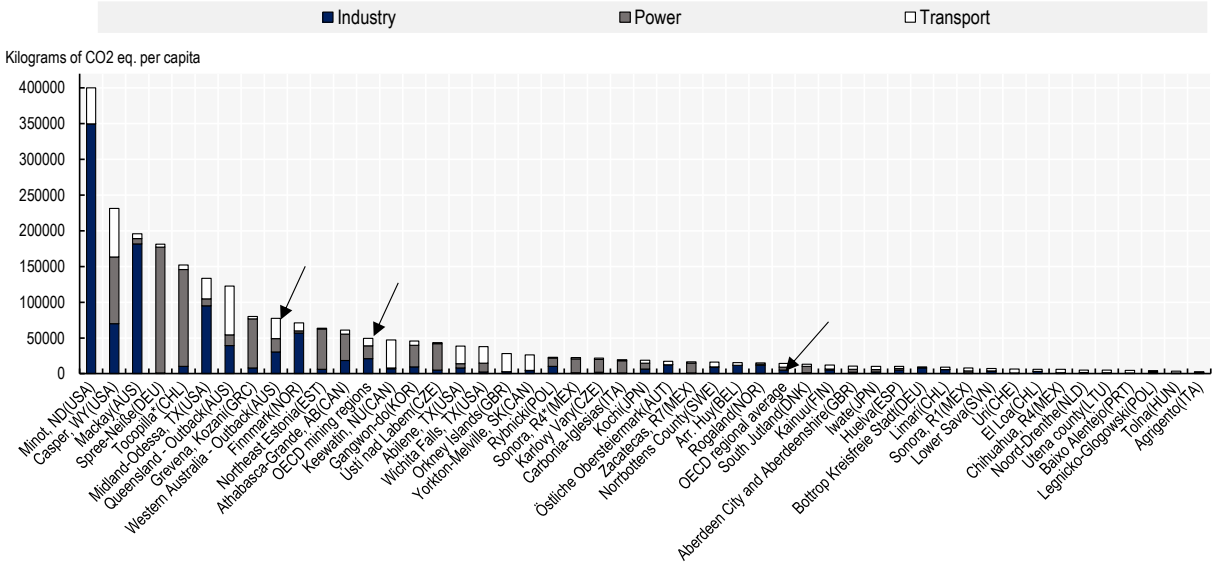
Moreover, the Western Australia Outback produces higher GHG emissions from electricity generation (496 tonnes of carbon dioxide [CO_2] equivalent per gigawatt hour) than the OECD benchmark of 50 mining regions (331) and almost twice above the OECD regional average (252) (Figure 2.20). Electricity generation in the region comes mainly from fossil fuels (more than 90%), with still a far lower contribution from renewable sources (mainly solar and wind) than the average of OECD mining regions (44% in 2019). Overall, the region generates higher GHG emissions across the power, transport, and industry sectors (77,320 kilograms of CO2 equivalent per capita in 2018) than in other OECD mining regions (47,605), and far above the OECD regional average (14,796) (Figure 2.21).

Figure 2.20. GHG emissions per unit of electricity generated, 2019



Source: OECD (2023[1]), "Toolkit to measure well-being in mining regions", https://doi.org/10.1787/5a740fe0-en.

Figure 2.21. GHG emissions per capita from the energy, industry and transport sectors



Source: OECD (2023[1]), "Toolkit to measure well-being in mining regions", https://doi.org/10.1787/5a740fe0-en.

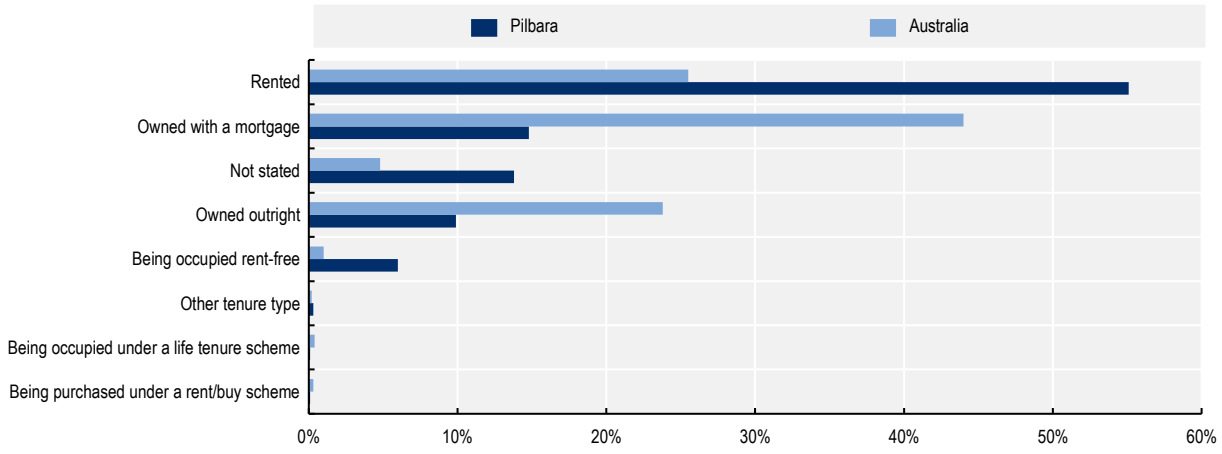
Housing is a key challenge in the region

The lack of available homes drives the high prices of housing. Residential vacancies in 2021 were below 1% and many of those who work in the mining companies have their accommodation provided for them by their companies (REIWA, 2022[57]). Figure 2.22 shows that 45% of dwellings are company or publicly owned. The rate of home ownership is much lower than in other parts of Western Australia, meaning rental

prices in the private rental market for lower-remunerated occupations, are fast becoming unaffordable and may even be driving people away. Data compiled by realestate.com.au show the Karratha suburb of Millars Well experienced the most rental growth in the year up to January 2021, surging by almost 40% to a median weekly rent of AUD 600 (realestate.com.au, 2021[58])

Incentives for long-term investment are mixed as pricing is highly cyclical and, once mining slows down, rental levels will drop, as will house prices. In addition, construction costs are very high as a consequence of the high cost of labour and materials that need to be supplied from far-away Perth. Home building approvals have also declined over the last few years, with just over 30 new residential buildings approved between 2019 and 2020 compared to over 300 five years prior (ABS, 2020[59]).

Figure 2.22. Housing ownership in the Pilbara region and Western Australia, 2021



Note: Not applicable includes non-private dwellings.
Source: Australian Bureau of Statistics 2021 Census of Population and Housing via (REMPLAN, 2022[9]) (Accessed on 30th March, 2023)

Across the OECD, in rural areas on average, housing costs are lower as land prices are cheaper per square metre than in larger metropolitan cities. In fact, this lower cost of living is often a driver in attracting residents to the area (OECD, 2020[54]). Considering the most scarcely populated OECD regions, the average number of rooms per capita is lower in remotely populated areas than the OECD average, as is the share of household disposable income spent on housing. However, Australian regions across the board have lower costs and a greater number of rooms per inhabitant than the OECD. This makes the findings in the Pilbara even starker (Table 2.10).

Table 2.10. Housing benchmarks

Region	Average number of rooms per inhabitant (rooms per capita)	Share of housing cost (in % of household disposable income)
Western Australia	2.5	13.5
Australia average	2.4	14.3
Population comparator region average	1.6	20.3
OECD average	1.8	23.1

Source: OECD TL2 regional statistics from OECD (2022[16]), *OECD Regional Statistics (database)*, https://doi.org/10.1787/region-data-en.

Chapter 4 will further explore the challenges to improve access to affordable housing in the Pilbara, which include: i) the volatility of the economy that leads to uncertainties in supply and demand of housing; ii) low levels of owner occupancy and high construction costs; and iii) high property prices and finance valuation delta shortages of affordable housing in the Pilbara. Chapter 4 will also make some recommendations to improve the housing market in the region.

Health and childcare can be bottlenecks for citizens' well-being

The average age of the region residents is 34, leading to an elderly dependency ratio of 3.3% (23.9% in Australia and 28% across the OECD). In theory, this means less pressure on healthcare services. However, poor environmental and household conditions (e.g., either work- or lifestyle-related) meant that 1 in 4 adults (24%) reported an injury requiring treatment from a medical professional. In addition, during 2007-11, 56% of deaths of Pilbara residents under 75 years of age could have been avoided through better use of primary prevention and treatment interventions and potentially preventable hospitalisations (hospitalisations that could have been avoided with disease intervention plans and various methods of preventative care); this is much higher than the state average (WAPHA, 2016[60]). Combining the high demand of services and remoteness of the region provides a reason for high costs. This is a challenge for many OECD remote regions. Recent OECD work on public service delivery costs in rural areas states:

> *"Lower density means higher transportation costs, loss of economies of scope and economies of scale, and greater difficulty in attracting and retaining professionals (e.g., health care professionals). At the same time, new technological advances have opened the door to providing quality services in new forms and substituting physical forms of delivery with virtual ones. Many governments increasingly pursue integrated and flexible approaches to the provision of services in rural areas as a way of maintaining quality and access. Integration involves the coordination of public services across a range of sectors –from health to education and eldercare/continuing support services."* Service delivery in rural areas - OECD

Investing in education is a key driver for social and economic development

As noted within the labour force segment, educational outcomes for the population are lower than the Australian average. This has improved over time, with final year of school or equivalent school completion shares increasing from 31% in 2006 to 42% in 2016; the Western Australian average is over half. This represents the greatest change, while the numbers attending tertiary education – including technical institutions – have increased but not substantially so (1 841 to 1 876 students from 2011 to 2016). As with many other OECD remote regions, costs associated with distance are key drivers of lower educational attendance. Lower levels of education do not directly translate to higher levels of youth unemployment (Table 2.11).

Table 2.11. Youth unemployment and educational attainment

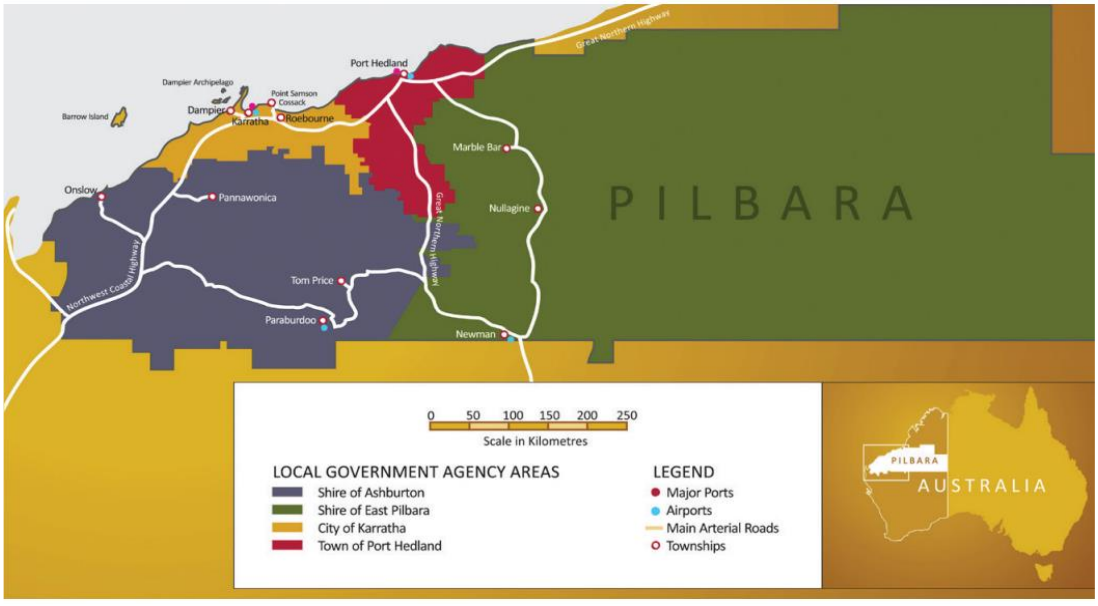
Region	Youth unemployment rate (% of unemployment 15-24 over labour force 15-24)	Below upper secondary education (% population 25-64)
The Pilbara	11.2	23.4
Western Australia	13.8	18.8
Australia	10.3	19.2
OECD average	16.3	26.5

Note: Educational attainments are internationally standardised through the International Standard Classification of Education (ISCED) 2011 (http://uis.unesco.org/en/topic/international-standard-classification-education-isced) used to define the levels of education: ISCED 0 Early childhood and pre-primary, ISCED 1 Primary, ISCED 2 Lower secondary, ISCED 3 Upper secondary, ISCED 4 Post-secondary non-tertiary, ISCED 5 Short-cycle tertiary, ISCED 6 Bachelor or equivalent, ISCED 7 Master or equivalent, ISCED 8 Doctoral or equivalent. The table above refers to the share who have completed up to but not including level 3.
Source: OECD TL2 regional statistics from OECD (2022[16]), *OECD Regional Statistics (database)*, https://doi.org/10.1787/region-data-en.

Whilst physical connectivity infrastructure is competitive, digital connectivity is limited

Infrastructure in the Pilbara region prominently features major ports, airports, roads, and towns (Figure 2.23). Given that the workforce operates predominantly on a FIFO (Fly-In Fly-Out) basis, the need for such connectivity is evident. Rail lines dedicated to transporting iron ore are abundant. However, these lines don't support passenger trains, and each rail network is owned and operated privately by individual companies for their iron ore logistics. With the vast distances separating towns, coupled with over 2,200 residents in 2016 expressing the lack of access to a motor vehicle, it presents travel challenges for many. Essentially, while there's robust infrastructure for goods transport, the same doesn't hold for the dynamism of people.

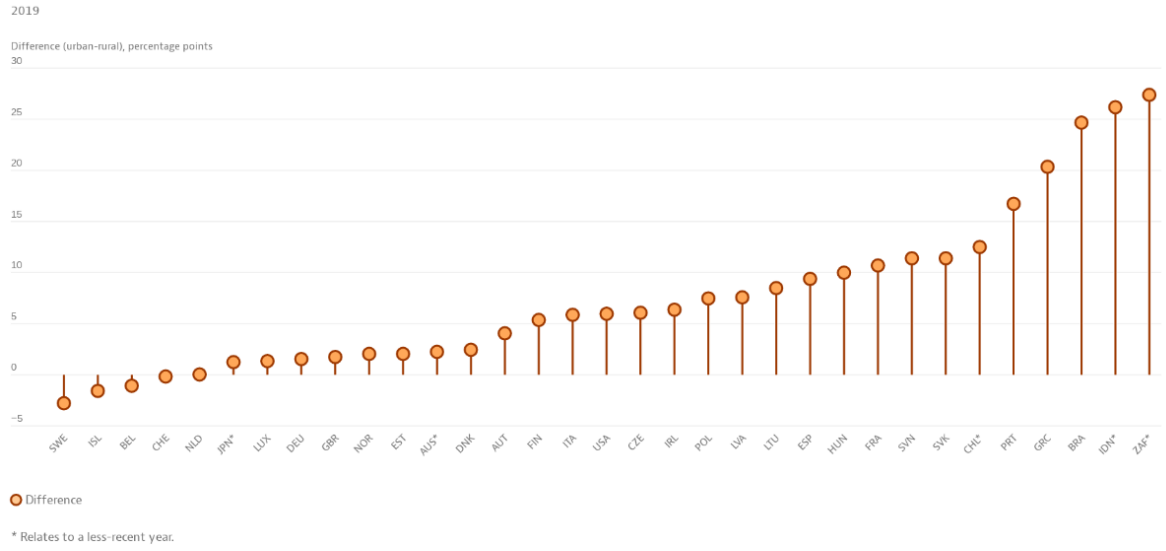
Figure 2.23. The Pilbara connectivity infrastructure



Source: Australian Government Initiative (2014[47]), *The Pilbara Resources & Beyond Regional Development Australia-Pilbara*.

The importance of technology, especially Internet infrastructure, cannot be overstated, especially for low-density regions. Enhanced Internet connectivity can mitigate several challenges, like isolation, heightened transportation costs, the expense of service delivery and the distance to markets. Earlier data suggested that in the 2016 census, only 42% of the Pilbara residents could access the Internet from their homes, a more thorough examination that filters out "not applicable" responses (which likely represent FIFO workers in non-private dwellings) shows a higher figure. When focusing on valid responses alone, an average of 86.7% of residents across the four Pilbara LGAs reported Internet access from their dwellings. All in all, Australia broadly ranks 12th among OECD regions on the digital urban-rural divide (Figure 2.24) (OECD, 2023[61]). Internet accessibility is a common challenge in Pilbara and the rest of rural-remote regions of Australia and the OECD.

Figure 2.24. Urban-Rural digital divide



Note: According to the OECD Regional Typology, a region is classified as rural if more than half of the population lives in local units with a population density below 150 inhabitants per km² and urban if less than 15% live in such low-density local units, with some variation for Brazil, Chile, Japan, Korea and the United States. See (Brezzi, Dijkstra and Ruiz, 2011[62]).
Source: OECD Going Digital Toolkit based on OECD (OECD, 2023[61]), *ICT Access and Usage by Households and Individuals (database)*, http://oe.cd/hhind and ITU (2022[63]), *World Telecommunication/ICT Indicators Database*, https://www.itu.int/en/ITU-D/Statistics/Pages/publications/wtid.aspx.

A closer analysis of the Internet accessibility across the Pilbara region highlights distinct variations among its subregions. In Karratha, 66.0% of its 25,262 residents accessed the Internet from their homes, and when focusing solely on valid responses, this figure rises to 89.4%. On the other hand, East Pilbara shows a different scenario. Out of its 17,933 residents, 22.0% accessed the Internet from their dwellings, and among valid responses, this percentage increases to 74.2%. The other subregions, Ashburton, and Port Hedland, exhibit connectivity rates of 21.2% and 59.4% respectively from their total populations, with the rates based on valid responses at 87.5% and 87.7%. This data emphasizes the importance of differentiating between total counts and valid responses to accurately assess digital connectivity. For a detailed breakdown, the subsequent table provides a deeper insight into the data across these subregions.

Table 2.12. Internet accessibility within the Pilbara region, 2016

	Internet accessed from dwelling	Internet not accessed from dwelling	Not stated	Not applicable	Total
Ashburton	5388	773	806	18426	25389
Karratha	16670	1967	2158	4464	25262
Port Hedland	10313	1448	2397	3208	17373
East Pilbara	3950	1372	824	11787	17933
Total	36317	5572	6182	37880	85958

Source: 2016 Census - Counting Persons, Place of Enumeration (MB). LGA by NEDD Dwelling Internet Connection. Counting: Persons Location on Census Night (ABS, 2022[64])

The long-term locals, the First Nations population

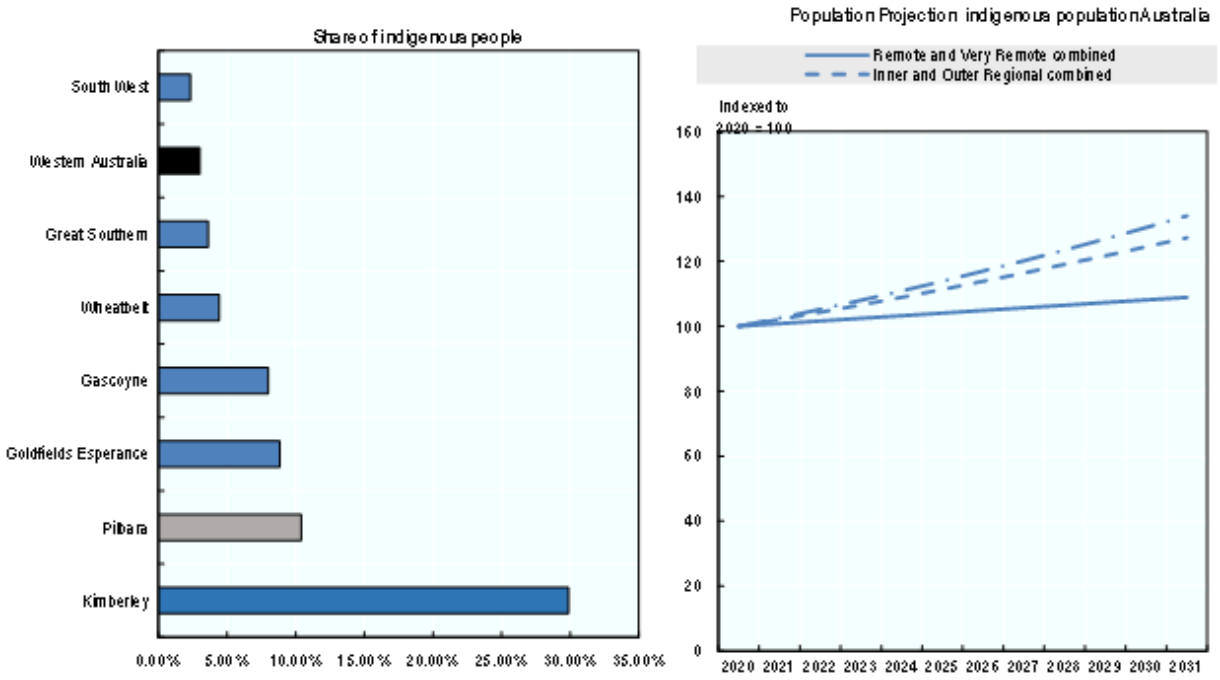
Some regional rankings mask vast inter-regional inequality, particularly between First Nations and non-First Nations peoples

The Pilbara region in Western Australia has a significant First Nations population, with 13% of the region's population identifying as First Nations, compared to just 3% across wider Western Australia (Figure 2.25). Additionally, almost half (45%) of the total Aboriginal and Torres Strait Islander population in wider Western Australia are under the age of 20, indicating a young age structure within the population (WAPHA, 2016[60]) (Figure 2.25).

However, using the region of East Pilbara as an example, these communities face significant disparities when it comes to income levels. The median personal income for First Nations individuals aged 15 and over is reported to be AUD 311 per week (in East Pilbara). This is significantly less compared to the median personal income of AUD 481 in wider Western Australia and AUD 540 nationwide. Thus, the First Nations community in East Pilbara earns substantially lower personal incomes, reflecting a significant income inequality in the region.

This disparity extends to family income as well. First Nations families in East Pilbara have a median weekly income of AUD 897, compared to AUD 1 469 for families in broader Western Australia and AUD 1 527 across Australia. Despite this, it is worth noting that the median household income for the First Nations community in East Pilbara slightly exceeds the state and national medians. Specifically, First Nations households in East Pilbara report a median income of AUD 1 529, compared to AUD 1 480 in Western Australia and QUD 1 507 nationally. This discrepancy could be a result of larger household sizes among the First Nations population.

Figure 2.25. The regional share and population projections of First Nations population

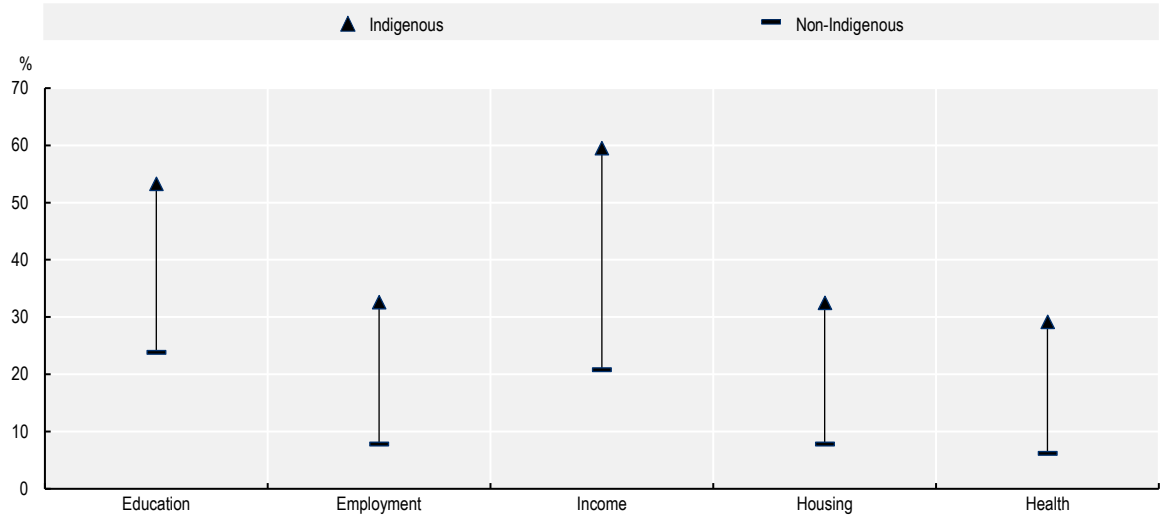


Source: Australian Census 2021 via (REMPLAN, 2022[9]) (Accessed on 14 May 2022)

The OECD report *Linking Indigenous Communities with Regional Development* (OECD, 2019[65]) reveals that First Nations populations are more likely to live in rural areas though recent trends show that they are becoming increasingly urbanised in countries such as Mexico and, to some degree, in Canada. However, the growth rate of First Nations peoples in these more rural areas is expected to decline over the next ten years. First Nations populations are more likely to experience poorer socio-economic outcomes, with the lowest employment rate of First Nations peoples found in Australia, while New Zealand has the highest rates (OECD, 2019[65]).

Despite land use agreements between mining companies and traditional owners, whereby trusts benefitting traditional owners receive significant royalties, poverty in many dimensions still persists among First Nations communities in the region. This is reflected in significant disparities across differences in health, education and income compared to non-First Nations populations, with estimations suggesting that non-Aboriginal people live around ten years longer than Aboriginal people in the Pilbara (ABS, 2017[66]). Figure 2.26 displays these inequalities by comparing five different dimensions that impact the quality of life of First Nations people in the Pilbara region, specifically focusing on education, employment, income, housing and health. Each dimension is presented as a percentage of First Nations individuals experiencing disadvantage compared to non-First Nations people in the same region, based on data from the 2016 Census and the Australian Bureau of Statistics.

Figure 2.26. Percentage of population experiencing disadvantage in the Pilbara region: A comparison of five dimensions, 2021



Source: Australian Census 2021 via (REMPLAN, 2022[9]) (Accessed on 14 February, 2022)

Employment and education

First Nations people in the Pilbara experience poorer socio-economic outcomes, with the lowest employment rate compared to other First Nations populations in OECD countries. In the Pilbara region at the start of the century, 60% of First Nations people were unemployed, with double the number of women compared to men in this category (Taylor and Scambary, 2005[67]). Those employed were often in lower occupational classes and earned, on average, AUD 250 less per week than non-First Nations workers, equivalent to approximately USD 10 000 per year in 2020 (NRHA, 2020[68]). By comparison, the income gap in Mexico was USD 11 600 (2016) and USD 4 000 in New Zealand (2013) (Olive, 1997[69]).

Educational outcomes are a significant factor in these disparities, as individuals with at least an upper secondary degree are more likely to participate in the formal economy, earn higher incomes and enjoy better health. However, the rate of upper secondary education attainment in the Pilbara is only 25%, which is lower than the national average of 33%.

Access to services

Access to essential services such as healthcare, transportation and telecommunications can be challenging for remote First Nations communities in the Pilbara. The Australian government has committed to improving service delivery to First Nations communities but there is still significant room for improvement in terms of accessibility and quality. Access to healthcare, in particular, is a concern for First Nations communities in the Pilbara. The National Aboriginal and Torres Strait Islander Social Survey (NATSISS) of 2014-15 found that First Nations Australians were more likely to report having a long-term health condition and the preventable hospitalisation rate for First Nations residents in the Pilbara was more than five times greater than that of non-First Nations residents between 2006 and 2010. Additionally, First Nations communities in the Pilbara are more likely to experience violence, with physical abuse rates significantly higher than non-First Nations communities.

Moreover, the 2014-15 NATSISS (ABS, 2017[66]) identified that 60% of Aboriginal and Torres Strait Islander people in Western Australia report long-term health conditions. In the Pilbara, between 2006 and 2010, Aboriginal residents had a preventable hospitalisation rate more than five times greater than non-Aboriginal residents. Additionally, physical abuse rates are considerable, with 27% of First Nations peoples in Western Australia experiencing or being threatened with physical violence in the previous 12 months, the highest rates across Australia; half of those incidents occurred within the family (ABS, 2017[66]). In comparison, the life expectancy gap is smallest in Mexico, where the average gap is less than two years.

Housing constraints

One-third of Western Australian First Nations peoples had experienced homelessness in 2015, with many living in overcrowded dwellings. While frequently an urban issue, housing constraints are relevant in the Pilbara despite being a relatively remote area. For example, in Canada, urban First Nations peoples are eight times more likely to end up being homeless than non-First Nations people living in cities (The Homeless Hub, 2019[70]). In 2015, one-third of Western Australian First Nations people had experienced homelessness despite it being frequently perceived as an urban issue. Housing affordability is also an issue, with many First Nations peoples struggling to afford rental costs in the Pilbara. The lack of affordable housing has resulted in many being forced to relocate to urban centres in search of better housing conditions, which can have significant cultural impacts. The housing crisis in the Pilbara has been attributed to a lack of investment in social housing by both the government and private sector.

Cultural diversity

First Nations people in the Pilbara are not a homogenous group, with differences in culture and socio-economic outcomes. The region is home to First Nations people working in a variety of employment niches, including mining, pastoralism, private business and community organisations. However, some feel excluded from such opportunities. One of the main challenges is preserving and celebrating the region's First Nations cultural heritage, which is under threat due to factors such as urbanisation and the impact of the modern economy, particularly the mining industry (ANTAR, 2022[71]). Efforts to preserve First Nations cultures and traditions can contribute to social cohesion and reconciliation.

Annex 2.A. OECD regions economically comparable to the Pilbara and the OECD mining region benchmark

Annex Table 2.A.1. Selected OECD TL2 "economically specialised" regions

Region	Code	Country	Sector specialisation	Regional GVA share (%)
Southern and Eastern	IE05	Ireland	Industry, including energy and manufacturing	91 and 68
Campeche	ME04	Mexico	Industry, including energy	68
Antofagasta	CL02	Chile	Industry, including energy	61
San Andrés	CO88	Colombia	Distributive trade, repairs, transport, accommodation, food services	59
Hokuriku	JPE	Japan	Public admin, education, human health	54
Mayotte	FRY5	France	Public admin, education, human health	53
Quintana Roo	ME23	Mexico	Distributive trade, repairs, transport, accommodation, food services	51
South Aegean	EL42	Greece	Distributive trade, repairs, transport, accommodation, food services	49
Western Macedonia	EL53	Greece	Industry, including energy	48
Vaupés	CO97	Colombia	Public admin, education, human health	48
Melilla	ES64	Spain	Public admin, education, human health	48
Tabasco	ME27	Mexico	Industry, including energy	47
Ceuta	ES63	Spain	Public admin, education, human health	47
Atacama	CL03	Chile	Industry, including energy	46
Taranaki Region	NZ17	New Zealand	Industry, including energy	46
Chungcheong region	KR05	Korea	Industry, including energy and manufacturing	48 and 44
Ionian Islands	EL62	Greece	Distributive trade, repairs, transport, accommodation, food services	45
Central Transdanubia	HU21	Hungary	Industry, including energy and manufacturing	46 and 43
Central Bohemian Region	CZ02	Czech Republic	Industry, including energy and manufacturing	45 and 42
Tarapacá	CL01	Chile	Industry, including energy	42
Guainía	CO94	Colombia	Public admin, education, human health	42
Western Transdanubia	HU22	Hungary	Industry, including energy and manufacturing	44 and 41
Thrace	TR21	Türkiye	Industry, including energy and manufacturing	44 and 40
Northern Hungary	HU31	Hungary	Industry, including energy and manufacturing	42 and 37
South East	BG34	Bulgaria	Industry, including energy	41
Northeast	CZ05	Czech Republic	Industry, including energy and	43 and 40

Region	Code	Country	Sector specialisation	Regional GVA share (%)
			manufacturing	
Central Moravia	CZ07	Czech Republic	Industry, including energy and manufacturing	43 and 40
Coahuila	ME05	Mexico	Industry, including energy and manufacturing	41 and 40
Gyeongnam region	KR02	Korea	Industry, including energy and manufacturing	41 and 37
Northwest	CZ04	Czech Republic	Industry, including energy	40
Algarve	PT15	Portugal	Distributive trade, repairs, transport, accommodation. Food services. Activities	40
Moravia-Silesia	CZ08	Czech Republic	Industry, including energy and manufacturing	43 and 37
Gyeongbuk region	KR03	Korea	Industry, including energy and manufacturing	42 and 39
Eastern Marmara - North	TR42	Türkiye	Industry, including energy and manufacturing	42 and 39
Toukai	JPF	Japan	Industry, including energy and manufacturing	40 and 38

Note: Sorted by Share of GVA. Excluding Australian regions, a sector is considered specialized if its regional GVA in one sector group accounts for 40% or more of the average regional GVA from 2016-18. Under OECD groupings, mining activity falls under industry, including energy, based on ISIC REV4. For completeness, if a secondary sector group exhibited a GVA of more than 35%, these details are included from the table above.
Source: GVA from OECD (2022[16]), *OECD Regional Statistics (database)*, https://doi.org/10.1787/region-data-en.

Mining benchmark

To better understand the effects of mining on regional development and the impact of the green and digital transition, the OECD has built a benchmark of 50 OECD regions with a high specialisation in mining activity relative to their respective countries and 13 indicators to measure well-being standards across these regions. The selection of 50 OECD regions uses the following criteria:

- First, identifying the small regions in the OECD country (Territorial Level 3). The OECD has more than 2 400 TL3 regions in its 38 member countries. The distribution of these regions by country is a mix of statistical and administrative boundaries that are at a geographically comparable scale and consistent with national classifications.
- Second, defining regional mining specialisation based on employment location quotients (LQ). The degree of regional specialisation in mining is obtained by comparing the share of mining employment in the region with the share of mining employment in the country. A value of LQ above one implies that the region is more specialised than its respective country. The employment specialisation in mining, based on LQ values, is ranked from highest to lowest.
- Third, 50 of these regions are selected taking into account their degree of specialisation in mining, the country's weight in overall mining employment across the OECD, the type of minerals involved and the geographical diversity.

The 13 indicators of well-being, adapted to the characteristics of OECD regions specialised in mining activities, draw on the OECD's well-being framework and are structured around the following three core dimensions of well-being:

- **Economy**: Economic diversification, unemployment, employment growth and innovation.
- **Community/social**: Gender balance, population growth, share of young population, death rate and education level.
- **Environment**: Change of green land cover, anomalies in soil water content and GHG emissions from the mining supply chain and electricity generation.

Annex Table 2.A.2. Fifty regions in the OECD mining region benchmark

Country	TL3 mining regions	Corresponding TL2 region
Australia	Mackay	Queensland
	Queensland Outback	
	Western Australia Outback	Western Australia
Austria	Östliche Obersteiermark	Styria
Belgium	Arr. Huy	Wallonia
Bulgaria	Starazagora	North West
Canada	Athabasca-Grande	Alberta
	Keewatin	Nunavut
	Yorkton/Melville	Saskatchewan
Chile	El Loa	Antofagasta
	Tocopilla	
	Limarí	Coquimbo
Czech Republic	Karlovy Vary	Northwest
	Ústí nad Labem	
Denmark	South Jutland	Southern Denmark
Estonia	Northeast Estonia	Estonia
Finland	Kainuu	Eastern and Northern Finland
France	French Guiana	French Guiana
Germany	Bottrop Kreisfreie Stadt	Rhine-Westphalia
	Grevena, Kozani	Western Macedonia
Greece	Spree-Neiße	Brandenburg North
Hungary	Tolna	Southern Transdanubia
Italy	Agrigento	Sicily
	Carbonia-Iglesias	Sardinia
Japan	Iwate	Tohoku
	Kochi	Shikoku
Korea	Gangwon-do	Gangwon region
Lithuania	Utena county	Central and Western Lithuania
Mexico	Caborca/Puerto Peñasco	Sonora
	Cananea/Fronteras	
	Concepción del Oro/Mazapil	Zacatecas
	Guerrero/Madera	Chihuahua
Netherlands	Noord-Drenthe	Drenthe
Norway	Finnmark	Northern Norway
	Rogaland	Agder and Rogaland
Poland	Rybnicki	Silesia
	Legnicko-Glogowski	Lower Silesia
Portugal	Baixo Alentejo	Alentejo
Romania	Gorj	South West Oltenia
Slovenia	Lower Sava	Eastern Slovenia
Spain	Huelva	Andalucia

Country	TL3 mining regions	Corresponding TL2 region
Sweden	Norrbottens County	Upper Norrland
Switzerland	Uri	Central Switzerland
United Kingdom	Aberdeen City and Aberdeenshire	Scotland
	Orkney Islands	
United States	Abilene	Texas
	Midland-Odessa	
	Wichita Falls	
	Casper	Wyoming
	Minot	North Dakota

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Notes

[1] The Fly-In Fly-Out (FIFO) calculation for the Pilbara region was determined by comparing the number of individuals working in Pilbara to the number residing there. The resulting figure represents the difference attributed to workers who commute to the region for work but do not live there. This methodology was applied for both the years 2011 and 2021, and the subsequent increase over the decade was calculated.

[2] The share of First Nations in the Pilbara has been obtained by combining the 2021 Census data from East and West Pilbara and based on the place of usual residence, serves as the most updated and closest approximation to identify the number of First Nations individuals in the region.

[3] 2016-18 average GVA. Cleaned for data anomalies.

[4] Where 40% or more of a region is 2016-18 average GVA is concentrated in one OECD industry group. See Box 2.1 for further information on the construction of benchmarks.

[5] Churn rate is the sum of birth and death rates of enterprises, provides a measure of how frequently new firms are created and existing enterprises close down.

At the same time, the rate of business churn is much higher than in other OECD regions. Calculated at as the proportion of entry plus exits to total firms in any given year, OECD economic comparator regions tend to have a lower churn rate than the OECD average.

[6] 25% of workers in the Pilbara hold a diploma or a degree compared to 39% in Western Australia and 42% in Australia.

3 Maximising the Pilbara's potential for a sustainable and diversified economy

This chapter examines the strengths and bottlenecks of the Pilbara's mining sector and identifies strategies and policy responses to overcome the bottlenecks and help unlock new growth opportunities in the region. The chapter begins with an overview of the Pilbara's mining ecosystem. It then analyses the weaknesses and strengths that the region can mobilise to improve diversification and encourage a more inclusive economy aligned with its mining potential. Finally, it examines the governance strategies that are required to ensure long-lasting regional development outcomes.

Assessment and recommendations

Assessment

The Pilbara's mining sector is a global powerhouse in the supply of quality iron ore that has fuelled the economic growth of the state and the country. The development of mining and other extractive sectors (oil and gas) has been characterised by private investments from top global companies that have deployed export-oriented infrastructure across the region (ports, railways and roads) and attracted a competitive pool of international companies in the mining equipment, technology and services (METS) sectors. The region also has one of the highest income per capita across OECD mining regions, a diverse amalgam of cultures and natural amenities, and a rich geology and export-oriented infrastructure. The Pilbara is benefitting from a growing investment interest in critical minerals necessary to the green transition e.g. lithium and manganese. By operating with the Australian Government's Critical Minerals Strategy and federal environmental reforms, the Pilbara can position as a potential key player in meeting global demand for critical minerals whilst ensuring the protection of natural and cultural resources.

However, the remoteness, low-density population, low level of First Nations people's economic engagement and high dependency on extractive activities have shaped a regional development model with economic volatility, high levels of fly-in fly-out (FIFO) workers, socio-economic disparity between First Nations and non-First Nations populations, and low economic diversification. The development approach has stifled the growth potential of local labour markets and manufacturing activities, small businesses and entrepreneurs in the region. Furthermore, there is scope to promote economic diversification strategies via greater co-ordination across state departments responsible for development projects in the Pilbara, local government plans and private company initiatives, with meaningful First Nations engagement.

The Pilbara has a good opportunity to mobilise its assets to become a global leader in supporting the global green transition, especially in Asia, and to create a diversified economy and long-lasting thriving communities. For this, the Pilbara needs to work with the region's First Nations and communities to co-create an economic ecosystem that continues to attract international investments and unlocks new growth opportunities inside and outside the mining and energy sectors:

- Inside the mining and energy sectors, the region can: i) diversify the minerals supply to meet global demand for critical minerals; ii) benefit from the deployment of renewable energy sources to decarbonise the economy and incentivise downstream processes locally; and iii) promote circular mining practices at scale to unlock business opportunities and reduce environmental impacts.
- Outside these sectors, the region can support First Nations and interested stakeholders to unlock: i) cultural and traditional business opportunities; ii) ecotourism and/or adventure-based businesses due to its environmental amenities; and iii) manufacturing, logistics and services that leverage the mining know-how and demand in the region.

Unlocking these multiple opportunities requires a coherent, long-term vision of the future of the Pilbara, with a place-based masterplan and mechanisms to co-ordinate and monitor actions across different state and federal ministries, in collaboration with First Nations, towards common strategies and to build local capacity and regional networks, with the aim of ensuring lasting, inclusive, and sustainable development in the region.

Recommendations

- **Diversifying and adding value to the mining and energy sectors in the Pilbara to leverage the global green transition with more sustainable practices and new growth opportunities for local companies, First Nations people and municipal citizens**. For this, the government of the state of Western Australia, in collaboration with the federal government, should:
  - Facilitate the co-development of critical mineral projects with active input from industry, various levels of government and local First Nations, promoting inclusive, collaborative, value-added initiatives and greater linkages locally.

    This includes:
    - Improving information inside and outside Australia on government support for midstream and downstream projects of critical minerals and the potential of the Pilbara's diverse value chains to support these projects.
    - Improving the co-ordination of the state and local First Nations and non-First Nations strategies with Australia's Critical Minerals Strategy, to ease conditions for strong, active partnerships such that industrial companies interested in processing critical minerals can build the necessary relationships to successfully establish themselves in the region and be better positioned to develop local and First Nations partnerships with shared outcomes and negotiate access to suitable land and infrastructure in the region.
  - Incentivise renewable energy projects with strategies tailored to the particular conditions of the Pilbara and with greater involvement of local businesses and First Nations communities. This includes:
    - Prioritising incentives for the deployment of renewable energies and hydrogen production in the Pilbara to decarbonise mining and play a strategic role in the green transition in Asia. This involves setting up a one-stop shop that co-ordinates state ministries' policies and regulators to expedite permits and work collaboratively with First Nations to ease access to land and the labour force.
    - Enabling First Nations equity ownership in renewable energy projects via federal or state public loans and debt guarantee programmes for greater access to finance and grants to enhance First Nations business capabilities.
    - Promoting shared renewable energy infrastructure and facilities (e.g. energy transmission networks) to expand access to clean energy beyond mining sites, including towns and ports. This involves policies to create interconnected energy ecosystems and power-sharing agreements.
  - Accelerate the uptake of sustainable mining and circular economy practices in the mining value chain to increase social license to operate, facilitate access to new markets demanding mineral traceability and unlock new, diverse business opportunities locally. This includes:
    - Establishing a networking platform that gathers providers, mining companies, academia and First Nations leaders to explore opportunities around circularity and define possible projects of common interest. This could allow mining companies to integrate external innovations in circularity, e.g. reusing mining equipment and valorising recycling projects of decommissioned infrastructure from offshore oil and gas operations.
    - Evaluating the development of regulations and public-private agreements to incentivise circular practices in mining, accompanied by a consolidated and public reporting of

progress in the adoption of circular practices in the region. Chile's law involving recycling targets for mining tyres could be a good example for the state government.

- In co-operation with First Nations corporations, improving the mapping and geological information of abandoned mines to enable waste mining opportunities and incentivise mining site rehabilitation.

- Promote more sustainable mining with greater transparency on environmental impacts by:
  - Improving public reporting of greenhouse gas (GHG) emissions in the Pilbara and working with extractive companies to better monitor emissions from energy production to incentivise energy transition.
  - Encouraging monitoring control of environmental impacts by First Nations communities and/or universities. This can be done through the provision of environmental monitoring systems to citizens or the establishment of environmental citizen boards (with mandatory First Nations board members), through public-private funds from companies.
  - Establishing a public and easily accessible report of certificates and due diligence carried out by mining companies in the region.

- **Mobilising the social and environmental capital of the Pilbara to boost entrepreneurship and foster local business**. For this, the state government of Western Australia, in collaboration with the federal government, should:
  - Facilitate access to government programmes and administrative processes via a single information source for local businesses, with a networking mechanism that connects entrepreneurs and small businesses amongst themselves and with large firms, financing companies and research centres. This can be in the form of a dedicated team in the Pilbara Development Commission (PDC) that actively reaches entrepreneurs across the region or a forum with a clear frequency that focuses on First Nations and non-First Nations small businesses and entrepreneurship, showcasing good experiences and government programmes.
  - Support entrepreneurship programmes for people already working in mining companies (intrapreneurship) to incentivise employee-driven businesses. In a labour market with low levels of unemployment, intrapreneurial programmes can help increase local business in the region. This involves easing and adapting access to capital and training for mining workers and adopting a proactive approach to reaching companies and workers. These programmes could also involve universities or research centres and be created in collaboration with mining companies.
  - Co-create or co-adapt existing entrepreneurship programmes with First Nations peoples to support and advance First Nations entrepreneurs and help foster strong First Nations partnerships with industry players. This can be accomplished by promoting entrepreneurship programmes in existing First Nations corporations and ensuring their long-term funding, and should involve improving connections with regional and international First Nations businesses and organisations and sharing success stories.
  - Improve the support to social enterprises (non-governmental organisations, First Nations corporations) by working with mining companies to better map and facilitate access to available funding from social responsibility programmes and enhancing connections with impact-driven investors outside the region. The PDC can play this broker role and help define and plan the business models of this enterprise.

- **Establishing a coherent place-based strategy with a long-term vision for development**. For this, the relevant state government departments should:

- Create a coherent long-term vision for the Pilbara's development with a communication plan. This vision should clarify priorities for the development of the Pilbara's communities in the long term and set clear goals in pressing well-being areas, and of the role of the Pilbara in the net zero transition of Australia and Asian countries, placing the region as a benchmark in "responsible sourcing" of raw materials and clean energy.
- Adopt a place-based policy approach with improved participation of local governments and First Nations to set strategies based on local priorities. This should be an action led by the state government that can build on the Pilbara Strategic Plan. This requires:
  - Adopting a proactive approach to integrate views of First Nations and non-First Nations peoples in the Pilbara through stakeholders or citizens platforms that support the preparation and monitoring process of the plan.
  - Involving local government areas (LGAs) and local government structures in the modernisation of state agreements. This calls for considering local visions in the amendments of state agreements.
  - Adopting an anticipatory policy approach to build strategies for different futures in the region, including a future without mining.
- Establishing a co-ordinating mechanism that sets common goals and investment action across state departments and supports the capacity of LGAs. The PDC can be instrumental in improving the co-ordination of policies at the local level. This involves:
  - Setting or adapting a current institutional mechanism to co-ordinate the implementation and monitoring of strategic policies in the Pilbara. This can be in the form of meetings or decision councils headed by the state premier with representatives of different stakeholders (academia, private sector, First Nations people and civil society). The example of the quadruple helix (4Helix) model in Eindhoven, Netherlands, can be good guidance.
  - Better linking corporate social responsibility and environmental, social, and corporate governance (ESG) strategies in the region with state and local government plans. This involves mapping these private strategies, disseminating them for public awareness and linking them with public policies. The region could increase transparency and accountability and support social licences to operate by making these ESG strategies and their links with local plans publicly available on a single website.
  - Enhancing the co-ordination of local governments, with technical guidance, promotion of synergies among local strategies, common business attraction plans and better information sharing on needs for labour demand and supply**.** The action of the inter-municipal agency Business Joensuu in North Karelia, Finland, represents a guiding example for this.

Introduction

The Pilbara is one of nine regions in the state of Western Australia and a leading global mining producer, accounting for a major share of the global mining value production of iron ore. The Pilbara is situated on the traditional lands of numerous First Nations communities and includes culturally significant archaeological sites, vast mineral and energy deposits and a significant potential for renewable energy based on a climate that makes it one of Australia's sunniest places. Besides mining, the region is a global player in liquefied natural gas (LNG) production and offshore oil (Chapter 2).

Mining has been the main engine for economic growth in the Pilbara, contributing to the largest share of exports for Western Australia and Australia. This sector also supported the recovery after the 2008 world financial crisis and mitigated the economic disruptions caused by the COVID-19 pandemic. The region presents a number of assets that make it attractive for mining ventures focused on other minerals for which new markets are emerging and can be mobilised to increase the impact of the sector in regional development. These include, amongst others, a strategic geographic location close to Asia with a solid export-oriented infrastructure, relatively lower cost of mineral extraction and an efficient regulatory and business environment with internationally competitive METS and mining firms.

However, the Pilbara faces challenges to attain a more diversified and resilient economy and increase regional attractiveness for people and businesses beyond the extractive sector. The remoteness of the region and the harsh weather, coupled with high dependency on extractive industries, have fed a regional development model characterised by economic volatility, high levels of FIFO workers, insufficient levels of engagement with local First Nations communities and businesses, low integration of local communities in the mining value chain, and relative few small and medium-sized enterprises (SMEs) and entrepreneurs.

The region has scope to leverage its mining and associated industries and its environmental assets and the First Nations' cultural heritage to become a strategic leader in supporting the global energy transition and creating diversified and thriving communities. The region's weather, geographical extension and energy know-how position the Pilbara with opportunities to deploy renewable energy projects and circular mining practices at scale. The deployment of renewable energy and hydrogen projects can be a means to create new partnerships with First Nations communities and new development opportunities locally while reducing the energy cost for downstream initiatives and placing the region as a strategic partner in the net zero transition of Asia. At the same time, the Pilbara's social and natural capital, with a multicultural population and pristine environmental amenities, can open further opportunities beyond extractive industries, including tourism and logistics.

Unlocking these multiple opportunities requires a long-term and coherent vision from the federal and state governments on the future of the Pilbara, with place-based strategies that build local capacity, networks and local coalitions among regional stakeholders with sustained funding and an ecosystem that focuses on supporting diversification inside and outside the mining value chain. The growing global requirement to reduce the environmental impact of mining operations can be harnessed in the Pilbara to enhance collaboration with mining companies and First Nations communities in an effort to accelerate investments and partnerships in clean energy technologies and circular practices. The resources industry in part addresses these challenges by offering its employees a FIFO alternative to residing in the region, which has also led to negative externalities in local communities, including cost of living and social cohesion.

This chapter identifies policy recommendations to help realise the potential of the Pilbara's mining ecosystem to unlock new growth opportunities that benefit the different and diverse communities in the region. The chapter begins with an overview of the Pilbara's mining environment. It then analyses the regional strengths that can be mobilised to meet a diversified and inclusive economy. Finally, it examines the governance strategies that are required to ensure long-lasting development outcomes in the region.

The Pilbara region as a global powerhouse of mining, with a competitive METS sector

The Pilbara's minerals and extractive sector is a worldwide powerhouse. It is home to an abundance of iron ore, offshore petroleum (primarily natural gas), lithium, gold, copper, nickel and uranium. Its national and global mining relevance spans across different dimensions (see chapter 2):

- The Pilbara produces approximately 93% of Australia's iron ore production and 28% of global production.
- The Pilbara accounts for 31.5% of the share of total export revenue in Western Australia and 11.5% in the country.
- The Pilbara's mining sector employs about 21% and 10,7% of the mining employees in Western Australia and in the country, respectively. This sector employs more than half of people working in the Pilbara.
- The Pilbara generates 91% of the royalties received by Western Australia (2021-22), representing around one-quarter of total Western Australian fiscal revenue (WA Government, 2022[1]).
- The mining sector accounts for more than 86% of total output in the region (Chapter 2)

The Pilbara also has relevant activity in oil and gas production, providing 85% of Australia's crude oil and 70% of Australia's LNG, which is mostly supplied to Asia. In fact, Australia is the second-largest exporter of LNG, behind Qatar. However, iron ore is by far the single activity that provides the greatest wealth for the region (AUD 134 billion of output in 2021), 2.6 times higher than the oil and gas industry's output (WA Government, 2022[1]).

A world leader in metal minerals, with a specialisation in iron ore

Since the establishment of the first iron mine in 1965, the region has been known as a global powerhouse of iron ore. The Pilbara's minerals history began with small-scale exploitations, mainly gold, at the end of the 19th century, when the first European settlements occurred, occupying a territory that historically was exclusively inhabited by Aboriginal populations. Yet, it was following the discovery of vast iron ore resources and the removal of the national government restrictions on the export of iron ore in the 1960s that the region initiated rapid growth of mineral production, fuelled by an increasing demand from Asian economies, particularly in the context of the post-Second World War expansion of the Japanese and Korean economies. As a result of this boom, ten new towns were created by 1970 (two of them have already closed) and the population increased tenfold.

In the early 2000s, the Pilbara experienced a boom in iron ore production, mainly driven by the demand from China's growing economy. In the first decade of the 2000s, the region opened 17 mines (more than 1.5 mines per year). Currently, the region has at least 60 principal mining projects (export-oriented and high value projects with mineral sales valued at more than AUD 5 million), which represents half of all principal mining projects in the state (WA Government, 2022[1]). All of the projects are export-oriented, with the People's Republic of China (hereafter China) as the main destination. This country accounts for three-quarters of iron ore shipments. Other major markets continue to be Japan and Korea. Today, the region leads a country globally renowned for supplying a range of mineral and hydrocarbon products. Australia (particularly Western Australia) already produces about half the world's lithium and is a globally significant producer of bauxite, gold, lead, rare earths, uranium, zinc, nickel, silver, cobalt, copper, tin, ilmenite, zircon and rutile.

The Pilbara's iron ore production is highly concentrated in two companies, BHP Billiton Limited and Rio Tinto, which account for more than 70% of the region's iron ore production volumes (together with various joint venture partners). Rio Tinto is the largest iron ore producer in the Pilbara and the second-largest iron ore producer in the world. With an integrated network of 17 mining sites in the region, this company exports

iron ore out of two locations: Cape Lambert and Dampier. BHP Billiton operates seven mining sites across the Pilbara and exports exclusively from Port Hedland. The region's third-largest iron production company is Fortescue Metals Group, which exports ore through Herb Elliott Port at Port Hedland.

The Pilbara's mining sector has increased its activity in other minerals

Beyond iron ore, the region has one of the most important productions of lithium in the world, along with significant production of gold, copper, manganese and nickel (Table 3.1).

Table 3.1. Value of minerals and share over total value in the Pilbara, 2021-22

	Value	Share in the Pilbara's total mineral value (%)
Iron ore	134 361 355 958	97.6
Gold, silver and copper	1 373 041 534	1.0
Lithium (spodumene and tantalum pentoxide)	994 504 888	0.7
Salt	438 933 365	0.3
Manganese ore and crude oil	431 154 700	0.3
Construction materials	73 222 901	0.1
Dimension stone and gems and semi-precious stones	1 398 744	0.0

Note: Crude oil does not include offshore petroleum.
Source: WA Government (2022[1]), *Mineral and Petroleum Statistics Digest 2021-22*, http://www.dmp.wa.gov.au/Documents/About-Us-Careers/Stats_Digest_2021-22.pdf.

- **Gold**: Gold is the second largest mineral production in the region, after iron ore, and is primarily produced by Newcrest's Telfer mine in the East Pilbara, one of Australia's largest gold mines. Gold exported from the Pilbara predominantly goes to China, India and the United Kingdom.
- **Lithium**: The Pilbara is home to the second- and third-largest lithium-producing mines in Australia: Pilgangoora, 120 km south of Port Hedland (split into 2 resources, Altura Mining Ltd, with approximately 586 kilotonnes of lithium content [kt Li] and Pilbara Mining Ltd, with approximately 204 kt Li) and Wodgina, 110 km south of Port Hedland (approximately 240 kt Li). Given that Australia is the largest lithium producer in the world, these mines represent some of the most important lithium sources in the world. In fact, about 95% of Australia's lithium resources are found within just 5 deposits and all are in Western Australia (Champion, 2019[2]),[1] with the world's largest producing lithium deposit (in the form of spodumene) in the southwest region of the state in the Yilgarn Craton (Greenbushes Lithium Operations with 1 320 kt Li).
- **Manganese**: The Pilbara has the only two principal mining projects of manganese in Western Australia: Woodie Woodie in the Shire of East Pilbara, the second major producer in the country, and new project Butcherbird that achieved its first shipment in July 2021 (Summerfield, 2021[3]).
- **Copper**: The region is also an important national player in the production of copper and nickel. The Birla Nifty Copper Operation, located 350 km east of Port Hedland, is Western Australia's second-largest copper mine. The concentrate product is exported to India. The expected growth of energy demand for minerals will increase the attractiveness of mining the Pilbara's copper deposits.
- **Salt fields**: The region also has considerable coastal salt fields, with large ventures operating out of Dampier, Onslow and Port Hedland.

Table 3.2 depicts the main mines in operation in the Pilbara, which are classified as Western Australia's principal resource projects, are export-oriented and of high value, with individual mineral sales valued at more than AUD 5 million (or more than 2 500 ounces of gold).

Table 3.2. Main mining sites in the Pilbara by owner, year, main commodity, company and LGA, 2023 (selected)

Mine name	Year opened	Main commodity mined	Company owner	Town (LGA)
Mount Tom Price	1966	Iron Ore	Rio Tinto	Tom Price (Shire of Ashburton)
Hamersley iron ore mine	1966	Iron Ore	Rio Tinto	Tom Price (Shire of Ashburton)
Mount Whaleback	1968	Iron Ore	BHP Group	Newman (Shire of East Pilbara)
Paraburdoo	1972	Iron Ore	Rio Tinto	Paraburdoo (Shire of Ashburton)
Newman	1972	Iron Ore	BHP Group	Newman, (Shire of East Pilbara)
Woodie Karla Winda	1990	Manganese	Consolidated Minerals	Shire of East Pilbara
Marandoo	1994	Iron Ore	Rio Tinto	Tom Price (Shire of Ashburton)
Yandicoogina	2002	Iron Ore	Rio Tinto	Tom Price (Shire of Ashburton)
Hope Downs 1 and 4	2006	Iron Ore	Rio Tinto/Hancock Prospecting	Nullagine (Shire of East Pilbara)
Cloudbreak	2007	Iron Ore	Fortescue Metals Group	Port Hedland
Firetail	2008	Iron Ore	Fortescue Metals Group	Port Hedland
Christmas Creek	2009	Iron Ore	Fortescue Metals Group	Port Hedland
Chichester Hub	2011	Iron Ore	Fortescue Metals Group	Nullagine (Shire of East Pilbara)
Solomon Hub	2013	Iron Ore	Fortescue Metals Group	Tom Price (Shire of Ashburton)
Sino Ore	2013	Iron Ore	Citic Pacific Mining	Roebourne (Karratha)
Roy Hill	2015	Iron Ore	Roy Hill Holdings	Shire of East Pilbara
Pilgangoora lithium mine	2018	Lithium	Pilbara Minerals Limited	Port Hedland
Karlawinda	2021	Gold	Capricorn Metals	Shire of East Pilbara
Gudai-Darri	2022	Iron Ore	Rio Tinto	Shire of East Pilbara
Warrawoona	2022	Gold	Calidus Resources	Shire of East Pilbara

Source: OECD elaboration, (WA Government, 2022[1])..

An attractive region for mining investment with clear geological information and an agile regulatory environment

Western Australia also benefits from a business-friendly regulatory environment, which is seen as predictable and stable compared to other mining jurisdictions. Western Australia ranks as the most attractive jurisdiction for investment in mining in the world according to the 2021 Fraser Institute Investment Attractiveness Index applied to 83 jurisdictions. This index represents the opinion of executives and managers around the world in companies involved in mining exploration, development and other related activities in the sector (290 responses in 2021) (Yunis and Aliakbari, 2022[4]). The regional attractiveness has had a steady improvement over the years. The Fraser Institute mining investment attractiveness ranking went from 11th (of 77) in 2020 to 4th (of 84) in 2021 and 1st place in 2022. The factors explaining Western Australia's mining investment are the quality of the geological database, security, political stability, and low trade barriers.

The region also stands out with its transparent permitting process. According to the Fraser Institute 2022 survey, about half of respondents stated that the time expected to obtain a permit for exploration in Western Australia is less than 2 months, which is the top 3 best performance of the 20 jurisdictions analysed (regions in Canada, the United States and Scandinavia) (Yunis and Aliakbari, 2022[4]). Moreover, it was the second-best performing jurisdiction in terms of the level of transparency and in meeting established

timelines (62% of respondents indicated that the permitting authority met its own established timelines between 80% and 100% of the time) (Yunis and Aliakbari, 2022[4]).

This positive international perception is in line with the state government initiatives to reduce uncertainty for investors and approval times to obtain permits and notices to either conduct exploration activities or start the construction process (Box 3.1).

Box 3.1. Selected Western Australia government initiatives to increase efficiency and efficacy of mining regulation

Ensuring mining projects reduce to a minimum their social and environmental impact requires strong government evaluation and monitoring that needs to be coupled with agility and certainty to create dynamic investment environments.

The initiatives below are a selection of relevant Western Australia government initiatives to improve transparency for mining investment, and reduce uncertainty and approval times.

Geological Survey of Western Australia (GSWA) geological database

The GSWA has developed several applications to view and access geological and resource information about the geology of the state. It includes the GeoVIEW.WA online GIS-based mapping tool that allows users to view, query and map various geoscientific and resource information. Users can construct and print a customised geological map and incorporate other mineral and petroleum exploration datasets, including mines and mineral deposits, petroleum wells and active leases. GeoMap.WA is a standalone application that allows users to visualise, interrogate and integrate vector and raster data types and associated attributions.

The GSWA Unearthing Western Australia Strategy 2030 also supports the Exploration Incentive Scheme, the state's flagship programme to encourage exploration in underexplored areas of the state, with ongoing funding of AUD 10 million per year since 2017.

Fast-track construction of mining sites

The Department of Mines, Industry Regulation and Safety (DMIRS) has implemented new processes to allow environmental assessments of the whole mining infrastructure corridor to be conducted as part of a holistic mining proposal at the start of the project, rather than conducting the assessment of the infrastructure corridor after land access licences have been granted.

Many large mining projects rely on infrastructure corridors to connect their mines to processing and export facilities. Mining companies were previously required to have all land access licences granted prior to lodging applications for environmental approval, meaning that construction could not start until land access was approved along the entire corridor.

Streamline WA

Launched in December 2018, Streamline WA is a whole-of-government initiative designed to make it easier to do business in Western Australia by improving regulation and regulatory practice. Its priority focus is environmental approvals for mining. A series of workshops were held with representatives from state and local governments, industry and environmental consultants to help build the initiative.

The Streamline WA Mining Environmental Approvals Project Board is a partnership between key approvals agencies – the Department of Water and Environmental Regulation and the DMIRS – to improve and clarify regulation of mining environmental approvals.

Single process to achieve federal and state regulation

The Commonwealth aims to enter in an approval bilateral agreement with Western Australia to provide a single avenue for industry to achieve Commonwealth and state environmental approvals. It is estimated to result in an average six-month reduction in decision-making timeframes.

Source: (Government of Western Australia, 2021[5]).

A strong export-oriented private-owned infrastructure but with scope for synergies

The Pilbara is an extensive and remote region, covering twice the size of the state of Victoria and similar to countries like Spain. Moving among the four main cities of the region, Karratha, Newman, Port Hedland and Tom Price, can take more than five hours on average. Such dispersity creates challenges to attain economies of scale for innovation, moving freight and people, matching labour supply and demand or providing public services (Chapter 4).

The privately owned infrastructure, coupled with cost-competitive ore extraction and its strategic proximity to major markets, has helped alleviate impacts during decreasing iron ore international prices and placed this mineral as a continuous source of growth for the region. For example, back in 2015, when iron ore prices fell almost by half, many small iron ore producers, as well as domestic African, Chinese and South American producers, withdrew or reduced their iron ore supply due to their relatively higher operating costs, resulting in increased global market shares for major Pilbara-based iron ore producers.

Mining also requires certain essential infrastructure if it is to develop its full potential: this includes roads, railroads, airports and ports for the inward flow of raw materials and personnel, as well as for the industry's outward flow of products. A reliable energy supply, both in the form of generation and transmission capabilities, is a key element to power mining operations and processing plants. Likewise, communication and information technology (IT) networks, particularly high-speed broadband, are increasingly needed for mining, allowing remote operations and automation transition.

The Pilbara benefits from a strong transport infrastructure, whose development has been mainly driven by mineral and hydrocarbon production. Mining companies have invested for a long time in infrastructure that facilitates the construction of the mines and exports of the products. In fact, mining companies have privately funded many ports and routes, allowing companies to tailor the export infrastructure to their planned needs. The infrastructure governance framework in Australia has facilitated infrastructure development by private companies. The main features of the infrastructure in the region include:

- Five main public airports located at Karratha, Newman, Onslow, Paraburdoo, and Port Hedland. As a result of FIFO traffic associated with construction activity in the mining sector, passenger traffic has increased significantly over the past five years at all airports, especially Karratha, which has become Western Australia's second-largest airport for passenger movements (over 850 000 passengers passing through each year). These public airports are complemented by a large number of private aerodromes and airstrips servicing more remote mining and pastoral operations.
- Numerous marine facilities and offshore petroleum terminals support three major international-calibre ports at Cape Lambert, Dampier and Port Hedland. In fact, Port Hedland is Australia's largest port by annual throughput and the largest bulk export port in the world, with iron ore, mainly mined by BHP Billiton and Fortescue Metals Group (FMG), dominating the exported goods and fuel and oils, representing the main imports of this port.

- The rail network is privately owned and transports the bulk of iron ore production. It comprises approximately 1 525 km of rail on the 4 main lines of Fortescue railway (FMG), Goldsworthy railway (BHP), Hamersley and Robe River railway (Rio Tinto) and Mount Newman railway (BHP).
- Roads transport some mining outputs and almost all mining inputs. While some iron ore and all other minerals production are transported by road instead of rail, roads are used to move smaller volumes of mineral products and provide a key transport mode for people and other industries such as agriculture.

Nevertheless, some challenges exist in making the most of the infrastructure for diversified regional development, especially in the midst of the green transition.

- First, much of the privately owned infrastructure that serves the mining and hydrocarbon sector is largely at capacity and prevents use by new operations and other economic sectors. The need for multipurpose regional infrastructure is more evident in the rail network.
- Second, as projected with the green transition, a decreasing trade of hydrocarbons in the coming decades might hamper the economics of some existing ports, which requires adapting strategies to other non-mining industries. Exports of hydrocarbon-based industries still represent an important share of cargo in these ports. Planning for future needs in cargo requires long-term thinking and a degree of investment risk to offer solutions to new industries.
- Finally, the road network is old and there is a lack of transport infrastructure corridors to facilitate and shorten travel times between the region's cities. As roads are less of a focus of investment by mining companies, significant sections of the road network are to be maintained and not all roads are sealed, with many gravel and dirt roads.

To address these issues, the state government and the PDC should:

- Improve co-ordination in the use of the Pilbara's infrastructure to allow multiple uses, for example in railways, that it may also benefit non-mining economic sectors. This strategy can be inspired by spaced-based sharing models with a degree of priority to infrastructure owners.
- Collaborate with port owners to create long-term strategies to replace cargo from hydrocarbon-based industries.
- Use the opportunities to enhance active business partnerships with local First Nations communities and business owners and co-operate with those partners and other companies to upgrade tertiary roads and non-mining transport infrastructure through, for example: benefit-sharing agreements in projects linked to further expansion of the resource industry in the East Pilbara; the use of public-private investment models or business crowd-funding models that include spreading the cost of equipment over several organisations to maximise its productivity.

A competitive METS sector but mainly headquartered outside the Pilbara

Western Australian-based METS companies are held in high regard internationally for being technology-leading and able to operate in the world's harshest and remote conditions. Australian mining and METS companies compete in a contested international market, where innovation and technological improvements play an important role in remaining globally competitive. Overall, about 66% of METS businesses in Australia are located in New South Wales, Queensland and Western Australia.

Western Australia's METS sector serves many of the most important resource projects in the world and is also a global resources technology base for the Asian and Indian Ocean regions. Out of the 100 top METS companies globally, 77 operate in Western Australia and 22 are headquartered in the state (Mining Journal Intelligence, 2021[6]). While many of the mining companies operating in the Pilbara also have activities in mining technology and services (BHP and Rio Tinto), there are about 1 702 specialised METS companies in the state. A number of the international METS companies servicing the mining sector through their

Western Australian operations include ABB, Atlas Copco, General Electric, Hitachi, Komatsu, METSO, Outotec, Sandvik and Thyssen Krupp. These companies span across various activities, including mining support services, chemical manufacturing, telecommunication services, computer systems design, equipment manufacturing and transportation services.

Most of these METS serve operations in the Pilbara but tend to be located outside the region, either in Perth or other states. According to Austimine's WA METS Digital Mining Export Hub project, about 268 METS are doing business in the Pilbara, based on the Industry Capability Network WA and vendor registration (Austmine, 2022[7]). Out of those companies, only 45 – less than 17% – were companies with a primary business location or headquarters based in the Pilbara, mainly in Karratha (23 businesses recorded). The rest were located either in Perth (35%) or the Northern Territory (38%); 13% of the METS companies headquartered in the Pilbara were owned by First Nations people.

As in other OECD remote and low-density populated mining regions, the Pilbara region faces entrenched challenges to attain economies of scale in labour supply and technological investment to support local METS development. The challenges of low economies of scale are coupled with other particular challenges of the region, including the competition with high levels of FIFO workers and high operational costs. Nevertheless, some opportunities can be capitalised to better integrate local businesses in mining operations and scale them up (Table 3.3).

Table 3.3. Challenges and opportunities to scale up local companies in the Pilbara's mining value chain

Challenges	Opportunities
High number of FIFO workers who self-perform contracts with low levels of subcontracting	Knowledge spillovers from globally competing mines in innovation to local companies that visit mining sites
A corporate perception that there is little digital capability in the region to conduct technological projects	Industry adoption of operational cost tender evaluations that incorporate ESG and enhanced Aboriginal participation
Low levels of internationalisation as local METS tend to conduct the value propositions around proximity to mining site and infrastructure	New trade opportunities from a forthcoming direct shipping service from Singapore, which can improve cost structures of certain supplied products entering the region
High regional operational costs due to housing prices, cost of transport	

Source: Based on stakeholder interviews and Austmine (2022[7]), *WA Regional Profiles Report 2021*, WA METS Digital Mining Export Hub Project.

Some initiatives have promoted local business training and participation in mining value chains (Table 3.4).

Table 3.4. Initiatives to increase local content in mining value chains

Strategies	Initiative selected	Description
Mining companies	Rio Tinto Australian procurement portal companies	Easing the process for local companies to become providers of mining operations.
	BHP C-Res Local Buying Program is available in Newman and Port Hedland	Identifying and understanding regional business capabilities and finding supply opportunities. Hub recruitment and SME export/digital mining capability development activity.
	Rio Tinto's commitment to pay suppliers for purchase orders below AUD 1 million within 30 days of operating	Supporting provider cash flow.
Other private strategies	Karratha-based company Tender Relief	Assistance, workshops, a tender response template and training for small companies to bid for tenders and contracts across the region.
Public	PDC local content round table	

	Karratha local content roundtable	
	Newman Business Activation Program (run by the Shire of East Pilbara)	Activating new co-working spaces. For example, ensuring that a flexible module facility, known as The Edge, becomes a sustainable shared office space, commercial kitchen and retail pop-up space.

Mineral transformation activities are also less present in the region

The Pilbara's economy has a low share of forward linkages in the mining value chain (see Chapter 3). Most current manufacturing capacity in the Pilbara region is directed towards servicing the mining industry and is dominated by chemical manufacturing, machinery and equipment manufacturing, and fabricated metal products. Basic chemical manufacturing represents close to half of the Pilbara's manufacturing output, including the Yara Pilbara Nitrates technical ammonium nitrate production facility in the city of Karratha.

Iron ore is exported with little value-added: it is crushed, screened, and blended before being directly exported on bulk carriers from the region. As mentioned above, it is used as a key input to the East Asian, mainly Chinese, steel manufacturing industry.

The region's remoteness from markets and high-cost structure (energy, labour, chemicals, logistics, etc.) have served as significant detractors from investment in downstream and manufacturing capacity in the Pilbara.

The increasing investment in renewable energy infrastructure could improve the conditions for manufacturing in the region (see next section), not only from a cost perspective but also with respect to the lifecycle assessment of the carbon emissions of manufactured products. Renewable energy (solar and hydrogen) has the potential to reduce energy costs in the region. At the same time, this is an opportunity to unlock First Nations and industrial businesses to support the deployment of the new energy infrastructure. Regardless, the Pilbara will still face significant cost issues with respect to manufacturing.

In summary

The Pilbara is a global powerhouse of minerals supply, with great strength in exploration and extraction phases. Yet, other elements of the mining value chain are less present in the region, including processing and transformation and local equipment, technology and service providers. A significant number of companies operate in the Pilbara but many have their main operations and headquarters located in Perth, the capital of Western Australia. This is also the case for METS multinational companies operating in the region.

The Pilbara has a number of assets that make it one of the most attractive jurisdictions for mining investment. These include its geology, the opportunity to partner actively and fairly with local First Nations communities, which would work to facilitate uncontested access to large uninhabited land areas, its geographic location close to Asia, good infrastructure (ports and airports) along with a competitive, regulatory environment that is less likely to be overturned through active, local First Nations participation in regional development economy and internationally competitive mining companies.

Nevertheless, as explored later in this chapter, the mining business ecosystem needs greater integration of operations and synergies with the local First Nations and non-First Nations communities, supporting opportunities inside but also beyond mining. Moving beyond an economy highly dependent on an extractive sector with low value-added can help outline diversification strategies to better prepare the Pilbara's mining ecosystem for the green and digital transition and unlock new growth opportunities for sustainable and inclusive development.

Mobilising strengths of the Pilbara to attain a diversified and resilient economy

The mineral resource sector has brought income and development to the region and, as in many OECD mining regions, the wealth produced by this sector has translated into important investment rates, infrastructure development and high income for some regional dwellers (McMahon and Moreira, 2014[8]).

Nevertheless, the Pilbara's high reliance on mining activities, along with its remoteness and harsh climate, have shaped a regional development model characterised by high volatility due to the FIFO culture generating a number of challenges to the well-being of the region, such as negative impacts on social cohesion and a shortage of affordable housing, childcare and quality education. This model at scale provides few incentives for economic diversification in the region, placing the Pilbara among the least diversified mining regions across OECD (Chapter 2).

The long-term sustainability of both the mining sector and the region itself relies on transitioning to a well-functioning regional environment that creates opportunities for people and families to work and live. A combination of strategies to promote economic diversification and increase accessibility to quality public services and infrastructure (e.g. housing) is a cornerstone to attain sustained and resilient growth in the Pilbara. One that goes beyond the life of mining itself.

At the same time, the international climate and sustainability goals have increased the political and social pressure for a more sustainable use of resources and reduction of environmental impacts of economic growth. The Pilbara can benefit from this increasing demand for sustainable practices to accelerate the decarbonisation of its mining sector while facilitating First Nations participation and opening local business opportunities around renewable energy technologies and circular economy practices. These processes can help improve social licence to operate in the region and improve social cohesion by involving First Nations and non-First Nations communities in environmentally sustainable activities across the mining value chain.

This section focuses on policy strategies to unlock new growth opportunities, while the next chapter will discuss policy recommendations linked to greater liveability. A vast development literature agrees that economic diversification cannot be imposed from the top down or conducted without consideration of local assets. Therefore, any policy strategy to support the Pilbara's diversification should be anchored on existing strengths and opportunities, including its resource sector. Based on the literature review and virtual and onsite interviews with various stakeholders, this study identifies four main areas to unlock the Pilbara's new growth opportunities:

- Diversifying the supply of minerals to meet the global demand from the green transition.
- Benefitting from the deployment of renewable energy sources to create a new partnership with First Nations by integrating them as active participants and owners of renewable energy assets.
- Promoting circular mining practices to reduce environmental impacts and unlock new business.
- Unlocking business opportunities based on its cultural, traditional and environmental amenities.

Leveraging the global demand for minerals for the energy transition

The Pilbara is more than iron ore and LNG, offering deposits of new minerals that can meet the increasing demand from green energy technologies. Mobilising new minerals will help diversify supply chains beyond iron ore and fossil fuels, and attract new types of companies into the Pilbara.

The Pilbara's geological framework consists of a stable craton with world-class mineral deposits, including gold, iron, nickel and heavy mineral sands. The Pilbara Craton is a coherent geological area of 300 km by 500 km and one of Australia's 3 main areas of oldest rocks, along with the Yilgarn Craton in the south of Western Australia and the Gawler Craton of South Australia (Phillips and Matchan, 2007[9]). Much of the Pilbara Craton consists of exposed rocks. The depth of weathering is quite variable, being many tens of metres in places and negligible in other places where there are fresh rocks at the surface.

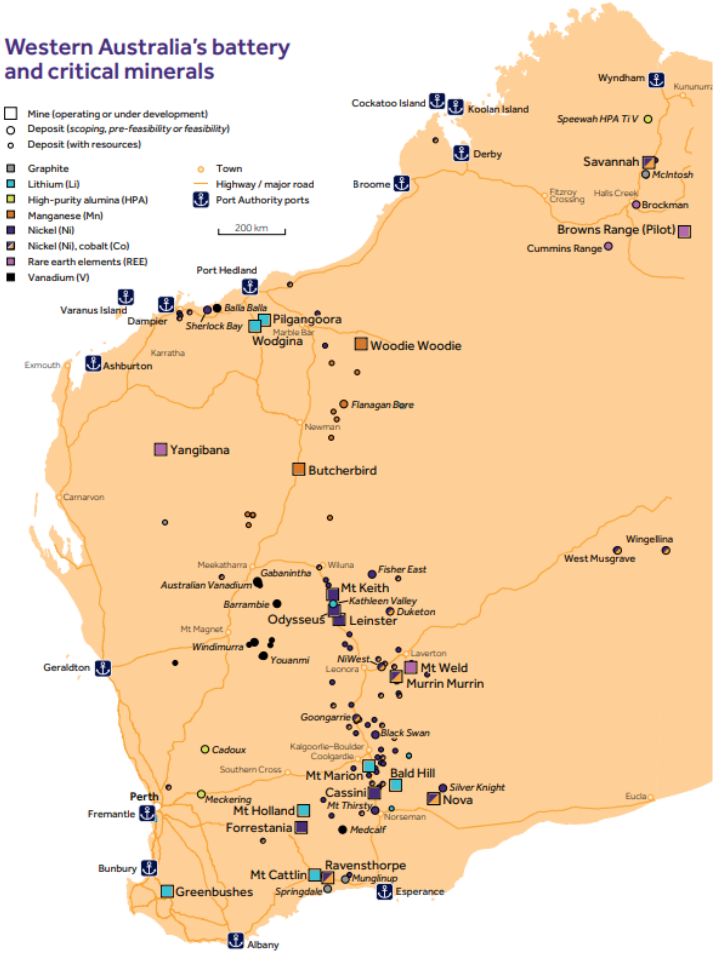
The Pilbara Craton is renowned for several of its geological features and still has unexploited resources and minerals that have been identified globally as critical because of their relevance for the construction of renewable energy technologies present in the region (Figure 3.1).[2] Many of these minerals include lithium, manganese or nickel, which are the backbone for green energy technologies (batteries or solar panels). To achieve the net zero scenario with a global temperature below 1.5 degrees in 2050, the global demand of these minerals would need to increase at least by 4 times by 2030 (IEA, 2023[10]). These minerals are also basic inputs for other essential industries in our lives. For instance, lithium is also used in medical implant batteries, and platinum is used in pacemakers, medical apparatus and titanium for artificial joints, prosthetic limbs and surgical equipment.

The Australian government has recognized the strategic importance of enhancing the internal supply and processing of critical minerals through incentives for attracting investments and improving local businesses and skills, which can benefit the Pilbara (Box 3.2). The Australia's Critical Minerals Strategy 2023–2030 aims to enhance autonomy of critical minerals with initiatives to de-risk strategically important critical minerals projects, attract private investment and better engaging First Nations people in these projects and promoting the country as a ESG benchmark, among others (Australian Government Department of Industry, Science and Resources, 2023[11]). This strategy has identified 26 resource commodities to be critical minerals.

In line with this plan, the federal government has committed specific funding to help establish midstream critical mineral projects in Western Australia, including the Lynas Mount Weld/Kalgoorlie project or the Northern Australia Infrastructure Facility loan to Hastings Technology Metals' rare earths project in the Pilbara, which can make Western Australia one of the few jurisdictions outside of China offering export quantities of processed rare earths.

On top of this, the Australian Government is reforming the national environmental law to better protect, restore and manage the environment (Australian Government Department of Climate Change, Energy, the Environment and water, 2023[12]). This includes dedicated funds to support the establishment of the new Environment Protection Australia, establishment of Environment Information Australia and legislating the commitments set out in the Nature Positive Plan. All these reforms will accelerate the green transition in the mining sector.

Figure 3.1. Selected critical minerals in Western Australia and the Pilbara



Source: WA Government (2022[13]), *A Global Battery and Critical Minerals Hub*, https://www.wa.gov.au/government/publications/battery-and-critical-minerals-prospectus-english.

Box 3.2. The Australia's Critical Minerals Strategy 2023–2030

In June 2023, the government of Australia published its Critical Minerals Strategy 2023–2030, with the vision to enhance the country's geostrategic and economic benefits of its critical minerals sector and supported diverse, resilient and sustainable supply chains. The strategy has 4 objectives:

- create diverse, resilient and sustainable supply chains through strong and secure international partnerships
- build sovereign capability in critical minerals processing
- use our critical minerals to help become a renewable energy superpower
- extract more value onshore from our resources, creating jobs and economic opportunity, including for regional and First Nations communities.

The focus areas and actions to attain these goals include:

- Developing strategically important projects with support from the Australian Government to de-risk strategically important critical minerals projects.

- Increased investment from, and collaboration with, likeminded partners to grow Australia's downstream processing capability
- Genuine engagement and collaboration with First Nations communities that promotes benefit sharing and respects the land and water rights and interests of First Nations people
- Promoting Australia as a world leader in ESG performance with an enabling regulatory framework.
- Working with states and territories, strategically planned enabling infrastructure and services
- Growing a skilled workforce

Source: Australian Government Department of Industry, Science and Resources (2023[11])., *Critical Minerals Strategy 2023–2030*, https://www.industry.gov.au/sites/default/files/2023-06/critical-minerals-strategy-2023-2030.pdf

In parallel, Western Australia's government has issued plans to align with the national goals on critical minerals, including the state's 2020-22 Future Battery and Critical Minerals Industries Strategy and the Global Battery and Critical Minerals Hub plan. The state has also implemented a ministerial task force with private companies. These measures have helped land a number of projects in Western Australia in midstream mineral processing activities, including small volumes of battery-grade lithium hydroxide (which is set to expand) and battery-grade nickel sulphate only, as well as some prospective projects on the production of battery-grade vanadium, graphite, high purity alumina and precursor cathode active materials (WA Government, 2022[13]).

The region also counts on strategic industrial areas (SIAs) as a planning instrument that favours industrial development by setting aside areas of land in strategic locations to attract investment in industrial activity associated with Western Australia's main upstream primary industries. The Pilbara has 4 of the 12 SIAs across Western Australia (Anketell, Ashburton North, Boodarie and Maitland)

Once the Pilbara is recognised as an inclusive, collaborative economic centre, it can capitalise on its many assets to become a standout leader in critical mineral strategy, including its geological potential for example, with important lithium, manganese or copper deposits (Figure 3.1). This is coupled with mining companies that can be both investors and consumers of downstream products from critical mineral, positioning the Pilbara strongly in the critical mineral industry.

One of the Pilbara's assets in critical minerals is lithium deposits. Beyond the two existing producer mining sites (Pilgangoora and Wodgina), companies have recently announced the discovery of lithium resources. For example, Global Lithium Resources announced in 2020 a deposit of 10 million tonnes 100 km east of Pilgangoora and the Tambourah Lithium Project in the southeast of Port Hedland houses a number of companies that have announced promising results of high-quality lithium (Birney, 2022[14]).

Despite this significant resource, the current manufacture of battery-grade lithium chemicals in Western Australia is mainly located in Kwinana (Perth), which hosts one operational refinery and one refinery under construction, and Kemerton (near Bunbury in the South West region), where a refinery is under construction. The primary growth in lithium demand has been driven by the use of lithium in rechargeable batteries for electronic devices, storage of renewable and other energies and, most importantly, electric vehicles. Other uses for lithium include the production of ceramics and glasses, including heat-resistant glass and ceramics, such as those used in oven wear and cooking, and as an alloy. However, the rapid growth in demand, particularly for electric vehicles, has resulted in batteries becoming its main application.

Manganese ore is another asset related to critical minerals in the Pilbara. Most of the manganese consumed annually goes into steel as an alloying agent, followed by consumption in the production of rechargeable electric vehicle batteries (in the form of electrolytic manganese dioxide and electrolytic manganese metal). Manganese is also an important alloying element with aluminium and copper, being used in plant fertilisers and animal feeds and as a colourant in glass and ceramics. Australia has ranked

since 2019 among the fourth largest producers of this mineral, with the Pilbara being home to Australia's second major mine of manganese (Woodie Woodie) (Summerfield, 2021[3]). By 2019, the Pilbara was also home to the greatest number of manganese deposits in the country, although mostly subeconomic resources (geologically demonstrated but that are not economically viable at the time of determination) (Summerfield, 2021[3]).

The region also has downstream projects in critical materials, in which the rare earth beneficiation investment project in Onslow can be of strategic relevance for the region. While the rare earth market is currently dominated by China (60% of rare earth mining) from the upstream to the downstream end of the value chain, Western Australia already accounts for around 11% of rare earths mining production in the world, mainly produced by the Lynas Corporation Mount Weld operation in the Goldfields region of Western Australia (Huleatt, 2019[15]). This market is experiencing a growing interest, with new projects and the expectation of rare earth mineral production in Western Australia, to which the Pilbara could contribute. For example, a Pilbara Onslow Plant pipeline project – still in the definition process – aims to produce mixed rare earth carbonate – extracted from the Yangibana site in the Shire of Upper Gascoyne – and to benefit from the Pilbara's export port facilities, proving that downstream processing is economically attractive in the region (Hastings Technology Metals, 2022[16]).

The Pilbara has an important role in this strategy, given its export-oriented infrastructure and relevant deposits of some of these critical minerals. Ensuring that the Pilbara moves beyond the simple extraction of critical minerals and gets involved in higher-value-added activities of these minerals' value chain should be seen as a federal and state government priority to ensure self-sufficiency in these minerals and unlock further downstream opportunities for the region. To seize this opportunity and attract stability, for long-term investments that honour ESG considerations in the extraction and processing of critical minerals, the federal and state governments should work with local First Nations communities and business leaders to co-develop a meaningful First Nations economic participation framework that facilitates capacity and skills development, partnerships and access to capital.

Simultaneously, the state government should further clarify the geological potential of the region's rare earths minerals by improving the mapping of new minerals and communications around the potential value chains. Attracting new industrial companies interested in processing these minerals in the region should include working with local First Nations communities and corporations in an effort to ease land acquisition for industrial objectives and improve connections with universities.

As the next section will depict, attractiveness to developing world-class local partnerships and bringing transformation activities in the region relies on the deployment of renewable energy infrastructure to reduce the cost of energy and transport as well as on a stronger labour market that supplies a qualified labour force.

The historic iron ore production in the Pilbara required visionary policy, international investment and co-operation. Leveraging the endowment of critical minerals in a progressive, modern-day manner can fortify ongoing political commitment and investment attraction by ensuring the meaningful participation of First Nations and communities in new mineral developments.

Benefitting from the deployment of renewable energy to develop the local economy

As the driest inhabited continent on the planet, Australia is highly vulnerable to long-term climate change and associated extreme events. Despite ongoing reduction, Australia's per capita GHG emissions remain among the highest in the OECD (OECD, 2021[17]). This is also true for Western Australia and the Pilbara, which rank as the OECD regions with the highest emissions per capita (Chapter 2). These aspects not only undermine the federal and Western Australian government commitment to achieving net zero carbon emissions by 2050 but also future opportunities to reach markets and companies that prioritise low-carbon supply chains (e.g. in European countries).

To this end, the federal government has recently stressed the development of clean energy technologies as the path to lower emissions, with strong institutions in place to support these aims, including the Australian Renewable Energy Agency that provides grants for research, deployment and early-stage commercialisation of renewables technology, the Clean Energy Finance Corporation that facilitates the financing of clean energy projects or institutions like the Clean Energy Regulator and the Australian Carbon Credit Unit market. Likewise, the Government of Western Australia issued the Energy Transformation Strategy to enable the transition to low-emission and distributed energy sources and to plan for the future of our power system (WA Government, 2021[18]).

The Pilbara has many assets to become a key player in the national strategy to deploy clean energy technologies. While the region is a high emitter, it has an export-oriented infrastructure (trains and ports), large solar and wind resources, large areas of undeveloped land and established global energy companies that can help to deploy renewable energies. Increasing clean energy solutions offers the opportunity to decarbonise the mining process and the country's energy mix while providing new income sources and affordable energy supply for regional industry and local communities, particularly First Nations people.

A large-scale renewable generation that supports the production of minerals is in fact needed to demonstrate low-carbon supply chains, which will be increasingly important to reach new markets and customers that prioritise sustainability. For example, it can accelerate the goal of exporting low-carbon iron ore to support the production of green steel.

Mining companies in the region are set to play an important role in the deployment of renewable energy technologies in the region as it is the cornerstone to reducing carbon dioxide (CO_2) emissions and improving attractiveness for ESG investment and social license to operate while reducing the operational costs of mining. Renewable energy is also an opportunity to reduce the cost of mining operations as most mining sites currently source energy mostly from non-renewable sources – gas to power the mines and processing plants and diesel to run the trucks and trains. Most of the big companies in the region have already set investment plans to increase renewable energy sources, mainly focused on solar power to feed mining sites (Box 3.3).

Box 3.3. Renewable energy projects from mining companies in the Pilbara region

Rio Tinto's Pilbara Renewables project aims to establish an integrated network of solar and wind power sources to power their Pilbara operations, which, together with the first phases of fleet transition away from diesel, would abate around one million tonnes of CO_2 – about a third of the company's total Scope 1 and 2 emissions across the iron ore business.[3] A first step in this plan is the 34 megawatt (MW) solar plant at the Gudai-Darri mine, which will supplement gas power to provide one-third of the mine's electricity.

Fortescue plans for a 5.4 gigawatt solar, wind and battery plant to power its projects in the region in a commitment to reach net zero emissions by 2030.

Also, the Australian Renewable Energy Agency has provided AUD 24.2 million in funding to Alinta Energy Pilbara Finance Pty Ltd to develop its Solar Gas Hybrid Project to power Fortescue's Chichester mining hub. This will allow Fortescue to reduce the use of diesel by around 100 million litres annually, as the mines currently rely on diesel generators. The project will also see the transmission lines connect the Chichester Hub mines and **Roy Hill** to Alinta's existing 145 MW gas-fired Newman Power Station.

BHP expects to halve emissions from the generation of solar energy to power its Western Australia iron ore port facilities in Port Hedland by the end of 2024. It will contribute to BHP's medium-term target to reduce operational emissions by at least 30% from 2020 fiscal year levels by 2030. In addition, BHP and Alinta Energy have entered into a memorandum of understanding in relation to the development of

the Shay Gap Wind Farm, which is currently planned to be 45 MW, with a potential first-generation date of 2027.

Source: Arena (2019[19]), "Pilbara breaks new ground with renewable energy", https://arena.gov.au/news/pilbara-breaks-new-ground-with-renewable-energy/

In addition, the Pilbara is well positioned to advance production at scale and eventually export hydrogen. The federal and state governments provided funding to create one of Australia's first hydrogen hubs in the Pilbara, with the aim to fast-track renewable (green) hydrogen production and exports. The Pilbara Hydrogen Hub includes various projects such as a hydrogen and/or ammonia pipeline between the Maitland and Burrup Strategic Industrial areas, a Clean Energy Training and Research Institute to develop the required skills for the emerging industry and port upgrades to enable the import of oversized renewable energy equipment (e.g. turbine blades). These complement advanced projects aiming at developing and exporting both green hydrogen and emissions-free materials: for example, the Yuri Green Hydrogen Project is one of the largest of its kind in Australia and capable of sourcing green hydrogen into the Yara ammonia production plant, enabling the export of green ammonia and production of green hydrogen at scale.

Hydrogen will provide the opportunity for the Pilbara to provide greater amounts of energy with more reliability than solar or wind power. This could reduce energy costs to incentivise the development of downstream facilities and feed the fleet of trucks and boats that transit in the region. In fact, the region is well placed to show short-term gains in implementing the state government's strategy to accelerate its production and adoption of hydrogen (Box 3.4). Many areas of this strategy still require significant technology development to be achievable but opportunities for remote application, where hydrogen can be used at the site of production, negating the need for transport and storage, seem to be the most viable opportunity in the short term. This is particularly beneficial for the Pilbara and its dispersed mining sites as it can reduce the use of diesel in operations and transportation.

Box 3.4. The Western Australian Renewable Hydrogen Strategy and Roadmap

Launched in November 2020, the roadmap identifies 26 initiatives the Government of Western Australia is driving and supporting to realise the Western Australian Renewable Hydrogen Strategy's vision, mission and goals. The vision is to make Western Australia a significant producer, exporter and user of renewable hydrogen.

Strategic focus areas

- **Export**: While still requiring significant technology development to be achievable at scale, the global market for renewable hydrogen is expected to grow significantly over the coming decades. Western Australia is well placed to capture a significant share of this market due to its excellent renewable energy capacity, skilled oil and gas workforce, proximity to Asia and export infrastructure.
- **Remote applications**: Renewable hydrogen can reduce reliance on diesel for remotely located industries and communities.
- **Hydrogen blending in natural gas networks**: Blending low concentrations of hydrogen into natural gas networks provides an opportunity to partially decarbonise the state's gas sector.
- **Transport**: Fuel cell electric vehicles present an early opportunity for hydrogen utilisation in mobility and freight transport.

The strategy sets ambitious goals for 2030

- Western Australia's market share in global hydrogen exports is similar to its share in LNG today.
- Western Australia's gas pipelines and networks contain up to 10% renewable hydrogen blend.
- Renewable hydrogen is used in mining haulage vehicles.
- Renewable hydrogen is a large fuel source for transportation in regional Western Australia.

Source: WA Government (2023[20]), *Western Australian Renewable Hydrogen Strategy and Roadmap*, https://www.wa.gov.au/government/publications/western-australian-renewable-hydrogen-strategy-and-roadmap.

However, the deployment of renewable energies needs to have a community focus to ensure people in the Pilbara benefit from this growing sector. The strategic deployment of renewable energy is also an opportunity to diversify the local economy and reduce income inequality by involving new local businesses and promoting the integration of First Nations in the value chain of renewable energy solutions. Renewable energy projects offer some short- to medium-term business opportunities in the construction phase and some more long-term opportunities in the form of maintenance during the operational phase. These projects can bring a number of additional opportunities for the region and its population, such as:

- **A greater tax base for local governments, which can be invested in improving service delivery**, as was the case in Abruzzo, Italy, or Scotland, United Kingdom (OECD, 2012[21]). In the case of Pilbara, this opportunity will rely on the land where these technologies are established (see Chapter 4).
- **Extra income for land owners and land-based activities**. For example, farmers and land owners who integrate renewable energy production into their activities can diversify and stabilise their income sources (OECD, 2012[21]). For the Pilbara, this involves exploring diversification permits for this purpose, which can also apply to mining leases.
- **New indirect jobs**. While the number of new jobs created by renewable energy projects is limited (mainly in operating and maintaining equipment), rural communities can implement strategies to benefit from indirect jobs arising along the renewable energy supply chain (construction, manufacturing and specialised services). This was the case in Extremadura, Spain, where the newest manufacturing jobs were created in firms producing metal frameworks to support solar energy installations (OECD, 2012[21]).
- **Delivery of affordable and clean energy** will reduce the cost of doing business and accessing housing. This can be particularly relevant for people who do not work in mining activities and want to settle in the region, as well as for Aboriginal communities.

Accelerating the deployment and adoption of renewable energies in the Pilbara

Accelerating the deployment and adoption of renewable energies in the Pilbara needs to overcome a number of challenges.

First, a high reliance on and good accessibility to affordable LNG. Unlike other OECD mining regions, the Pilbara has a higher competitive advantage in consuming LNG, given the *in situ* natural gas resources, historical infrastructure investments and Western Australian government policy that ensures a share of production for the domestic market. Many other jurisdictions, including traditional energy importers, have equivalent domestic infrastructure suitable for hydrogen generation (e.g. China), paired with, in many cases, existing hydrogen production well in excess of Western Australia's. Furthermore, green hydrogen (produced with energy from renewable sources) still requires technological progress to become an economically viable alternative; in the transition, blue hydrogen (produced with fossil fuels but captured in carbon capture and storage projects) could be a transitional fuel in the region.

Second, the labour shortage and the cost of construction due to remoteness is a challenge. Salaries for workers who deploy renewable energy solutions must compete against the salaries in mining operations. Shortage of affordable housing also undermines the labour force supply in the region (see Chapter 4). Transport of materials to the region adds to this cost.

Furthermore, access to land for renewable energy can pose an important challenge to accelerating the pace of the deployment. As Chapter 4 will depict, new projects require high shares of land as the renewable ones need to overcome some challenges in land management in the region, including the timing of allocation of state lands and a coherent process to negotiate with Aboriginal communities to use First Nations land.

Overcoming the abovementioned challenges needs a comprehensive public strategy to collaborate with the private sector, facilitate access to the labour force and reduce costs such as transport. This strategy should ensure a positive connection between renewable energy projects and development in the Pilbara by ensuring these projects integrate rural economies within larger supply chains while mitigating the adverse effects on current or potential economic activities, including agriculture and tourism. This should be seen as a strategic policy to enhance market opportunities with traditional trade partners, such as Asian countries, but also with countries adopting more environmentally driven trade policies, like European Union countries.

The Commonwealth has an important role to play in incentivising a greener and diversified future for the Pilbara. Targeted incentives to increase the deployment of renewable energy technologies, including some added-value stages (e.g. assembly, maintenance or repair), is an important area for action for the government. In other countries like the United States and in European Union zones, national policies have adopted active support in the form of tax credits and incentives to accelerate the deployment of renewable energies. For example, the US Inflation Reduction Act (IRA) released USD 370 billion in funding to provide tax credits for clean energy projects to promote investments in manufacturing clean technologies in the country. In less than 6 months after the IRA, 100 000 green jobs were created, including electricians, technicians, mechanics and construction workers (WEF, 2023[22]). To this end, as previously recommended by the OECD, the federal government of Australia needs to develop a national long-term emissions reduction strategy that defines clear goals and corresponding policy settings for the path to achieving net zero emissions by 2050 (OECD, 2021[17]). This strategy should prioritise incentives for the deployment of renewable energies in mining regions.

In parallel to those incentives, a clear monitoring and public reporting of GHG emissions in the Pilbara, along with other regions of Western Australia, should be promoted as a strategy to improve transparency in the environmental impact of mining and to accelerate investments in renewable energies.

The government can also better co-ordinate the mining-led renewable energy projects to accelerate the deployment of clean energy sources in the region and create a favourable ecosystem for the net zero economy transition. The renewable energy projects of mining companies are done in silos, with almost no co-operation among them. Each company has an individual transport, storage or assembly facility. The federal government's project to support common-use port upgrades in the Pilbara (e.g. expand Lumsden Point in the port of Port Hedland) is a first step in the right direction to create infrastructure for common use and increasing the capacity to export battery metals such as lithium and copper concentrates, as well as import renewable energy infrastructure (e.g. wind turbines and blades). But there is still scope for unlocking further synergies with common solar or wind facilities as well as co-investment in energy transmission infrastructure that covers other users beyond mining sites, including towns and ports.

The Commonwealth and the state can leverage the growing interest in renewable projects in the region to boost development opportunities for First Nations people and local businesses by facilitating equity stake or ownership schemes for generation or transmission projects. The deployment of renewable energy can be an example of a new model that shares and empowers local communities. It will also ease the deployment of these projects in the Pilbara, as they require extensive land and thus negotiation and

approval of First Nations owners. Other OECD countries have support schemes where First Nations are active partners in energy projects (Box 3.5). While capacity building is still needed to help establish First Nations companies able to manage this type of project, many communities have the potential and knowledge. In many cases, the main bottleneck is rather the access to finance and the channels and trust to build equal-power partnerships with energy and mining companies. Therefore, the state could support First Nations to participate in renewable energy business by acting as a broker in partnerships with energy companies and providing public loans or debt guarantees to support funding.

Box 3.5. Examples of First Nations taking equity or ownership of renewable energy projects

Pilbara (Western Australia) – Yindjibarndi traditional owners in the Pilbara have partnered with renewable energy company ACEN to develop and operate large-scale renewable energy projects. The partnership will develop, own, and operate renewable energy projects with a capacity of up to 3GW. The partnership includes principles such as traditional owner equity participation of 25% to 50% as well as Yindjibarndi approval for all project sites to protect cultural heritage.

California (United States) – The Morongo Band of Mission Indians near Palm Springs is the first Native American tribe in the nation to become a participating transmission owner as part of a new project of the Southern California Edison transmission lines to connect solar, wind and battery resources to the regional power grid. In this agreement, Southern California Edison (the public utility company) obtained new rights of way across the Morongo Indian Reservation and granted Morongo Transmission the option to lease a percentage of the project in return for the payment of a percentage of the project cost. In other words, the public company benefitted from access to the land, sparing the need to fund the entire project, and the Morongo community became the majority owner of the project.

Ontario (Canada) – Twenty-five First Nations groups (51% of the shares) partnered with Fortis Canada (49%) (a gas and electric utility company) to create Watay Power, a project that brings grid connection to 17 remote communities in the region, which were powered by diesel generation. The First Nations had minimal equity to invest, so the majority of their ownership stake was debt-based: it was a syndicated deal but the Canadian Imperial Bank of Commerce covered all of the First Nations debt. To ensure revenues and debt servicing, this deal had provincial and federal support.

Source: Morongo (2021[23]), "Morongo becomes first Native American tribe to be approved as a participating transmission owner in nation", https://morongonation.org/news/morongo-becomes-first-native-american-tribe-to-be-approved-as-a-participating-transmission-owner-in-nation/#:~:text=Completed%20in%20May%202021%2C%20SCE,MW)%20to%20the%20transmission%20lines; Wataynikaneyap Power (2022[24]), *The Partnership*, https://www.wataypower.ca/ownership/partnership. (ACEN, 2023[25]) "ACEN and Yindjibarndi people forge historic partnership for renewable energy development in West Australia" https://www.acenrenewables.com/2023/07/acen-yindjibarndi-partnership-renewable-energy-development-west-australia/

Promoting circular mining practices to reduce environmental impacts and unlock new business

Circular economy practices in mining can open up new business opportunities locally, attract new investments and reduce the negative environmental effects of mining. The circular economy is about preventing wasted resources, improving the durability of goods and products, and transforming waste into new inputs or products (OECD, 2020[26]). In mining, circularity can translate into more efficient use of natural resources needed for the mineral extraction process (e.g. reuse of water) and reuse of mining waste (e.g. rock, slag), non-mining waste (e.g. oil, office waste, old technology) and mining infrastructure (e.g. mining sites' structures or transport infrastructure). The mining sector also has a key role in supporting circularity in other economic sectors by promoting greater reuse of machines and equipment used in mining operations or supporting urban mining (extracting minerals from common-use traditional and electronic

devices). It can also incorporate the sequestration of carbon through processes such as geological sequestration, mineral carbonation or revegetation.

These circular mining processes can bring a number of opportunities for environmental, economic and social outcomes. For example, reusing mining waste (also referred to as tailing remaining rock after the extraction of valuable minerals from the mined ore) is of growing importance across different countries (Finland, Canada, Finland, Portugal, Spain) given the important number of existing tailings already stocked and the expected amounts from future operations. Mining waste in some mining operations can be more than twice the amount of ore extracted. For example, for each tonne of iron ore extracted, it is estimated that between 2 to 12 tonnes of overburdened material is removed as waste (Kinnunen and Kaksonen, 2019[27]; Mohanty et al., 2010[28]).

Promoting the mining of tailings can be an opportunity to unlock new types of business, reduce the environmental impact of new mining operations and ensure the supply of minerals and raw materials. This is an area with a great number of possibilities but without a clear global frontrunner, as circular processes can be very specific to local mining operations. Beyond economic opportunities, mining tailings can benefit from greater societal support and be combined with environmental policies to clean hazardous waste. One potential process that is also gaining increasing attention in this regard is mineral carbonation, whereby the natural process by which minerals draw carbon from the atmosphere is accelerated through engineering intervention.

However, creating a system that harnesses the benefits of a circular economy in mining requires addressing multiple barriers, including technological development, environmental and administrative regulation and market and value chain bottlenecks (Box 3.6).

Box 3.6. Opportunities and barriers for circular economy in mining

The circular economy in the mining industry is still an emerging activity in many companies, which need clearer strategies and communication. This process can bring many benefits to the environment, the economy and society, but needs to address some barriers.

Table 3.5. Benefits and barriers of circular economy in mining across different areas

Area	Opportunities	Barriers
Technology	• Processes have been developed for some valuables, nor for the whole material. • New technologies enable metal recovery from lower concentrations than before.	• Heterogeneous material in old waste dumps. • Technology gap for upscaling. • Knowledge gap on tailing content.
Economic	• New needs in society make certain elements economically valuable. • Cheaper for the whole society after tailings valorisation. • Industrial symbiosis, e.g. municipal waste utilisation.	• Need of expertise from several companies. • Lack of value chains and SMEs in the sector. • More SMEs are needed, as circular economy is not the core business of big mining companies. • Lack of clarity on market use (recycled content rates of final products).
Society/institutions	• Less visual impact than mining. • Greater collaboration with other sectors in the economic contribution to recycling. • The recovery of metals from tailings inside an existing restricted industrial area is faster than in greenfield projects.	• Issues related to the ownership of the waste. • The permitting process has clear effects on the selection of solutions. • Regulatory incentives to determine disposal of tailings or use of resources. • Global market with different regulations in different areas.

Environment	• Removal of environmental hazards. • Cleaning of the environments.	• Environmental risks in opening old heaps or environmental permits for reuse of water. • Regulation on the registration, evaluation, authorisation and restriction of chemicals.

Source: Based on Kinnunen, P. and A. Kaksonen (2019[27]), "Towards circular economy in mining: Opportunities and bottlenecks for tailings valorization", https://doi.org/10.1016/j.jclepro.2019.04.171.

The Pilbara can mobilise its know-how to promote new business in circular mining. This is an important opportunity in the region, given its daily production of mining waste and the number of abandoned mines in the territory. Major mining companies in the Pilbara have already acknowledged the relevance of circularity and recycling and started putting in place actions at the operational level (Box 3.7).

However, there is scope for mainstreaming circular approaches in the overall business model, communications (e.g. in regard to their sustainability reports) and the involvement of the local businesses (Upadhyay et al., 2021[29]). Likewise, some of the companies operating in the Pilbara are pushing the frontier in circular practices with ongoing trials in other mining sites around the world, which could be translated into the Pilbara. For these, the size of mining sites in the Pilbara and the high temperatures should be used as an incentive for experimentation on circularity in the region.

Box 3.7. Circular economy practices of mining companies operating in the Pilbara and other mining regions

BHP has increased its focus on water recycling and reuse to reduce the use of freshwater in operations.

Rio Tinto's circular practice involves extracting lithium from waste rock at a borate mine in California. This approach represents an innovative solution to a longstanding waste management challenge the mining industry faces. By repurposing the waste product into a valuable resource, Rio Tinto is able to reduce its environmental impact and simultaneously meet the growing demand for lithium. Rio Tinto also uses dewatering from one of its Pilbara mines to irrigate hay crops.

The **Fortescue** Iron Bridge project will receive low-cost power through Fortescue's investment in the Pilbara Energy Connect programme, which incorporates hybrid solar gas generation and battery storage. The project will also look into extensive surveys to identify areas of high conservation value and develop a comprehensive rehabilitation and closure plan to restore disturbed areas to a stable and sustainable condition.

Moreover, the company implements a circular economy practice on water by reusing and recycling water in its mining operations. Most of the water used for mine pit dewatering is brackish or saline and is reused wherever possible, forming a key water source at the company's Christmas Creek, Cloudbreak, Eliwana and Solomon mining sites. Of the 151 gigalitres (GL) of water abstracted for mine dewatering at the company's Chichester Hub, 126 GL is reinjected as part of the Managed Aquifer Recharge programme.

Roy Hill uses mine waste as backfill material as a circular economy practice. The waste generated during mining operations is collected and transported back to the mine pits for use as backfill material. This approach has several benefits, including reducing the need for new materials to be extracted from the ground and reducing the environmental impact of the mining operation. This approach helps to reduce the environmental impact of mining operations by reducing the amount of waste that is

generated and sent to landfills, conserve natural resources and minimise the environmental impact of mining operations.

Source: BHP (2022[30]), *BHP Annual Report 2022*, https://www.bhp.com/-/media/documents/investors/annual-reports/2022/220906_bhpannualreport2022.pdf;; Reuters (2021[31]), "Rio Tinto starts producing lithium from waste rock at California mine", https://www.reuters.com/article/us-rio-tinto-plc-lithium-idUSKBN2BU1ON; Fortescue (2022[32]) fortescue announces execution plan for industry leading decarbonisation; Mining Digital (2020[33]), "Inside the making of Roy Hill", https://miningdigital.com/smart-mining/inside-making-roy-hill; Albermarle (2021[34]), *2021 Sustainability Report*, https://www.albemarle.com/skins/base/flipbooks/sustainability-report-2021/2021SustainabilityReport_2022-06-02_19-43-55.pdf.

Mining companies can play a greater role in incentivising circular and sustainable practices across their providers. Encouraging providers to follow due diligence guidelines or ESG practices is in the interest of the company to improve trade with new markets as well as with the communities and government. Prioritising providers established in the region with more sustainable practices can help reduce the environmental impact of mining across the value chain while triggering innovation in the local economy. The state and local governments can have a role in this process by facilitating the exchange of practices among local providers and companies with innovative and sustainable providers in other countries and universities. The PDC and local government should also encourage mining companies to use reporting mechanisms related to procurement, for example the Mining Local Procurement Reporting Mechanism from the Engineers Without Borders Canada Mining Shared Value initiative.

The Pilbara's mining sector also has relevant opportunities to promote the recycling business of mining equipment. By virtue of the volume of conveyor belts and particularly large truck tyres used in the iron industry, tyres seem to be one of the most attractive businesses in terms of recycling. According to Tyre Stewardship Australia's 2020 Off-the-Road Used Tyre Analysis report, 93% of the metric tonnes (Mt) of used tyres in the Australian mining industry (68 100 Mt in 2019) were disposed of on site, piled up or buried, 3% were sent to landfill and just 1% was recycled, with the remainder stockpiled or used in civil engineering (Tyre Stewardship Australia, 2020[35]).

While many of these investments in circularity are privately led, the Western Australian government and local governments in the Pilbara have a relevant role in incentivising and facilitating the circular economy process in mining. First, they can promote partnership opportunities with new businesses or research organisations to ensure appropriate value chains in the transition to the circular model. As waste valorisation is not a core business for big mining companies, many of these companies would be willing to partner with other companies and organisations. The government should be the broker that gathers providers, companies in transformation activities, mining companies and research organisations to explore the opportunities around circularity and define possible projects of common interest. This networking support could allow big mining companies in the Pilbara to promote and integrate external innovations on circularity, e.g. on the reusing and recycling process. The case of Norrbotten and Västerbotten in Sweden can be an example of developing partnerships to attain a more sustainable mining process (Box 3.8).

Box 3.8. Creating the environment to unlock circular economy in mining: Norrbotten and Västerbotten, Sweden

The mining companies operating in Norrbotten and Västerbotten, Sweden, are at the forefront of technological development in the CO_2-free mining process and circular economy strategies.

A Partnership to create carbon-free steel

The state-owned company LKAB has undertaken a number of key projects to attain a carbon-free steel value chain. Its HYBRIT project already produces fossil-free (green) steel by developing a CO_2-free pelletising process and fossil-free iron-making through the use of green hydrogen gas, which relies on renewable energy hydropower production. This project emerged from a partnership between LKAB, the steelmaker SSAB and the energy company Vattenfall with the aim of creating a competitive ecosystem for green mining production in the region.

In parallel, LKAB is conducting a research project to extract rare earth metals from apatite, a material that today goes to waste in the Kiruna and Malmberget iron ore mines. This recycling process in iron ore is conducted in joint work with SSAB, which has major operations in the capital city of Luleå.

The mining industry has historically collaborated with universities to conduct research on mining and metallurgy. Luleå University also hosts the Centre for Advanced Mining and Metallurgy, a strategic national research area assigned to the university with the goal to study the sustainable use of natural resources.

The region also promoted the creation of a platform – Georange – that gathers 54 members, including municipalities, organisations, universities and private companies with the aim to create conditions for the development of new and existing companies in the mining industry, promoting knowledge exchange and co-ordinating work around different actors to develop a sustainable mining and minerals industry. This non-profit organisation participates in applications for national and European Union funds and organises conferences and trade fairs on mining every two years.

Source: OECD (2021[36]), *Mining Regions and Cities Case of Västerbotten and Norrbotten, Sweden*, https://doi.org/10.1787/802087e2-en.

Second, the government needs to actively contact and attract new companies to participate in the circular process in the mining value chain. In many cases, companies with expertise in recycling or reusing are not present in the region. Facilitating the establishment of these companies in the region can accelerate the rise of circular business. An interesting example is the effort by the local government of East Pilbara to contact and make the business case to attract foreign companies with expertise in recycling tyres into the region. In view of the attraction of circular economy companies to conduct the circular process in mining, the government of Western Australia should facilitate interested companies' access land in the region. As the next chapter will discuss, access to land in the Pilbara is a major challenge for establishing new industrial parks or industrial sites and providing affordable housing to the labour force. Co-ordinated work among local, state and federal governments to provide land and basic services for these potential industries in mining circularity should be part of a sustainable mining strategy in the region.

Third, governments can accelerate the adoption of circular processes with regulations or policy incentives. For example, Chile recently introduced a law which specifies that, starting in 2023, 25% of mining tyres must be recycled, which should increase to 75% as of 2027 and 100% as of 2030 (Box 3.9). Moreover, environmental regulations might face challenges to assess and facilitate projects to mine tailing or closed mines. To promote circularity, the Western Australian state government should consider regulations and policies to lead companies to adopt circular processes and report their progress.

Box 3.9. Outcomes of the law for recycling truck/vehicle mining tyres in Chile

In 2021, Chile published the first decree of the Extended Producer Responsibility (REP) Law establishing goals for the collection and recycling of tyres, which will make it possible to take advantage of the materials to create new products and reduce the generation of garbage. The REP Law operates with a list of products, including giant mining tyres, to which ambitious but gradual recycling targets apply. Currently, only 17% of tyres are reused once they are no longer fit for use.

The law differentiates the recycling goals of tyres according to their size, over and under 57 inches, projecting that the larger ones (miners) must be completely reused in 2026, while those less than 57 inches (90%) must be treated by 2028.

As a result of this law, different companies set up operations in the last years to recycle tyres in mining regions. These include:

- The alliance between the French tyre manufacturing company Michelin and Enviro (a Swedish company that recovers oil, steel and gas from tyres) is building the first tyre recycling plant for mining in Antofagasta and one of the biggest in the world. The recycling plant will have the capacity to process 30 000 tonnes of tyres per year, which is 60% of the total tyres discarded in the same period throughout the country.
- In 2021, Kal Tire's Mining opened a tyre recycling facility in Antofagasta, which can process up to 20 000 kg of tyres. The equivalent of five 63 inch tyres will be converted into 6 500 litres of alternative fuel, 4 000 kg of steel and 8 000 kg of carbon black as well as enough synthetic gas to fuel the plant itself for 7 hours. Local companies are already lined up to receive these reusable products.

In addition, the national government established a strategic committee to prepare the roadmap for the circular economy of mining and set an agreement between the Ministry of Mining, the National Geology and Mining Service and a consortium of private companies (JRI-EcoMetales) to develop a guide for projects to recover value from tailings and mining debris.

Source: Chilean Ministry of the Environment (2021[37]), "Ley REP: Se publicó decreto que obliga a empresas importadoras de neumáticos a recolectar y reciclar el 90% de ellos", https://mma.gob.cl/ley-rep-se-publico-decreto-que-obliga-a-empresas-importadoras-de-neumaticos-a-recolectar-y-reciclar-el-90-de-ellos/; KalTire (2021[38]), "Kal Tire nears full start-up of OTR tire recycling facility in Chile", https://www.kaltiremining.com/en/news-release/otr-tire-recycling-facility/; Guía Minera de Chile (2022[39]), "Michelin inicia en Antofagasta la construcción de su primera planta de reciclaje de neumáticos en el mundo", https://www.guiaminera.cl/michelin-inicia-en-antofagasta-la-construccion-de-su-primera-planta-de-reciclaje-de-neumaticos-en-el-mundo/.

Circularity also refers to making the most of abandoned mines and decommissioned infrastructure

Circularity in mining also refers to strategies to make the best of abandoned mining sites or operations. With data up to 2012, it is estimated that there are about 10 000 abandoned mines across all of Western Australia, many of which had previous exploitation of gold (WA Government, n.d.[40]). Many of these abandoned mines ceased operations prior to the introduction of environmental approvals, which required rehabilitation and were left by the companies without any measure to mitigate the environmental impacts of these sites.

The government of Western Australia has identified abandoned mines as a relevant challenge in Australia and the region. This issue led to the confirmation of a senate committee to investigate the rehabilitation of abandoned mines. Rehabilitation of abandoned mines could allow grazing, tourism or food production activities.

Beyond mining, the Pilbara also has a growing opportunity to reuse decommissioned infrastructure from offshore oil and gas operations. Over the next 10-20 years, an increasing number of offshore oil and gas facilities in the Pilbara will cease producing hydrocarbons and will need to be dismantled. All over Australia, the infrastructure to be decommissioned includes 57 platforms for a total weight of 755 000 tonnes, with a large share located in the Carnarvon Basin, offshore the Pilbara (Melbourne-Thomas et al., 2021[41]). Australian legislation requires oil and gas companies to develop acceptable plans to safely remove all offshore infrastructure at the end of a project's life (Shaw, Seares and Newman, 2018[42]). Studies have shown clear benefits of leaving oil and gas infrastructure *in situ* to support biodiversity and marine fauna, albeit others that demonstrate these structures pose a risk to the environment (Melbourne-Thomas et al., 2021[41]).

As some offshore infrastructure will require removal, there might be opportunities to reuse equipment that is still in working order as well as to recycle large volumes of material such as steel, concrete and plastics. Reusing these large amounts of infrastructure requires a strong enabling environment with a collaborative approach to enhance cost-effectiveness and environmental outcomes. Furthermore, facilities and land located on the coast will be required to bring infrastructure ashore and process it.

Overall, the government of Western Australia, in collaboration with local governments, should promote circular practices in mining by:

- Developing a comprehensive strategy to map the opportunities of the circular economy across the mining value chain in the Pilbara, support the uptake of circular practices and increase the involvement of local communities and businesses in these new business models. This should include targeted capacity building for local businesses and fast-track processes to promote recycling businesses in mining, mining tailings, secondary use of abandoned mines and reuse of decommissioned offshore oil and gas infrastructure.
- Considering new regulations and policies to accelerate the adoption of circular mining processes with improved progress monitoring. Chile's regulation on recycling mining tyres is a good guide in this regard.
- Promoting networking events to attract companies with expertise in mining circularity (e.g. recycling of tyres) and multi-stakeholder discussions with providers, mining companies and academia to explore the opportunities around circularity and come up with possible projects.
- Updating the information on tailings and abandoned mines. The dataset of mines and minerals deposits from the DMIRS provides a good base for this type of mapping but its information needs to be updated and include greater geological information, specifically to promote the mining of tailings.

Moving towards environmentally sustainable mining in the region requires regaining communities', especially First Nations, trust in the possibility of achieving a green mining process. Transparency is a first step in this process, which can be done by better sharing companies' efforts and investments in this matter. Mining companies in the region have complied with international due diligence and guidelines (such as the sustainable mining guideline of the Mining Association of Canada). However, this information is scattered on each company's website. The government can improve this transparency by creating a single site for citizens to consult all of the certificates and due diligence carried out by the different mining sites in the Pilbara.

But certifications alone are often not enough to build citizen trust, as these processes tend to happen without community involvement. Going a step further would be to ensure First Nations and community representatives are involved in the certification process or adopting processes that already involve citizens as part of the process. Other regions, such as Antofagasta in Chile, have also empowered citizens with technological tools and access to mining sites in view of conducting independent monitoring of the environmental impacts of mining operations.

Mobilising the social and environmental capital of the Pilbara to foster economic diversification

In addition to the advantages provided by its rich geology, geographic location and export-oriented infrastructure, the Pilbara has a diverse amalgam of cultures and environmental amenities that can be mobilised to diversify the economy and gain resilience. Traditional owners have conducted non-extractive activities for millennia, including the application of traditional knowledge to produce food. Likewise, the region's towns benefit from a relatively high share of young people, bringing opportunities for new businesses and ideas.

Nevertheless, as in many remote OECD mining regions, economic activities outside resource extraction sectors tend to be limited due to the lock-in effects produced by the high reliance on mining, the small internal markets that hamper economies of scale and the remoteness that increases the cost to transport goods and people. Promoting diversification requires an active policy approach to overcome these challenges, which otherwise would discourage entrepreneurship and the emergence of new businesses outside the resource sector.

The region has already acknowledged the need for an active approach to further diversify the economy and has conducted a number of policies to support this process. The most relevant is the PDC's strategic plan for 2019-21, which identifies a number of potential economic sectors for the region, in line with the state's strategy Diversifying WA. They include:

- new resources – sand, magnesium, cobalt, sulphate of potash
- logistics, engineering and supply chains
- innovative technology
- SMEs
- agriculture and aquaculture
- energy
- tourism
- arts and culture.

Despite this government effort, the Pilbara remains an economy with low levels of entrepreneurship relative to Australia. The government has the scope to adopt active policies that help focus on non-extractive activities and create a coherent vision among local actors of the future of the economy outside mining. This section discusses potential strategies that can help with the ongoing effort to diversify the economy, including supporting entrepreneurship, social economy and tourism.

Networking opportunities to promote entrepreneurship and scale up SMEs

The small internal market, the dominance of extractive industries and the high cost of living in the Pilbara have led to an underrepresentation of SMEs in the region compared to national averages (Chapter2). In a labour market with very low levels of unemployment, competing with the high salaries and workforce needs of the mining sector is a common barrier to diversification in the Pilbara, as in other remote OECD mining regions (OECD, 2023[43]). SME activity in the Pilbara tends to be predominantly in construction, rental, real estate, warehousing and logistics, activities that are closely aligned with the resources sector and thus subject to its cyclical fluctuations (RDA Pilbara, 2020[44]). Instead, businesses in other sectors, such as education, retail and professional services, are underrepresented across the Pilbara.

The underrepresentation of entrepreneurs and SMEs in a region not only undermines resilience and economic diversification but also limits innovation, knowledge diffusion and social cohesion as small businesses respond to new demands and social needs, and contribute to empowerment and inclusion in society. In fact, across the OECD, some of the most relevant forms of innovations come from entrepreneurs that are considered "unicorns" (the rare number of new entrants that become high-growth firms), conduct

disruptive activities (entrants that radically change incumbent competitor's business models) or build and innovate through marginal changes (entrants or incumbents that practice slow innovation) (OECD, 2022[45]).

To address this issue, the government of the state of Western Australia and the PDC have invested in projects such as a network of co-working and innovation centres. The region has three main innovation centres set up as not-for-profit organisations to accelerate small business growth and entrepreneurship in the region:

- **The Enterprise Hub Karratha**, delivered by the Business Centre Pilbara, is a flexible space incorporating co-working areas, incubation suites, meeting rooms and space for business and community events.
- The WEB Business Hub in Port Hedland provides flexible co-working accommodation and tailor-made innovation programmes to encourage entrepreneurship and support new and existing small businesses.
- **The Edge** in Newman is a multi-purpose business incubation hub that includes the following facilities: a community kitchen, a food court, two pop-up retail spaces, a mezzanine for temporary office space and a co-working office space.

Furthermore, the government has implemented support for larger networking initiatives such as the Creative Business Development Series to provide participants (mainly individuals in art and creative industries) capacity building tools, with talks and workshops facilitated by industry experts.

These plans are the right step to create agglomeration economies and promote networking with the critical mass of the workforce that is in the region. However, they will have little success if the challenges of the cost of accommodation with a policy to attract new workers are not addressed, as further discussed in the next chapter.

Beyond the cost of living challenge, government strategies for entrepreneurship and SME development in the Pilbara can be reinforced with a combination of formal networking opportunities that create scale and targeted support to different parts of the population, including mining employees, First Nations peoples and women. First, the government can establish a formal networking mechanism in the region to target entrepreneurs and small businesses in different sectors and connect them with large firms, private financiers and research centres. Several business-oriented events in the region, such as the Pilbara Summit or Pilbara Creative and Cultural Forum, are intended to promote networking and business support. Yet, some of the existing fora either have entry fees that discourage the participation of part of the population, focus mostly on the extractive sector or exclusively target First Nation people. A comprehensive forum that focuses on small businesses and entrepreneurship can attract First Nations and non-First Nations people and serve as a platform to showcase good experiences and facilitate access to government programmes. This can be a platform for innovation centres to present the results of their work and mobilise their networks of small businesses.

Second, with most of the workforce already employed in the Pilbara, the state government department should leverage the existing human capital working in mining companies to support intrapreneurship. Intrapreneurial programmes are associated with the in-company incubation of employee-driven initiatives that eventually spin off from the company to become independent entrepreneurial entities. Such intrapreneurial incubation can act as an outlet for employees' creativity and innovativeness. Mining companies can be interested in promoting intrapreneurship for different reasons: i) improving relationships with local communities and becoming more attractive for the workforce; ii) standing out globally with ESG practices that can be promoted internationally; or iii) promoting a vertically integrated value chain with companies that provide services tailored to the needs and working culture of the company.

This strategy could benefit from government support to allow mining workers access to capital or business plan training or legal advice. Innovation centres in the Pilbara can also proactively reach out workers in

extractive industries and encourage entrepreneurship. Besides training assistance, intrapreneurship support programmes can locally work alongside the firms to help plan and implement the creation of innovative career paths inside companies and support the incubation of projects to address future needs of the mining industry (e.g. in the green transition). These training programmes can be supported or outsourced to a university or a dedicated research centre for mining.

Finally, capacity and training should be increased to support entrepreneurship within the First Nations population. First Nations peoples are the layer of population with the greater unemployment and inactivity rates (Chapter 2), which is explained by unequal access to tailored education and training support, among other structural reasons discussed in the next chapter. Better involving the First Nations population in the regional economy will lead to multiple benefits in the region, including improving social cohesion, opening new growth economic opportunities locally and increasing regional attractiveness. This objective lies within a broader set of national and state policies that are undergoing a transformational process to improve the quality of life of this population (see next chapter).

Box 3.10. Intrapreneurship: Targeting the mining workforce to create their own businesses

In-company intrapreneurship programmes are rapidly becoming popular amongst many large corporate groups throughout OECD member countries. Despite the common timing for this relatively new corporate phenomenon, intrapreneurship development policies are being implemented in order to reach very different objectives. A list of these has been compiled by intrapreneurship expert Nicolas Bry (Bry, 2020[46]):

- Bringing new products and services to market more quickly, with less risk of failure, and improving customer intimacy.
- Protection against start-ups aiming to disrupt the business model.
- Motivating and retaining the best staff and grooming new leaders.
- Developing a nimble way to innovate.
- Creating an environment where new ideas can be systematically tested and iterated until they fit the market and company culture.
- Making a societal impact and linking with internal corporate social responsibility policy.

Specific examples

For Deutsche Telekom, the purpose of adopting an internal intrapreneurial approach is simply to help employees who want to realise their idea and become entrepreneurs. This differs from Bouygues, a French telecommunication company that uses intrapreneurship programmes in order to “innovate like a start-up”. Deutsche Bahn implements intrapreneurship mainly to foster new digital business models and encourage long-term cultural change amongst its employees and business units. Similarly, Air France seeks to “develop new business with an innovative approach” and to build a team-driven ecosystem that shows “initiative, wants to commit and take responsibility” (Bry, 2020[46]).

Source: Based on Bry, N. (2020[46]), *The Intrapreneurs' Factory*, Independently published.

There are already good cases of First Nations companies working in the mining industry that can serve as leading examples to motivate other First Nations people to start a business or access long-term jobs (Box 3.11).

Box 3.11. Aboriginal companies providing services to mining operations in the Pilbara

Brida

Brida is a 100% Aboriginal-owned business located in Roebourne community in Karratha that provides cleaning, ground maintenance, landscaping and labour hire services at the Pilbara sites. Established in 1974 by the Ngarliyarndu Bindirri Aboriginal Corporation, the company currently employs 140 people, all based in the region, with 65% of Aboriginal employees. The greatest share of Aboriginal employees work in ground maintenance.

In 2019, the company received the award of First Nations business of the year at the Aboriginal Enterprises in Mining, Energy and Exploration (AEMEE) Resource Sector Awards in Darwin.

Eastern Guruma Pty Ltd

Eastern Guruma Pty Ltd is a civil and mining contractor that is 100% owned by members of the traditional owner group, Eastern Guruma, which surrounds the town of Tom Price in the Pilbara region. Established in 2004, Eastern Guruma delivers projects in the Western Australian resources industry, including road construction and maintenance, bulk and detailed earthworks, concrete, construction of tailings dams, drainage and protection, traffic management and rehabilitation.

The company has an Aboriginal employment and training programme to provide employment, training and skills improvement to Eastern Guruma and other Aboriginal people. The company established a joint venture with Wirlu-Murra Enterprises to conduct a road maintenance contract at Solomon Mine in 2013. This contract currently has over 50% of Aboriginal employees.

KingKira Group

KingKira Group Pty Ltd (KingKira) is 100% Aboriginal female-owned and provides a range of services across the mining and resources sectors in Western Australia, including waste management, dust suppression, street sweeping services or security in mines sites. The company was established in early 2014 by Tammy O'Connor, a First Nation from the Pilbara region with a Nyiyaparli and Palyku Aboriginal heritage. Tammy started her career in community education support and then took on various community consultation and advisory roles, gaining knowledge in Aboriginal heritage and culture to then move on to work in the mining industry in waste management before founding KingKira.

In 2019, the company received the AEMEE New Indigenous Business of the Year award.

Source: Brida (n.d.[47]), *Homepage*, https://www.brida.com.au; KingKira Group (n.d.[48]), *Homepage*, https://kingkira.com.au; Eastern Guruma Pty Ltd (n.d.[49]), *Homepage*, https://www.easternguruma.com.au/.

Finally, the Pilbara can mobilise the women in their workforce with adapted entrepreneurship strategies. The region has a relatively low level of women's participation in the labour market (Chapter 2), which can be associated with childcare access issues that push women outside the labour market or some mining tasks and lifestyles that can disincentive women's participation. Increasing women's labour opportunities would require a combination of better accessibility to family care services and specific support for work opportunities. In remote regions like the Pilbara, focusing on women's involvement in the labour market can also mean increasing regional attractiveness for families and enhancing the sense of belonging to the territory. The PDC could revisit entrepreneurship support for women with strategies to promote role models, develop tailor-made entrepreneurship training and create women's networks and family care services for self-employed women (Box 3.12).

Box 3.12. Fostering women's entrepreneurship

Given that women tend to be underrepresented in entrepreneurship in comparison to men across the OECD, the implementation of targeted policies and programmes to support women's entrepreneurship and self-employment can help close this gap and would result in overall welfare gains. In addition, there is evidence that women are held back in entrepreneurship by institutional and market failures, including discouraging social attitudes or public support programmes that untaintedly favour male entrepreneurs. The policy can support women entrepreneurs by:

1. **Promoting a positive attitude through role models and ambassadors**: Role models can play a crucial role in developing an entrepreneurial spirit and have demonstrated an ability to influence an individual's entrepreneurial propensity through positive representations.
2. **Developing entrepreneurial training programmes tailor made for women**: Training programmes for women usually provide the same content as mainstream courses. However, there is evidence that women's programmes are more effective and intake mechanisms for mainstream programmes can potentially be gender-biased (i.e. maternity leave, work-life balance). This should also include improving financial literacy.
3. **Building entrepreneurial networks and ensuring linkages to mainstream infrastructure**: Networks for women entrepreneurs should not reinforce gender differences by isolating women from mainstream business service providers. A common approach to building networks is to create them around other policy interventions, such as training or other business development services.
4. **Promoting work-life balance and access to social protection**: First and foremost, family and tax policies should support women's participation in the labour market in general by adapting policies to provide family care services for self-employed women.

Women's Enterprise Centre initiative, Canada

The network of Women's Enterprise Centres (WECs) was established in 1994 as an effort to better address the challenges faced by women entrepreneurs. The WECs, present in each of the four provinces of Western Canada, are operated by non-profit organisations and are awarded five-year renewal contracts to offer advice, business planning assistance, mentoring, networking opportunities, information and referrals to accountants and lawyers, and specifically to women. They also deliver loan funds targeted at new or existing businesses owned by women. The WECs have provided a one-stop shop for women entrepreneurs. Some of the most significant impacts achieved by this programme have been on: further developing their business, management and personal skills, increasing their access to other programmes and services through information resources, and enabling them to network. The impact of the loan programme was also significant. Overall, clients attribute 55% of their current business revenues to the services provided by the WECs.

Source: (Halabisky, 2018[50])

Supporting social economy and social innovation

Promoting a social economy can help the Pilbara strengthen community cohesion, reduce inequality and unlock job opportunities outside extractive sectors. Social innovation is particularly important in remote areas because it fills in the gaps caused by a truncated market economy that provides only a limited number of goods and services and local governments that have too few resources. In rural areas, high levels of social capital may be more important for economic and social development because it can

increase social innovation (OECD, 2022[45]). Social economy refers to certain types of entities that contribute to economic activity with an express social purpose: associations, co-operatives, mutual organisations and foundations. Specific principles govern these organisations, notably: i) solidarity and mutuality; and ii) the primacy of people over capital or democratic and participative governance. Social economy organisations pursue activities in a wide range of sectors, such as banking, insurance, agriculture, health, social services and others (OECD, 2020[51]).

In the Pilbara, different social organisations are mainly working around issues of First Nations communities. These organisations perform activities to reduce addiction among the young, provide elderly and childcare, integrate persons with disabilities or help protect the environment.

The Pilbara and Western Australia have the scope to fully harness the potential of social enterprises to improve well-being and create new job opportunities. The first step is to map and showcase the existing social enterprises and their role in the different communities. Highlighting publicly the relevance of these organisations in providing support to the well-being of the communities will increase the recognition of their work and create opportunities for co-operation and funding. This is of special relevance for First Nations-related enterprises that perform activities to reduce addiction among the young, provide elderly care or protect the environment.

The second step is to support access to long-term finance for social enterprises. In the Pilbara, social enterprises mainly receive funding from the government or mining companies. However, this funding tends to be short-term and with no fixed amounts. There is a scarcity of established social or impact-driven investors in the Pilbara and Western Australia, which reduces the funding sources for social enterprises in remote areas. Therefore, providing long-term finance with a greater pool of sources can increase the resilience of these organisations, making them less vulnerable to political or mining cycles. This can be addressed by disposing of funding lines from the royalty's system to these enterprises or creating better links with private financers. On the other hand, bridging the gap between traditionally grant-reliant social enterprises and commercially oriented private financiers requires specialised intermediaries that can broker dialogue and design a financial offer satisfactory for both parties (Box 3.13). The PDC already has a specific team working on communities that can play the role of both the broker and the provider of long-term financial support.

Finally, the region can rely on existing social enterprises to help identify and promote new business opportunities. Many of these social organisations have networks with population segments that are less engaged in mainstream economic activities or official programmes. For example, in Canadian rural regions with a significant number of First Nations people, social innovation has been especially important as a way to expand economic opportunities in societies with different social norms and as a bridge between First Nations and non-First Nations firms and governments.

Box 3.13. Bridging the financing gap for social enterprises in Germany: The Financing Agency for Social Entrepreneurship

The Financing Agency for Social Entrepreneurship (FASE) is a German financial intermediary that deploys innovative financing schemes to overcome the boundaries between donors, investors and the private sector in order to provide hybrid financing to social enterprises. Many early-stage social enterprises face a common financing gap where their financing needs are too large for donations or to attract foundations, and too risky for institutional social investors.

Registered as a private company and owned by Ashoka Germany, FASE was founded in 2013 to create a financial intermediary capable of supporting early-stage social enterprises to raise growth capital in order to scale their impact. FASE was a beneficiary of the 2013 and 2016 editions of the

EaSI-PROGRESS calls to boost the demand and supply side of the finance market for social enterprises. FASE supports early-stage social enterprises through collaborative funding models and transparent transaction management that help social enterprises overcome scaling obstacles by tailoring transactions to the specific needs of each social enterprise while ensuring a reliable and rapid process.

Likewise, FASE provides business support services and guidance to social enterprises seeking to raise growth capital, including by raising awareness of available sources of funding. FASE has closed over 50 transactions as of 2019 and has overseen about EUR 25 million in investments into social enterprises. It has provided support to over 800 social enterprises to learn how to raise growth capital and overcome the specific challenges that social enterprises face. The organisation oversees a network of over 250 impact investors and has helped to raise awareness and expertise on growth capital for social enterprises and related policy issues.

Source: EC (n.d.[52]), *Financing Agency for Social Entrepreneurship (FASE): An Intermediary Bridging the Financing Gap for Social Enterprises (Germany)*, https://betterentrepreneurship.eu/en/node/34;.

Work with educational institutions to prepare for the digital and green transition

The digital transition in mining will bring different opportunities and challenges for the Pilbara (Chapter 4. Opportunities span from greater salaries and productivity for the region, with fewer activities requiring human physical strength and therefore opening up the workforce to a larger pool, including the elderly and women. However, digitalisation can displace some workers, increase the inequality gap and allow for remote work from outside local communities. Many companies in the region have started automation processes, mainly in trains, trucks and mining equipment.

Against this backdrop, the state is investing in upskilling and reskilling the workforce, including the development of education and training packages specific to the renewable energy industry, such as the design and installation of on-grid and off-grid battery storage systems.

A main challenge for the Pilbara is defining how to prepare human capital for the digital transition in mining and who is best suited to deliver such instruction. There are no dedicated universities in the Pilbara that can train the workforce or young population for the specific needs of the region. Improving access locally to high-level specialised education can also help retain young people and attract families to the region. Recommendations on this will be further developed in Chapter 4.

Universities and educational institutions can help the state and local governments establish long-term plans to improve both skills and innovation systems. Outsourcing skills strategies to educational institutions is particularly important for rural governments that lack staff capacity and critical mass. Universities can also be involved in the definition of diversification strategies for the Pilbara. This type of model has brought positive outcomes to other OECD regions, for example the agreement between the regional government of Värmland and Karlstad University in Sweden to develop the Academy for Smart Specialisation with the aim of promoting regional development (Box 3.14).

Box 3.14. University-government collaboration for local economic planning

The Academy for Smart Specialisation aims to utilise research for the benefit of industry, the county administration, county council and municipalities in Värmland, Sweden, and to strengthen the research environments in the region. High-quality research is expected to attract more external funding to the university and promote research co-operation. This initiative is a continuation of the agreement of intention that was made for the 2010-14 period when ten new professorships were instituted at Karlstad University. The six areas of specialisation identified by Värmland's research and innovation strategy are the foundation of the Academy for Smart Specialisation. Karlstad University and the region of Värmland will run the academy jointly for the purpose of serving as a meeting place for researchers, companies, financiers and entrepreneurs. By linking research innovation and education, the academy will prepare Karlstad University students for employment to drive industrial development in the six prioritised areas in Värmland.

Source: Karlstad University (2020[53]), *Academy for Smart Specialisation*, https://www.kau.se/en/external-relations/research-and-innovation-collaboration/research-collaboration/academy-smart.

Towards a coherent and long-term vision for the Pilbara's development

Supporting the green transition of the Pilbara's mining sector and leveraging its potential to unlock new economic activities requires a co-ordinated effort across different levels of government and the private sector. In Australia, this regional development co-ordination relies on the state government, which has the primary role in regional development. Local governments have responsibilities defined by the state and deliver a relatively narrow range of services, with decisions that can be overturned by the states (Box 3.15).

Box 3.15. Subnational government responsibilities in Australia

The constitution defines Australia's dualist federal structure and sets out expenditure responsibilities:

- The premier heads the state government, typically the parliamentary leader of the party or party alliance that holds a majority of seats in the state parliament's lower chamber, appointed as such by the governor on the basis of the outcome of a general election. State responsibilities cover the vast majority of legislation that pertains to land use – mining, environmental, pastoral – as well as education, roads, public transport, public works, community services, sports and recreation, consumer affairs, policing, prisons and emergency services. They manage independent systems of local government dispersed over 500 LGAs.
- Local governments, also known as shires and cities, have responsibilities defined by state and territory governments. Local governments are headed by city councils or shire councils, led by mayors or shire presidents. In Australia, local governments deliver a relatively narrow range of services, including recreation, waste management, support education services (e.g. libraries, adult education) and some care facilities. Their responsibilities do not cover services such as police, schools and hospitals, which are provided by states (Wilkinson et al., 2023[54]).

Table 3.6. Main responsibility sectors and sub-sectors

Sectors and sub-sectors	State level	Local government Level
1. General public services (administration)		Building inspections; food and health inspections; pet control
2. Public order and safety	Police;* emergency services; courts*	
3. Economic affairs/transports	Urban and regional transport (road, rail, bus, ports, etc.); agriculture; industrial relations; consumer affairs	Local roads; parking; aerodromes; cemeteries
4. Environmental protection	Environment; state and national parks; waste disposal; sewerage	Waste collection; recycling; green and public space provision
5. Housing and community amenities	Public housing; gas regulation; electricity regulation and distribution (in some states and territories), water supply; zoning legislation; building regulations	Town and land use planning
6. Health	Healthcare; hospitals*	
7. Culture and recreation	First Nations heritage, sport and recreation facilities; museums, theatres and state libraries	Local parks; open spaces; recreation facilities
8. Education	Planning and delivering early childhood education; pre-school; primary school; secondary school; vocational and technical school; higher education	Local libraries; local adult education programmes
9. Social welfare (e.g. early childhood care, aged care)	Early childhood care; aged care	Public childcare centres; certain elderly care programmes*

Source: OECD/UCLG (2022[55]), *2022 Country Profiles of the World Observatory on Subnational Government Finance and Investment*, https://www.sng-wofi.org/country-profiles/.

The national government (also referred as Commonwealth) acts as a key investor, mainly around regional development infrastructure (e.g. transport). Other federal funding programmes include subsidies for public services in remote locations in each state, while regional development agencies (RDAs) promote Commonwealth programmes in the region and provide the Commonwealth with information on regional issues. However, in many instances, there are overlaps in mandates between the Commonwealth and the states. For example, in healthcare, the Commonwealth funds general practitioner services, while the states are responsible for segments of primary service and for managing, running and partly funding public hospitals (OECD/UCLG, 2022[55]).

The Pilbara has four local governments that cover vast territories with low population density: i) the City of Karratha is the most populated municipality in the Pilbara; ii) Port Hedland, home of the world's largest export commodity port; iii) the Shire of East Pilbara, the largest municipality in Australia, which is larger than the whole state of Victoria; and iv) the Shire of Ashburton, the most southern of the Pilbara shires (Chapter 2).

The Pilbara Regional Council serves as the fifth statutory local government to ensure co-ordination among the abovementioned four governments. This council was established in 2000 as a collaborative partnership between the four Pilbara local governments and undertakes tasks on bureau services (ensuring effectiveness and efficiency in project management or identifying opportunities for economies of scale) and advocacy to the state and federal government (e.g. lobbying to attract events). Each local government appoints two councillors to join the regional council.

A place-based approach to create a common long-term vision for development and improve implementation co-ordination

The development of the Pilbara is mainly guided by Western Australia state policies and strategies. The state government, through its departments and particularly through the PDC that is in charge of promoting the Pilbara's economic development. The PDC -under the WA ministry for regional development- helps link state policies with regional stakeholders, identify the main development priorities and establish the strategic vision. State departments design and implement their regional sectorial policies and help co-ordinate regional development (e.g. the central government department).

The Pilbara's strategies are comprehensive and stress main development challenges, but lack co-ordination mechanisms and follow a top-down approach

The Pilbara benefits from a range of development strategies that recognise the need to further diversify the economy and improve well-being. The overarching strategic documents guiding the development of the Pilbara have a pilar on diversification and underline the need and relevance of liveable communities (Table 3.7). These state government plans are informed by a number of thematic strategic documents that focus on specific sectors. For example, the main roadmap for the Pilbara region – the PDC 2019-21 Strategic Plan – establishes a vision for the region to attain "vibrant and sustainable communities underpinned by a strong, diverse economy" (PDC, 2019[56]).

However, the Pilbara does not count on a master plan or vision with mechanisms that help co-ordinate actions across different state ministries for long-term strategies. Development plans are often managed and delivered independently by each ministry, following its thematic portfolio. These ministries manage their sectorial funds and their implementation, which the PDC supports in some specific programmes. In this setting, there is a lack of common objectives and monitoring indicators across ministries for the development of the Pilbara. For example, the departments responsible for infrastructure and energy can both implement relevant projects for the Pilbara without necessarily having previous co-ordination or shared programmatic objectives.

Table 3.7. Policy strategies and plans guiding the Pilbara's development

	Name of the strategy	Level of government that designed it	Brief description of the strategic axis
Overarching strategies	State Planning Strategy 2050	WA government	A vision of sustained growth and prosperity is framed around diversity, liveability, connectedness and collaboration.
	Pilbara Strategic Plan (currently for the period 2019-21)	PDC and WA government	Five strategic themes: industry growth and diversification, energy development, regional living standards, Aboriginal economic development and organisational excellence.
	Pilbara Regional Investment Blueprint	PDC and WA government	Towards a future that offers diversity of jobs and career opportunities, high standards of services and a vibrant community.
	Developing Northern Australia	Federal government	Identified high-level priorities based on infrastructure development, land and water access, trade, education and innovation and governance.
	Diversify WA	WA government	The state's framework for a strong and diversified economy includes 8 external-facing sectors: energy; tourism, events and creative industries; international education; defence industries; mining and METS; space industries; health and medical life sciences; and primary industries.

Example of thematic strategies	Regional Freight Transport Network Pla	WA government	Strategic long-term planning and policies to ensure optimal network performance for Western Australia.
	Pilbara Planning and Infrastructure Framework	WA government	Strategic planning goals and actions to provide adequate physical and community infrastructure.
	Pilbara Regional Water Supply Strategy	WA government	Options for meeting demand in the coastal towns and ports, scenarios of future demand for water.
	Pilbara Tourism Product Development Plan	WA government	A framework for the long-term development of the tourism industry in the region.

On top of that, the Pilbara's policy making has been historically top-down driven. The Pilbara's top-down approach is grounded in the region's industrialisation process that relied on direct agreements between the state and private companies to secure the significant investments needed to activate natural resources in the region.

This approach has resulted in limited integration of local initiatives in regional development and subsidiarity in governance, which hampers responsiveness to local needs and aspirations and, in turn, the capacity to sustainably address well-being and economic diversification challenges. The footprint of the Pilbara's mining industry, combined with a significant portfolio of what is termed "state agreements" has led mining companies to conduct government functions at the local level, such as provision and management of utilities (e.g. water or electricity), housing and even some public services such as childcare.

While initially this development approach helped ensure quality lifestyles, especially for mining workers and their families, this has also restrained the scope for local government revenue raising (Wilkinson et al., 2023[54]) and reduced public capacity to broaden these services to non-mining workers. This has been recognised by the Pilbara local governments for some time (ALGA, 2023[57]) as well as companies who are not in the position nor equipped to fully overtake government functions at the local level. In this structure, bottom-up projects defined by local associations or LGAs often need to apply for funding from the state, which can lead to delays in time, given the capacity of LGAs to design and structure the project application. The limited involvement in policy decision making also extends to First Nations and communities, which face even fewer institutional channels to participate in the planning and development decisions for the region.

The government had already implemented strategies to promote a bottom-up approach to improve well-being in the region. A significant sub-programme of the Royalties for Regions programme was an investment agenda referred to as Pilbara Cities that was intended to transform the population centres across the Pilbara region to attract new permanent residents from Australia and overseas. Between 2009 and 2015, approximately AUD 1.7 billion was invested under the Pilbara Cities programme, which helped build health, education and recreational facilities. Programmes were identified based on local needs and the PDC performed a key role in the co-ordination of resources and implementation of projects. Despite the positive results of this programme in delivering projects tailored to the basic needs of quality of life in the Pilbara's towns, it found difficult to create complementarities with economic diversification strategies to unlock new job opportunities and empower LGAs to ensure sustainability and ownership of the projects.

Against this backdrop, attaining a more diversified and inclusive development in the Pilbara relies on the capacity of the different governments to follow a common vision and work with regional stakeholders to implement strategies tailored to the most pressing local needs. To this end, the Pilbara needs a modern policy framework that: i) sets a long-term vision for development; ii) improves the participation of LGAs, First Nations and other regional stakeholders in policy making to adapt policies to local needs and grasp bottom-up solutions; and iii) strengthens the co-ordination of policies within the government to improve efficiency and scale in implementation.

A long-term vision for development: Reaching consensus among regional stakeholders with clear communication channels

The Pilbara would benefit from such a long-term vision that helps guide the state ministries' actions as well as provide investment certainty in the region and create the ecosystem for synergies among regional stakeholders (LGAs, First Nations, mining and non-mining businesses).

For the Pilbara, this vision needs to better clarify the role of the extractive industries in improving regional well-being in economic, social and environmental terms and also outline strategies for a future without those extractive industries. This plan should include a strategy to benefit from the strategic proximity to Asia and the existing commercial links with this market. With investors, companies and society increasingly focusing on social and environmental outcomes of extractive industries, the Pilbara can position itself as a benchmark region in "responsible sourcing" of emissions-free raw materials and products (e.g. green iron ore, lithium or ammonia) and in the integration of First Nations within the economy. This means further ensuring and promoting extraction, processing and trade of minerals conducted in socially, environmentally and economically sustainable ways that do not contribute to the generation of human rights abuses (OECD, 2016[58]). In doing so, the Pilbara can increase social licence for future investments and unlock other market opportunities for its METS companies in Asia. To do so, the PDC and Western Australian government could support conferences on responsible sourcing with a focus on Southeast Asian participants.

Developing this overarching vision requires consensus within the regional government and different actors at the local level. This vision needs to gather views on the role of mining for local development and concerns about the effects of this activity on the environment and society. Some useful techniques to set strategic visions include interactive methods of brainstorming, community assemblies and roundtable discussions. This vision is usually defined first by a small group of main stakeholders and then shared with wider stakeholder groups for discussion and consensus.

Other OECD mining regions have developed long-term mining visions based on strategies that go beyond the support of mining towards an overall goal to improve the well-being of the region. This is the case of the region of Antofagasta, which has developed a mining strategy for well-being with a vision until 2050.

Better adapting policies to local needs with greater involvement of local government structures and subsidiary

For rural and low-density regions, policies that adopt a consistent approach to enable communities to translate their needs into concrete strategic plans benefit from tailored solutions and local buy-in to ensure their implementation over time (OECD, 2020[59]). While a policy approach that includes bottom-up initiative in the Pilbara might take longer to build and imply greater resources to integrate the views of dispersed communities across a vast territory, the process itself will help create social cohesion and more sustainable policy outcomes while improving the sense of belonging in this region. This approach should help identify common development objectives for the Pilbara and specific actions per state department are instrumental in the horizontal co-ordination.

Other OECD mining regions have adopted such a place-based approach in collaboration with the private sector to shift the narrative about structural challenges, such as remoteness and harsh weather, towards advantages. For example, previously thought challenges in Lapland, Finland, like the remoteness, the cold temperatures (-30 degrees Celsius or °C) and darkness (50 days of 24-hour darkness), are now some of its main assets, attracting tourists and investors to experience the advantages offered by this particular setting (e.g. environmental beauty or First Nations know-how).

In the same vein, Fort McMurray, an urban area located in the province of Alberta, Canada, and considered one of the hubs of Canada's petroleum production, has seen its population more than double between 1990 and 2022 (Government of Alberta, 2023[60]). This is despite a subarctic climate with average low temperatures of about -22°C in winter and only 3 months in which average temperature is higher than 10°C

being prone to wildfires, one of which led to the evacuation of the community in 2016. This continued growth of the region has been supported by a number of factors other than economic attractiveness, including the commitment of extractive companies in the region to support housing development with industry-owned housing construction companies and the role of a specific federal development corporation dedicated to improving quality of life in the region (NADC, 2022[61]).

In contrast, policies that are delivered in a largely top-down centralised manner are only likely to work in countries and subnational governments whose different regions are broadly equal on a wide range of socio-economic indicators, including productivity, wages, educational attainment, public investment, professional networks, social capital and civic engagement (McCann, 2023[62]).

In this context, a place-based approach relies on adopting a principle of subsidiarity, where decisions about problems are taken as close as possible to where they take effect, thereby providing greater input to decision making from people whom those decisions affect (Drew and Grant, 2017[63]). Subsidiarity is a growing process in the structure of most modern federated states such as Canada, the United States and the European Union and many of its member nation states. Subsidiarity is particularly relevant for regions with characteristics such as the Pilbara. Its remoteness from centres of state and national government, dispersity of settlements, diversity of First Nations and singular industry dependency place its population and local governance structures in a unique position to grasp development priorities and identify solutions to improve their well-being.

An important step for the Pilbara to ensure views from communities are taken into account in shaping the future of the region is to involve local government structures in the preparation and monitoring process of the main strategic plans at different levels of government. Federal plans often guide state government policies but offer few involvement opportunities for local communities, especially those remote. The state government should adopt a proactive approach to integrate local views with platforms to allow frequent communication and discussion with communities. Some OECD regions have implemented citizen platforms, which contribute to promoting specific regional development strategies and overseeing implementation (OECD, 2020[59]). Relying on social enterprises to discuss policy drafts or propose concrete projects in a strategy can benefit the Pilbara.

Increasing LGAs' capacity in co-developing strategies is a cornerstone towards a stronger subsidiarity and local participation in policy making. For the Pilbara, this can include involving LGAs in negotiations of new state agreements (which are increasingly rare) or in amendment processes for current agreements. While state agreements were widely used by resource extraction companies at the beginning of the industrialisation of the region, these are less common today. As a number of historical state agreements either had a set end date or a set term for the mining leases issued, parliament has had to consider extensions over recent years. In the last decade, out of 16 bills that have passed through parliament concerning a state agreement, only 3 have ratified the new agreement in its entirety, while the majority (10) have approved amendments. Over the last decade, the Government of Western Australia has increasingly taken the amendment of an agreement as an opportunity to "modernise" and "standardise" it or impose additional obligations, again with the agreement of the proponent, for example placing further obligations on the company for community development plans, local participation plans or local content to be implemented for the project. In this case, these amendments are an opportunity to keep modernising the state agreements with the participation of LGAs to improve outcomes for local communities and the environment.

Adopting an anticipatory policy approach

Furthermore, the region needs to advance its anticipatory policy approach and build strategies aiming at outcomes for the region, even by preparing for a future without mining. The Pilbara Regional Investment Blueprint was a good example of setting policy strategies with a forward-looking approach. Despite this increasing acceptance of the importance of future thinking in policy, the state of Western Australia seems

to adopt a passive policy-making process for the future of the Pilbara, without clear strategies for imagining the legacy of mining in the region for a more diversified future. The state government of Western Australia should embed a forward-looking and adaptive approach to adapt to unexpected shocks and this entails possible strategies for a different future in the Pilbara. The example of Ireland's national rural policy can be of guidance for the Western Australian government (Box 3.16).

Box 3.16. Our Rural Future – Ireland's rural development plan

Our Rural Future represents the Irish government's blueprint for a post-COVID-19 recovery and development of rural areas over the next five years. Its stated objectives are optimising digital connectivity, supporting employment and careers in rural areas, revitalising rural towns and villages through enhanced participation, public services and resilience, as well as fostering the transition to a climate-neutral society.

The plan places particular importance on teleworking, acknowledging that the rise of this working mode has contributed to reducing transport emissions, provided a boost for small local businesses across the country and offered possibilities for young people to build a career while continuing to live in their communities, regardless of where their employer is headquartered. Planned actions specifically related to teleworking include, among other things:

- Investing significantly in teleworking infrastructure, providing an opportunity for people to continue living in rural communities while following their career ambitions.
- Providing financial support to local authorities to bring vacant properties in town centres back into use as teleworking hubs and develop an integrated network of over 400 teleworking facilities throughout the country, with shared back-office services and a single booking platform for users. Teleworking facilities would support the retention of skilled people in rural communities and attract mobile talent to rural areas.
- Piloting co-working and hot-desking hubs for civil servants in a number of regional towns and moving to 20% home or teleworking in the public sector in 2021, with further annual increases over the lifetime of this policy.
- Examining the potential to introduce specific incentives to encourage teleworkers to relocate to rural towns and provide funding to local authorities to run innovative marketing campaigns targeted at attracting teleworkers and mobile talent to their county.

Source: Government of Ireland (2021[64]), *Our Rural Future, Rural Development Policy 2021-2025*, https://www.gov.ie/en/campaigns/c6f5d-our-rural-future/.

Improving co-ordination of policy implementation and supporting accountability

Implementing a common long-term goal for the region also needs an institutional mechanism that works at the local level to ensure co-ordinated actions horizontally across different state departments and vertically among different levels of government. A specific master plan for the Pilbara's development must be supported with mechanisms to co-ordinate implementation and ensure long-term monitoring. The monitoring of this plan needs public communication of progress to allow stakeholders to track efforts and improve the accountability of government actions in the region.

LGAs also tend to act in silos in the Pilbara, partly because of the territory's extension and low incentives for co-operation in the region. The historical transition from closed-mining towns to self-governed areas that look after resources and services to remain attractive has likely impacted self-centred local strategies that relate little with neighbouring areas despite sharing all of the same natural resources. Few LGA

strategic plans to attract business or improve well-being involve common actions with other LGAs. At the same time, these LGAs struggle to attract a skilled workforce for a long-term stay, with many public servants coming from outside the region and leaving after a certain period or being hired by mining companies (see next chapter).

The PDC can further support LGAs by providing technical advice and helping them identify synergies among their policies. Co-ordination of the implementation of plans in the region should further benefit from the existing outreach of the PDC. The PDC can further collaborate with the chamber of commerce of each town and the LGAs to identify main local priorities and proposals of action for state programmes. Other mining regions like North Karelia, Finland, have an inter-municipal development agency, Business Joensuu Ltd, from whom municipalities buy services that are not efficiently performed in the LGA due to lack of staff or capacity, including business advisory services, placement and marketing services or space, community and event services (OECD, 2019[65]).

Co-ordination is also required across the different ESG strategies and investments of mining companies in local communities. Most extractive companies in the Pilbara have projects with local communities and towns, spanning from the provision of water and electricity to health and recreational infrastructure. However, these projects are dispersed and they are not taught to replace the long-term provision of public service. Therefore, there is a need for government involvement to help these programmes attain scale and obtain a long-lasting impact for these interventions. For this, the government needs to map the existing projects and their impacts to examine opportunities for co-investment and synergies. The PDC, in collaboration with the DMIRS, can advance in this mapping and, subsequently, co-ordination role.

To improve co-ordination across state departments and among local policies, the state government could leverage existing task forces and outreach with stakeholders to formalise a mechanism to oversee policy implementation with representatives of different stakeholders at once (companies, academia, communities). These multi-stakeholder co-ordination mechanisms have been used in other OECD regions to identify main local needs and agree on differentiated priority strategies for each regional area. This mechanism can take the form of a formal meeting to establish long-term commitments, supported on short-term projects focused on improving well-being in the Pilbara. These mechanisms often need strong political support to maintain the participation and interest of stakeholders in time. The case of Eindhoven, Netherlands, could be a guide for the Pilbara (Box 3.17). The newly created governance mechanism of the region of Antofagasta, Chile, to oversee the regional mining strategy and monitor its implementation is another multi-stakeholder platform that is set to remain beyond the political cycle and provide continuity to projects and the vision in the long term (OECD, forthcoming[66]).

Box 3.17. Co-ordinating regional stakeholders: The case of Brainport Development in Eindhoven, Netherlands

The Brainport Eindhoven region is the industrial high-technology heart of the Netherlands, covering Eindhoven and 20 surrounding municipalities. Industrial activity in the region ranges from manufacturing complex machines and systems in the semiconductor industry to embedded systems for automotive to advanced medical systems and design. Innovation in the region was previously based on closed organisational forms and mainly driven by Philips. The company's loss of international competitiveness drove it to establish the first knowledge campus and transitioned from a closed model of innovation into an open model by stimulating the strong involvement of the private sector. The innovation system of Brainport is, to an important extent, business-driven, powered by entrepreneurial leadership and strong collaboration between industry, knowledge institutes and government in the triple helix model and ample participative involvement of civil society.

Besides collaboration in the triple helix, its governance depends on how national, regional and local governments co-operate and interact and how Brainport connects to and collaborates with other regions (domestically and internationally). The most important innovation policy instrument, both in funding size and in popularity, is the national WBSO scheme for a corporate tax deduction of research and development expenditures. The project management approach consists of a large number of bottom-up initiatives with external project owners. Brainport Development invites the participating firms or knowledge institutes to take ownership of initiatives and projects that are being carried out.

Brainport Development was chosen as the Intelligent Community of the Year 2011 from more than 400 participants and won the Eurocities Award in 2010 in the "co-operation" category for co-operation among companies, knowledge institutions and government.

Source: Bronneberg, M., J. Pieterse and G. Post (2023[67]), "Brainport Eindhoven: Born from crisis - 25 years as a triple helix governed ecosystem", https://doi.org/10.24840/2183-0606_011.001_0003.

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Notes

[1] Lithium resources occur in two distinct categories: lithium minerals, largely from the mineral spodumene (Li2O.Al2O3.4SiO2), and salts, largely from lithium-rich brines in salt lakes. Australia, Canada and China have significant resources of lithium minerals, while lithium brine is produced predominantly in Chile, followed by Argentina, China and the United States. Lithium brines are the dominant feedstock for lithium carbonate production.

[2] A critical mineral is a metallic or non-metallic element that has the two following characteristics: i) it is essential for the functioning of our modern technologies, economies or national security; and ii) there is a risk that its supply chains could be disrupted (Geoscience Australia, 2023[68]).

[3] Scope 1, 2, and 3 are categories of carbon emissions created by a company's operations and in the wider value chain. Scope 1 emissions are Green House Gas (GHG) directly made by the company. Scope 2 emissions are indirectly made by the company. See: https://ghgprotocol.org/sites/default/files/standards_supporting/FAQ.pdf

4 Improving liveability in the Pilbara

This chapter provides a brief overview of factors that impact the quality of life for present and potential inhabitants of the Pilbara that can contribute to the decision to relocate. Subsequently, the chapter delves into potential strategies to enhance the region's appeal and overall liveability. The final section of the chapter emphasises the importance of advancing the well-being and self-determination of First Nations communities, discussing actionable steps for promoting cultural preservation, inclusive decision-making processes and equitable access to resources and opportunities.

Assessment and recommendations

For many First Nations people, the Pilbara region is the most liveable place on the planet, given their ancestral, kinship, community, cultural and spiritual ties to the region. Further, the Pilbara can offer high-paid employment, security and good recreational facilities for people who value small regional community living, are agnostic to the dry and hot climate and enjoy an outdoor lifestyle. The resources industry-oriented economy also offers residents of the Pilbara the prospect of developing and growing enterprises that service the local resources economy.

However, for a significant majority of the wider population, there are several key detractors from longer-term residency in the Pilbara. The extreme isolation, harsh climatic conditions, high cost of living, constrained access to affordable housing and limited local services render the Pilbara a challenging place to live. This makes it difficult to recruit and retain professionals to improve local service provision, which in turn further challenges the attraction of the population to permanent residency. The resources industry, in part, addresses these challenges by offering its employees a fly-in fly-out (FIFO) alternative to residing in the region, which has also led to negative externalities in local communities, including cost of living and social cohesion.

Improving the attractiveness of the Pilbara requires a coherent development policy that focuses on increasing well-being standards locally, with a particular focus on First Nations people and resource industry employees and their families choosing to relocate to the region. This involves a targeted strategy to: i) enhance access to services, especially childcare, education and health, with a proactive approach to attracting national and overseas talent; ii) improve housing availability and affordability; iii) minimise FIFO; and iv) empower First Nations people and improve their development opportunities. While FIFO may continue to be a preferred solution for companies, the environmental and social impacts of this model need to be carefully evaluated to reach compromises that benefit the Pilbara and the state.

Recommendations

- **Improving access and provision of services in the Pilbara with an inclusive approach** through living cost equalisation, attraction of service workers and tailoring services to the needs of First Nations people. For this, the state government should:
  - Attract and retain professionals to improve local service provision by:
    - Evaluating the implementation of a living cost incentive to attract employees working in public and non-tradeable service sectors, particularly childcare, education and health. Incentives in response to the higher cost of living can involve housing support or tax credits and should involve shared actions among private companies and governments. The experience of tax credits for residents in Yukon, Canada, can be a guide.
    - Attracting migrant workers through greater use of the Pilbara Designated Area Migration Agreement for key vocations in childcare, health and education. This would potentially serve to address the service deficiency in the Pilbara, as well as provide an opportunity for families in the neighbouring region to earn higher incomes.
  - Set a task force comprising representatives of mining companies and academia to strengthen skills in the region. Main actions could involve:
    - Mapping the future skills needed for the industry including establishing a baseline assessment of existing employment practices, status of occupation and skills development opportunities, with a particular focus on women and First Nations people in the Pilbara.

  - Scaling up companies' training programmes by involving a wider share of the population and making them sustainable in time. This includes further government and industry support for advocating the benefits of mining to young people (e.g., support for the transition to net zero) and ensuring culturally and gender safe training pathways and work environments designed by women and First Nations people.
  - Incentivising collaboration of local industry and education institutions to encourage local students to pursue fulfilling and diverse careers locally. This involves identifying emerging vocation gaps and better integrating vocational training and apprenticeship pathways with secondary schools and vacation employment. For instance, local governments may work alongside industry owned and led Jobs and Skills Councils (JSCs), which provide strategic leadership in addressing skills and workforce challenges and identifying skills and workforce needs for their sectors.
- Tailor education services to the needs of First Nations people to ensure that local First Nations children leave school with an adequate level of education and training. This involves attracting organisations focused on First Nations people's education (e.g. Studio Schools of Australia) to establish education options specifically for First Nations students and support the training of culturally equipped First Nations teachers.
- Promote integration with First Nations culture from the early years of schooling. This involves embedding in school curricula, and from the early years of primary school, an understanding of local and broader Australian First Nations history and culture to drive social cohesion and pride for the benefit of all members of society.

- **Improving the housing market** by creating dedicated spaces to reach common solutions among various stakeholders and exploring counter-cyclical investment in housing stock with the collaboration of resource companies. For this, the state government should:
  - Create a Pilbara housing task force where the full range of stakeholders can seek to understand the housing issues on an evidence basis and develop a clear and implementable housing strategy for the region. This could be in the form of a summit, conference or dedicated multi-stakeholder group. The state and Pilbara Development Commission (PDC) could get inspiration from the Labrador West Housing and Homelessness Coalition in Canada.
  - Set a formal housing strategy to promote collaboration with mining companies to support construction works and free up houses for permanent living or land with preferential prices for construction. This could make it easier for workers to decide where to live. While some will certainly choose Perth for amenities/liveability, others will prefer to avoid being FIFO and be close to their families every day.
  - Create a one-stop shop in the state to co-ordinate approval processes simultaneously, including land use and environmental permits.
  - Evaluate densification strategies and construction of multi-family or multipurpose buildings. This implies changes to zoning in some parts of town. Despite the cultural factor, densification may be an option to attract new generations, single people or immigrants with another cultural lifestyle, who are looking for comparably affordable housing options and immediate access to city-like services.
- **Better integrating FIFO workers** to increase social cohesion and strengthen local communities. For this, the state government should:
  - Improve co-ordination of industry's needs for camps with local and state government plans. This involves aligning potential future camps' needs with land use and development plans.

- Integrate FIFO worker accommodation within existing residential communities (where possible) and incentivise their participation in the local economy in consultation with communities. When operations are within a safely commutable distance to a settlement, this will allow FIFO workers and their host communities to benefit from an integrated community lifestyle.
- Develop a set of operating protocols, or standards, that define how effective settlement-integrated FIFO camps are designed and operate. This could be measured and tracked in various ways, including via regular stakeholder, community and workforce surveys to obtain feedback and track the effectiveness of any new framework and protocols/standards.

- **Improving well-being and development opportunities of First Nations people for thriving and inclusive communities in the Pilbara**, in collaboration with First Nations people. For this, the state government should:
  - Provide resources for a First Nations-led Pilbara First Nations Self-determination Summit to bring together the region's First Nations people, local governments, industry and the broader community to address truth telling, First Nations visibility in the Pilbara region and pathways to greater involvement in regional decision-making and economic self-determination.
  - Establish a Pilbara First Nations Capacity Building Program that resolves around the co-design of specific training, improves financial literacy and enhances opportunities for capability joint venture partnership opportunities.
  - Support financial grants, equity, lending or loan guarantee programmes to facilitate First Nations people's access to capital, entrepreneurialism and active participation in the economy.
  - In collaboration with First Nations businesses and mainstream industry, standardise First Nations procurement across industries and government. This involves clarifying the industry's First Nations procurement criteria, processes and procedures with the goal of making opportunities as broadly accessible as possible.
  - Support the establishment of a Pilbara First Nations Chamber of Commerce to drive their business initiatives with support from the state through the PDC and arms-length sponsorship from the local resources industry. This can be done through supporting the Pilbara Indigenous Business Network Group with the capacity to serve as a broker for funding, connecting public and private funds to Indigenous businesses.
  - Improve capacity and financial access to First Nations not-for-profit organisations with long-term funding adjusted to logical points that allow impact to be demonstrated and the programme to operate as efficiently as possible.

Introduction

The Pilbara region offers most residents security of employment and opportunity for economic prosperity. However, it also presents significant challenges to longer-term residents, including isolation, harsh climate, a relatively high cost of living, a volatile housing market, limited options for education and constrained access to healthcare. As such, despite population growth in the region, a large number of Pilbara residents still live in the Pilbara to work and improve their financial circumstances, with an intent to ultimately relocate to locations characterised by greater amenities, particularly regarding accessing secondary education for their children.

An important and significant exception to this general trend is the First Nations people of the Pilbara region, whose ancestors have lived in the region and managed its lands for millennia. For these people, their ancestral and contemporary ties to kinship and community, as well as their spiritual and cultural connections to the lands, waters and Sea Country of the Pilbara, render them a far more permanent, albeit on average less prosperous, component of the Pilbara residential population.

This chapter provides a brief overview of factors that impact quality of life for current residents and motivate people to leave the region. It then provides pathways to improve attractiveness and liveability in the region. The chapter concludes with a focus on actions to improve First Nations people's well-being and self-determination.

First Nations explain most of the Pilbara region's history

The first 49 800 years

The Pilbara region incorporates the traditional lands[1] of approximately 25 First Nations language groups who have, for at least the past 50 000 years, lived and continuously practised their culture in the Pilbara region (Wangka Maya Pilbara Aboriginal Language Centre, 2023[1])

The various First Nations cultures of Australia, including those of the Pilbara, are among the world's oldest continuously practised cultures in existence today (Malaspinas et al., 2016[2]). For First Nations people, British colonisation and subsequent industrial development of the Pilbara represent a small share of their history in the region. Colonisation has and continues to have significant impact on First Nations people's way of life in the Pilbara. For example:

- The Pilbara region has a complex history of colonisation that involved discriminatory practices, land dispossession, cultural site destruction and killings of First Nations people, including the Flying Foam Massacre on the Burrup Peninsula (Chapple, 2017[3]; University of Newcastle, 2023[4]). In many cases, this resulted in the disruption and loss of traditional territories, dependency upon religious and state institutions, and barriers to economic participation.
- Discriminatory legislation of historical Western Australian parliaments, such as the Aborigines Act 1905 (WA) and Native Welfare Act 1963 (WA) resulted in First Nations children being systematically separated, in many instances permanently, from their families and communities (hereafter referred to as the Stolen Generations).
- Since the late 19th and for much of the 20th centuries, the pastoral industry was the main source of employment for First Nations people in the northwest of Australia. However, First Nations people were often discriminated against, with practices that included payment of lower wages thank other workers or payment with clothes and food. In other early Pilbara industries, such as pearling, there is increasing evidence of settlers using local First Nations people for slave labour (Paterson and Veth, 2022[5]). Subsequent removal of the racially discriminative clause from the Federal Pastoral Industry Award meant the introduction of equal wages for First Nations pastoral workers. However,

due to pastoralists inability and unwillingness to pay First Nations workers, from the late 1960s onwards, there was a First Nations unemployment and welfare crisis across much of northwest Australia, including the Pilbara region.

High levels of welfare dependency and lower standing across all key measures of socio-economic status, together with intergenerational trauma caused by the circumstances of colonisation and ongoing discrimination, continue to be characteristic of many First Nations communities in the Pilbara. The historical discrimination in the labour market is a source of distrust from first Nations Peoples towards Non-Indigenous employers.

Box 4.1. The Pilbara First Nations language groups

The Pilbara region of Western Australia is home to numerous First Nations language groups, each with its own distinct culture and language (Figure 4.1). Despite the challenges of colonisation and cultural assimilation, many of these language groups have managed to maintain and revitalise their traditional languages, and their cultural heritage remains an important part of the Pilbara's identity. The following map illustrates the approximate location of the traditional lands of the First Nations people that have lived in the Pilbara region for at least 50 000 years (Wangka Maya Pilbara Aboriginal Language Centre, 2020[6]).

Figure 4.1. Pilbara language families

Source: (Wangka Maya Pilbara Aboriginal Language Centre, 2023[1]) *Pilbara Language Families*. https://www.wangkamaya.org.au/about-wangka-maya

The following table lists the First Nations language groups of the Pilbara region, together with a brief summary of their traditional lands.

Table 4.1. Traditional lands and language groups of the First Nations of the Pilbara

Language group	Traditional lands	Language group	Traditional lands
Banyjima	The area around the town of Wittenoom extends west toward the town of Tom Price and east toward the town of Newman.	Ngarla	Area of the coast near Port Hedland, including the DeGrey and Pardoo pastoral stations.
Bayunga	From Point Cloates through to Point Quobba, then east to Manberry Station and north to Winning Pool Station.	Ngarluma	Around the Roebourne area and to the east and southeast of Roebourne.
Bingura	Along the Ashburton River between Nanutarra and Wyloo Stations and around the Hardy River junction. Land may also have stretched north and east to Duck Creek and the Hamersley Range and south beyond the Ashburton River.	Nyamal	The area east of the coastal Kariyarra country, inland from the town of Port Hedland, encompassing Marble Bar and Nullagine and running north past Oakover River to the borders of Manyjilyjarra, Warnman, Nyangumarta and Ngarla country and south past the Shaw River.
Burduna	The Ashburton-Gascoyne region.	Nyangumarta	Central Great Sandy Desert from Eighty Mile Beach and the pastoral stations of Mandora and Wallal Downs inland to the east and south, bordering Karrajarri Country to the north and Nyamal and Ngarla Country to the west.
Jiwarli	Area of the southern Pilbara region at the top end of the Yannarie River down to Lyons River, where it divides and up to the Henry River.	Nyiyaparli	South of the town of Marble Bar, including the area around Newman and the pastoral stations of Balfour Downs, Ethel Creek and Roy Hill.
Juwaliny	North-west fringe of the Great Sandy Desert.	Putijarra	The southern end of the Canning Stock Route between Halls Creek and Wiluna.
Karajarri	North-western area of the Pilbara extending into the Kimberley just north of Bidyadanga.	Thalanyji	Around the Ashburton River and Onslow areas.
Kartujarra	Around the area of the Jigalong Community in the western area of the Pilbara.	Tharrkari	Southwest inland corner of the Pilbara between the towns of Onslow and Carnarvon, including all or parts of the Glen Florrie, Maroonah, Middalya, Ullawarra and Williambury pastoral stations as well as the Barlee Range Nature Reserve.
Kurrama	The Hamersley Range area from Marandoo and Tom Price to Palm Springs, extending along Duck Creek, around Boolgeeda Creek, the western arm of the Beasley River, down to Cajuput Spring and around Red Hill.	Warnman	Central Great Sandy Desert.
Mangala	North-western section of the Great Sandy Desert.	Yindjibarndi	Area around the Millstream-Fortescue Area and upper reaches of the Sherlock River.
Manyjilyjarra	Central Great Sandy Desert region, northeast of Telfer, includes parts of the Canning Stock Route.	Yinhaawwangha	Area southeast of Onslow covering Angelo River, Hardy River, Kunderong Range, Mount Vernon Station, Rocklea and Turee Creek.
Martuthunira	Around the coastal plains between the Fortescue and Robe River area.	Yulparija	Area from the Central Great Sandy Desert to the south east of the Bidyadanga Community.
Martu Wangka	Around the Gibson and Great Sandy Desert area.		

Source: Wangka Maya Pilbara Aboriginal Language Centre (2020[6]), *Aboriginal Languages of Australia*, https://www.wangkamaya.org.au/pilbara-languages/01-indigenous-languages-of-australia.

The First Nations people of the Pilbara region have and continue to perform an important role in the reclamation of Australian First Nations rights and the renaissance of First Nations culture. For example:

- In 1942, First Nations pastoral workers from across the Pilbara met at Skulls Spring (100 kilometres east of the town of Nullagine) to commence industrial action (a walk-off and strike) that lasted three years and remains Australia's longest-lasting industrial action. The strike led to a series of First Nations pastoral worker strikes across the nation, ultimately resulting in the aforementioned amendments to the federal Pastoral Industry Award.
- In 1964, Yuwali, a Martu woman from the eastern Pilbara, gained international fame when she had contact with non-First Nations Australians in the Western Desert for the first time at the age of 17 – one of the last generations of First Australians to grow into adulthood in a completely traditional way of life.
- Across the Pilbara region, there are extensive *in situ* examples of ancient rock art that, dating back as far as 40 000 years, are some of the oldest known human cultural artefacts still existing in their natural environment – most notably those at Murujaga (Dampier Archipelago) which are currently the subject of nomination for the United Nations Educational, Scientific and Cultural Organization World Heritage List.
- First Nations communities across the Pilbara continue to produce nationally and internationally acclaimed painters and other artists, contributing to Australia's AUD 250 million First Nations visual arts and craft industry (Australian Government, 2022[7]).

However, as discussed later in this chapter, despite this deep history, continued practice of traditional culture, and contemporary contribution to the reclamation of First Nations rights, First Nations people of the Pilbara remain grossly under-represented with respect to economic participation.

The relatively recent industrialisation of the Pilbara region attracted new inhabitants

Over the course of the 1950s and 1960s, the discovery of vast deposits of iron ore across the western Pilbara and the repeal of a World War II export ban on iron ore by the Australian government, as well as subsequent offshore petroleum discoveries set the foundation for the industrial transformation of the Pilbara region that, facilitated by state agreements and significant private investment, took place over the subsequent 70 years, and continues today.

Most people who arrived in the Pilbara region at the time did so for employment opportunities rather than lifestyle. A survey of regional Western Australian residents undertaken in 2013 – a decade ago – strongly indicates that most people who lived in the Pilbara region at the time did so for employment opportunities rather than lifestyle and did not intend to remain residents of the Pilbara (WA Government, 2016[8]). As summarised in Table 4.2, the Pilbara ranked comparatively low on most aspects of regional liveability with the exception of impact on financial position and employment prospects.

Table 4.2. Satisfaction levels of Pilbara residents and residents of other regional Western Australian locations, 2013

	Pilbara mean score out of 10	Average mean score across regional Western Australia	Pilbara ranking out of nine regions
Connectedness	6.79	7.21	Lowest
Education and training	5.55	5.86	2nd lowest
Employment prospects	7.59	6.57	Highest
Financial situation	7.60	6.94	Highest
Happiness	7.24	8.00	Lowest
Health and general well-being	7.29	7.58	2nd lowest

	Pilbara mean score out of 10	Average mean score across regional Western Australia	Pilbara ranking out of nine regions
Lifestyle	7.18	8.00	Lowest
Safety	7.31	8.01	2nd lowest
Sense of community	6.55	7.34	Lowest

Source: WA Government (2016[8]), *Living in the Regions 2016 Insights Report*, Department of Primary Industries and Regional Development, Government of Western Australia.

This survey of residents of regional Western Australia was repeated in 2016 (WA Government, 2016[8]) and, while results were not published in the same detail as they were for the 2013 survey, published outcomes reconfirm the importance of financial motivations for living in the Pilbara region, with over 80% of working-age respondents agreeing that working in the Pilbara was good for them financially, a full 20% above the next closest region.

The 2016 survey was conducted in a different economic environment than its predecessor survey: in 2013, the Pilbara resources sector was rapidly expanding, whereas in 2016, it was passing through peak construction. Notwithstanding its limited published detail, results from the 2016 survey that were disclosed indicate similar motivations for living in the Pilbara region. For example:

- Just over 40% of residents of the Pilbara who responded to the survey indicated that the region's economic outlook was the main reason to live in the region, albeit declining from 80% of respondents in 2016.
- Just over 60% of respondents claimed that living in the Pilbara was good for them financially, decreasing from 80% of respondents in 2013.
- Just over 40% of respondents claimed that the Pilbara's economic outlook is an important reason to live in the region, down from just over 80% in 2013.

The 2013 and 2016 surveys indicate that a large share of individuals who migrated to the Pilbara region did so for employment and financial benefits rather than liveability. Furthermore, those who are receptive to the region's unique lifestyle are often deterred from staying due to family, housing challenges, education or health reasons. The Pilbara's harsh climate and cost associated with the isolation of metropolitan areas increase those challenges, reducing attractiveness for permanent or long-term residents.

Despite these difficulties, recent surveys of residents in the city of Karratha – the region's largest and likely most liveable settlement – have revealed a significant increase in the number of people who no longer have plans to leave. In 2011, only 14% of interviewed residents expressed no intention of leaving the city but, by 2023, this figure had risen substantially to 38% (City of Karratha, 2023[9]). It should be noted that an important mark of Karrath's differentiation from other cities in the region has been its relatively greater investment in housing, streetscape and infrastructure.

In this context, the two main vectors for optimally increasing the residential population of the Pilbara region are:

- First Nations people who have traditional and customary ties to the region returning to or continuing to reside in the region under circumstances where they can live prosperous and culturally fulfilling lives.
- Resources industry employees and their families choosing to relocate to the region on a long-term basis, laying down roots and contributing to a larger, more permanent residential population and community, rather than being employed on a FIFO basis.

Progress across these two vectors will create additional demand to drive growth in the local private sector service economy, as well as justify investment by the public sector to compensate for market failure in service delivery. These vectors are a major focus of the following sections in this chapter.

Improving attractiveness for living in the Pilbara region

For some residents of the Pilbara region, typically those of a younger demographic with adequate disposable income, the region undoubtedly offers a great lifestyle with the larger population centres (e.g. Karratha and Port Headland) providing urban facilities that are comparable to most small-to-mid-sized Western Australian regional population centres whilst having access to a unique and spectacular natural environment that facilitates outdoor pastimes. However, for many others, living in the Pilbara presents challenges, including isolation, harsh climate, high cost of living and access to housing and services.

The Pilbara region and its settlements are known for their high level of isolation from major metropolitan areas in Australia and the world. By road, the main population centre of the Pilbara, Karratha, is approximately 1 530 kilometres from Perth, the capital of Western Australia, and 2 635 kilometres from the Northern Territory capital, Darwin. It is a two-hour flight from Perth, with no direct commercial flights from other Australian or international capital cities. As summarised in Table 4.3, the Pilbara is also characterised by significant intra-regional isolation, with the distance between settlements also significant.

Table 4.3. Driving distance (kilometres) to and within the Pilbara region

	Tom Price	Newman	Port Hedland	Karratha	Onslow
Perth	1 452	1 178	1 627	1 526	1 377
Onslow	376	650	530	302	
Karratha	344	612	238		
Port Hedland	414	452			
Newman	277				

The Pilbara is hot and dry, with climate change likely to make it worse. From December to March, average daily temperatures exceed 30 degrees Celsius (°C) across the region, with average daily maxima exceeding 35°C from October to March. The annual average rainfall ranges from 300 to 350 millimetres (mm) in the north-east to less than 250 mm in the south and west, with tropical cyclones generating around 25% to 34% of the region's coastal rainfall and up to 21% of its rainfall up to 450 kilometres from the coast. Average annual temperature across the region is expected to increase by between 0.6°C and 1.5°C by 2030 under low emissions scenarios, rising to between 1.5°C and 3.1°C for medium emissions trajectories and between 3.1°C and 5.6°C for high emissions trajectories (WA Government, 2021[10]; ESCC Hub, 2018[11]).

Furthermore, the region has a high cost of living (see Chapter 2). Prices for goods and services in the Pilbara region consistently exceed Perth prices by a considerable margin (WA Government, 2023[12]). While this is somewhat mitigated by the relatively higher median income in the Pilbara, it also serves as a reason not to reside in the region (i.e. greater spending power is derived from living elsewhere through a FIFO arrangement). Indeed, a survey of Pilbara residents in 2016 (WA Government, 2016[8]) suggested that 58% of respondents cited the higher cost of living as a major motivation for leaving the region.

Enhancing access to services

In large part, the Pilbara region faces a dilemma that is common to many remote regions: recruiting and retaining workers to improve local service provision and thereby increase liveability and attract permanent residents. More than quality infrastructure, labour supply is the main constraint to improving the region's public services. For employees working in the non-resource sector, the cost of living renders the Pilbara a less attractive place to reside and work. Even though employment terms in these areas typically provide some wage and conditions adjustment in response to the higher cost of living, it is typically not equivalent

to full equalisation. This is a common issue for all services in the region, including those three services identified as priorities for greater well-being in the region (Chapter 2): childcare, education and health.

Despite the Pilbara's specific set of characteristics, the challenges to improve service delivery are common in many other remote areas of OECD countries. OECD studies across other regions with similar challenges in delivering quality service due to labour availability have identified that collaboration across levels of government for long-term investments, anticipated planning with the promotion of economies of scale in service provision (e.g. school networks) and targeted attraction policies for public service workers (e.g. career incentives for rural teachers) are relevant actions to address the issue (OECD, 2021[13]; 2022[14]). In remote areas, relying mainly on private service providers can reduce the inclusivity and affordability of service provision, as the private sector tends to deploy capital in instances where the local market can produce adequate returns.

In this context, this section outlines some of the main challenges that the Pilbara faces in service delivery, including workforce shortage and improving childcare, education and healthcare provision for regional needs.

Addressing workforce shortage for service delivery in the Pilbara

A common issue for quality service provision in the Pilbara is the labour force availability, which is a common challenge in Australia but further undermined in the Pilbara by the challenges discussed above, particularly the cost of living. Some Pilbara towns have relied on FIFO workers to cover some particular services, which can be a punctual and short-term solution for some services (e.g. healthcare specialists) but a less sustainable option in terms of long-term local development.

Incentives to attract service workers

Reducing the cost of living, in particular for non-resource workers in the region, would help improve service provision and thereby increase regional attractiveness. Terms that reflect resources industry employment conditions will likely help address the local deficiency in these services by both attracting skilled workers to the region and reducing competition for those workers from the higher-paying resources industry. Unlike most remote regions across the OECD, the Pilbara is a source of income for the state and benefits from a high economic output. Part of this wealth can be reallocated to provide grants or other public incentives to compensate service workers for the high living cost, especially housing.

Beyond living costs, specificities of the work in rural remote areas can also deter specialised workers from coming. Small and multi-grade classroom teaching, multitasking or possible feelings of isolation and long travel times need to be taken into account when setting incentives. According to other OECD studies in remote rural areas, non-financial incentives for service workers could include more flexibility in roles and retirement plans for older staff and strong career and training incentives for newly qualified staff. This could also include the current attractiveness of part-time contracts, as a significant share of service workers in rural areas work on a part-time basis (OECD, 2022[14]).

The Pilbara faces harsh climate conditions including extreme high temperatures (daily maximums exceeding 35 degrees Celsius) and cyclones. This can create multiple responsibilities for regional development such as ensuring the existence of climate resilient infrastructure and systems. Decision makers need to have access to high quality information, consistent data, and capacity to use this information to inform planning (OECD, 2018[15])Tools for encouraging investment in climate resilient infrastructure include spatial planning frameworks, infrastructure project and policy appraisals, and regulatory and economic standards. The Pilbara may benefit from frameworks in other Australian regions and cities facing harsh climate conditions such as the Darwin Heat Mitigation Strategy, a ten year partnership between the Australian Government, Northern Territory Government, and City of Darwin to implement methods to cool and shade the city (CSIRO, 2021[16])

Embracing the benefits of migration

Furthermore, the Pilbara could benefit from its proximity to Southeast Asia, one of the world's most populous regions and with relatively high levels of unemployment. Australia has a mechanism to allow for a co-ordinated and targeted attraction of oversees talent, the Designated Area Migration Agreements (DAMAs), which are a formal agreement between the Australian Government and what is termed a Designated Area Representative, which can be a state government or regional body such as a local government. DAMAs help regions access a broader range of overseas workers than is available through Australia's standard skilled visa programme, allowing variation to standard occupations and skills lists and/or negotiable concessions to visa requirements. This effectively allows a region to address specific skills shortages through migrant workers by making visas conditional on the temporary or permanent migrant working in a specific vocation in a specific region for a specific period of time.

In this context, where DAMAs do not exist, the local, federal and state governments should consider establishing DAMAs for key vocations in childcare, health and education to attract overseas talent into the Pilbara region and, where they already exist, stakeholders should advocate for more competitive terms for those DAMAs. This would serve to address the service deficiency in the Pilbara and increase multiculturalism and population in the regional towns. Besides attracting workforce, some specific actions can be undertaken to improve service provision across childcare, education and health.

Co-ordinating private initiatives in childcare

Accessing quality childcare is a growing issue in the region, as in Western Australia. In fact, recent studies indicate that Western Australia has the lowest overall childcare accessibility in the country (Hurley, Matthews and Pennicuik, 2022[17]).

Childcare shortages deter family attraction and affect female participation in the labour market in the Pilbara. Relocating to the Pilbara region for a higher income implies working in mining operations, which tend to have a work shift roster that makes it difficult for families to care for children during the day if both parents work. This problem affects, to a greater extent, women's employment possibilities since they tend to be responsible for the majority of childcare (OECD, 2021[13]). The main bottleneck for childcare provision is professional shortages rather than facilities (see Figure 4.2). Private initiatives trying to attract childcare workers report that the majority of candidates identify the cost of living in the region as a significant barrier to considering the education and care sector as a career choice (Thriving Futures, 2022[18]).

Generally, affordable childcare is a pillar of common interest for all stakeholders in the Pilbara. Private companies, local governments and communities will all benefit from improving conditions for working in mining, improving social well-being and opening new business opportunities in education areas. Governments have made it easier for individuals to acquire childcare professional credentials. For example, the Technical and Further Education (TAFE) WA Karratha campus offers free qualifications in early childhood education and care or a Diploma of Early Childhood Education and Care. Likewise, mining companies have already put in place initiatives to address this issue, mainly by partnering with non-profit organisations. For example:

- **BHP** funded the Thriving Futures workforce development programme, available to both qualified educators and individuals to start or advance their career in early childhood education and care, and has partnered with the not-for-profit organisation Child Australia to provide a wage supplement and financial incentives for individuals to upskill themselves as a qualified educator.
- **Rio Tinto** and the not-for-profit organisation **Y WA** have joined forces to recruit family daycare educators in the city of Karratha and the Shire of Ashburton by offering a support system coupled with a funding package from Rio Tinto.

There is scope for further scale and co-ordination among the various private initiatives. Promoting greater co-ordination among privately led initiatives on childcare could help create long-lasting programmes on childcare with long-term funding and goals.

Adapting education to regional needs

The region benefits from an important network of primary schools (Table 4.4), which is relatively good for OECD remote rural regions. Most settlements in the Pilbara have at least one primary school (grade K-6), with secondary schools (grade 7-12) confined to the larger settlements. However, low satisfaction with secondary and higher education has been a significant deterrent for people to stay in the Pilbara (WA Government, 2016[8]).

Table 4.4. Pilbara primary and secondary schooling facilities

Settlement	Primary schools	Secondary schools
Jigalong	Jigalong Remote Community School	
Karratha, Dampier and Wickham	Baynton West Primary School Dampier Primary School Karratha Primary School Millars Well Primary School Peggs Cree Primary School Tambrey Primary School Wickham Primary School	Karratha Senior High School
Marble Bar and Nullagine	Marble Bar Primary School Nullagine Primary School	
Newman	Newman Primary School	Newman Senior High School
Onslow	Onslow Primary School	
Pannawonica	Pannawonica School	
Paraburdoo	Paraburdoo Primary School	
Port Hedland	Baler Primary School Casia Primary School and Education Support Centre Port Hedland Primary School Port Hedland School of the Air South Hedland Primary School	Hedland Senior High School
Roebourne		Roebourne District Senior High School (Cheeditha and Ngurrawaana Campus)
Tom Price	Tom Price Primary School North Tom Price Primary School	Tom Price Senior High School
Yandeyarra	Yandeyarra Remote Community School	

Source: WA Government (2016[8]), *Living in the Regions 2016 Insights Report*, Department of Primary Industries and Regional Development, Government of Western Australia.

There are no higher education institution campuses in the Pilbara; instead, the Pilbara Universities Centre provides facilities and support to link Pilbara residents wishing to undertake undergraduate and postgraduate studies mostly virtually with its various university partners – Central Queensland University, Charles Darwin University, Curtin University, Edith Cowan University and University of Tasmania. A not-for-profit organisation funded primarily by the Western Australian and Australian governments, the city of Karratha and the PDC, its main facilities are located in Karratha, with more limited facilities on offer in Port Hedland.

In Western Australia, public vocational education and training (VET) is delivered through a network of metropolitan, Southern, Central and Northern TAFE College campuses. TAFE is a government-run system in Australia that provides education after high school in vocational areas. In the Pilbara, TAFE campuses are operated by the Northern TAFE College network and include campuses in Karratha, Minurmarghali (Roebourne), Newman, Pundulmurra (Hedland) and Tom Price. These campuses offer various qualifications in mechanical, plumbing, gas and electrical trades and nursing. There are also several

private registered training organisations in the Pilbara, including those operated by resource companies for internal training purposes.

While increasing the physical offer of tertiary education in the region would depend on the critical mass available to support such investment, adapting the existing education supply to regional needs and excelling in providing niche training or education in the future of mining and energy challenges can be a distinct feature in the Pilbara. As across the OECD, industry innovation and transformations occur more rapidly than changes in curriculum and programmes in education (OECD, 2021[13]). It includes partnering with universities based in Perth and mining companies to offer a formal and renowned in-place VET option for Australian and international students immersed in the real working conditions in mining communities, including temperatures, distances and availability of human capital.

Moreover, students will be more likely to remain in the region if they are able to attain fulfilling local employment upon graduation. This means vocational training and professional education options should be integrated with school programmes, tailored for current and potential local employment opportunities to support a diverse and sustainable economy, providing a "seamless" transition from school to locally delivered vocational or professional training and career opportunities.

To prepare the regional human capital for the green and big data, robotics and artificial intelligence (AI) expansion of the digital economy and attract new talent in the Pilbara, the PDC, in collaboration with the Government of Western Australia department of Training and Workforce Development, should implement a formal mechanism of collaboration with industry and academia. It can initially focus on identifying the main shortage of skills in the region and then define clear alternatives of action to adapt and create capacitation programmes. Some of these actions can include:

- Scaling up companies' training programmes to involve a wider share of the population and make them sustainable over time. This includes both government and indistry support for advocating the benefits of mining to young people (e.g. mining's role in the transition to net zero) ensuring culturally and gender safe training pathways and work environments designed by women and First Nations people.
- Promoting apprenticeships or dual programmes to involve different types of populations in the innovation system of mining processes through collaborations of industry and education institutions. On-the-job internships are also mechanisms to durably connect youth with the work of the mining industry while continuing their studies. This might require regulatory changes to insert these models in the formal curriculum of high schools and universities, taking into account that students need to move outside their permanent residency. Local governments could work alongside industry owned and led Jobs and Skills Councils (JSCs) which provide strategic leadership in addressing skills and workforce challenges and identifying skills and workforce needs for their sectors. Local governments in the Pilbara can work with the Mining and Automotive Skills Alliance and the Powering Skills Organisation to ensure regional perspectives are considered in workforce planning.
- Making available mainstream (private and public) school options to parents so that they can be assured that once they relocate to the Pilbara region, they have school choices available to them that are not dissimilar to other major regional locations and can reasonably make choices in the best interests of their children's specific educational needs.
- Partnering with universities based in Perth and mining companies to offer a formal and renowned in-place VET option for Australian and international students immersed in the real working conditions in mining communities.

Improving the capacity of healthcare facilities

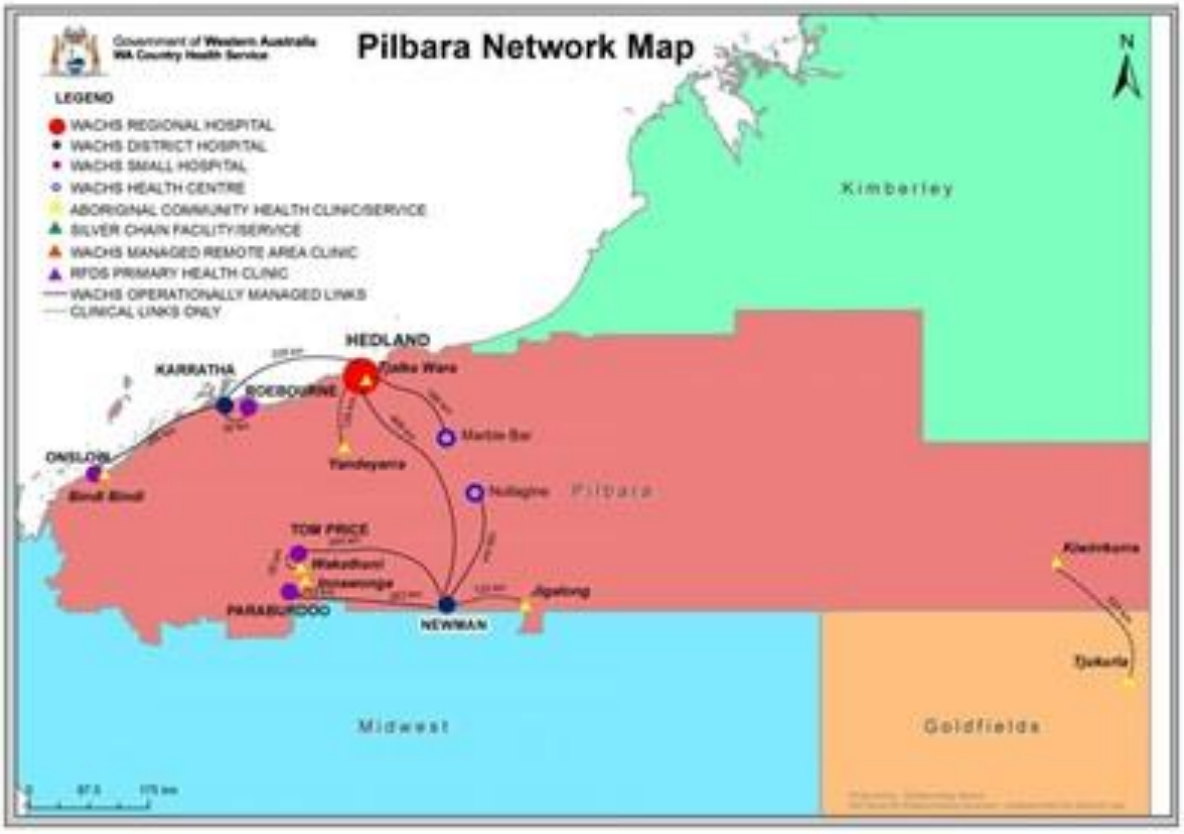
While facilities are less of an issue in the Pilbara, with most towns having at least one hospital (Table 4.5), the installed capacity might be an issue, especially to attend the FIFO population (albeit most larger mining companies operate their own basic treatment capacity) and conduct more specialised procedures. There are also particular issues associated with elderly care services, resulting in a tendency for older people to relocate to metropolitan centres when they require sustained healthcare. Furthermore, distances in the region present a challenge for emergencies, as secondary health services are located in Karratha and Port Headland (Figure 4.2).

Table 4.5. Hospitals in the Pilbara region

Hospital	Capacity (beds)	Commissioning
Hedland Health Campus	58	2010
Karratha Health Campus	40	2018
Newman Hospital	18	2019 (expanded)
Onslow Health Service	9	2018
Roebourne Hospital	27	?
Tom Price Hospital	8	?
Paraburdoo Hospital	2	?

Note: Question mark refers to missing values.
Source: WA Health (2016[19]), *Health and Wellbeing of Adults in Western Australia 2016, Overview and Trends*, https://www.health.wa.gov.au/~/media/Files/Corporate/Reports-and-publications/Population-surveys/Health-and-Wellbeing-of-Adults-in-Western-Australia-2016-Overview-and-Trends.pdf.

Figure 4.2. Location of Pilbara health facilities



Source: WACHS (2021[20]), *Program Overview - Pilbara Health Initiative*, https://www.wacountry.health.wa.gov.au/Our-services/Pilbara/Pilbara-health-initiative/Program-overview.

Despite this, the 2016 survey demonstrates that this is becoming less of an issue across regional Western Australia, decreasing from 48% of respondents in 2013 to 35% of respondents in 2016 (WA Health, 2016[19])

In addition to core medical infrastructure, a variety of health organisations and initiatives have been established to address the diverse healthcare needs of the local population in the Pilbara region. Some key players in the region include the Pilbara Health Network, the longstanding Royal Flying Doctor Service (RFDS), Aboriginal Community Controlled Health Services (ACCHS) and telehealth services. These organisations and initiatives work together with the Western Australian Country Health Service (WACHS) to provide a wider range of healthcare services.

The Pilbara Health Network focuses on providing primary healthcare services to communities in the region. This network collaborates with local communities, healthcare providers and government agencies to identify and address healthcare needs in the area. The RFDS plays a critical role in delivering emergency medical services and primary healthcare to remote and rural areas. In Western Australia, they conducted over 9 000 patient transports and more than 27 000 telehealth consultations in 2020-21, from which many were Pilbara-based patients (RFDS, 2021[21]). The ACCHS, including organisations like the Wirraka Maya Health Service and Mawarnkarra Health Service, provide culturally appropriate healthcare for First Nations communities.

Furthermore, the Western Australian government has implemented telehealth services for medical consultations that do not necessitate in-person interaction (WACHS, 2023[22]). By enabling patients in the

Pilbara to consult with healthcare professionals through video conferencing, telehealth reduces the need for patients to travel long distances to access healthcare services. The WACHS plays an essential role in managing public hospitals, community health services and other healthcare programmes in the region.

Additionally, the Pilbara Health Initiative (PHI), a collaborative effort between the state government's Royalties for Regions programme, the WACHS, and the Pilbara Industry's Community Council, was launched in August 2009 (WACHS, 2021[20]). Initially a five-year partnership with a budget of AUD 38 244 million but still ongoing, the PHI aims to enhance and improve health services in the Pilbara region, focusing on six strategic priorities: access, infrastructure, response, service provision, sustainability and workforce development. While the PHI implements a range of programmes, its primary goal is to facilitate co-operation and co-ordination among the various health organisations and services in the region to better address the diverse healthcare needs of the growing Pilbara population.

The healthcare gap in the Pilbara can potentially be at least partially addressed through telemedicine and the location of key diagnostic services at an appropriate scale in the region. Arguably, what is more important for younger families is choice and ready and reliable access to services such as general practitioners, dentists, physiotherapists and the like. Initiatives designed to better incentivise family healthcare professionals to establish operations in the Pilbara can assist in this regard.

These priorities are also important for the local First Nations population, yet additional efforts should be taken to design healthcare initiatives that are accessible through culturally appropriate means. Further, and as importantly, is the deployment of healthcare capacity that can address the longer-term health conditions that are substantially more prevalent among the Pilbara First Nations population than amongst non-First Nations Australians (diabetes, kidney disease and heart disease), as well as mental healthcare that is tailored for culture and the specific circumstances of First Nations communities across the Pilbara.

The OECD has identified a number of strategies that help overcome the difficulties in providing services in low-density areas, including economies of scale in resources, infrastructure or labour force (Box 4.2). These strategies can be used as a framework to help address issues for the Pilbara across the different priorities.

Box 4.2. Overview of OECD country strategies to improve rural service delivery

Investments in public services can require economies of scale that are difficult to achieve in low-density areas, so communities must identify other arrangements to ensure adequate service provision. With growing pressures on public spending due to an ageing population, regions are beginning to adopt new approaches to continue providing for rural dwellers.

Integrated service delivery is one approach frequently implemented to improve service delivery by providing improved cost, quality and access. This includes strategies of colocation, collaboration, co-operation or co-production.

Table 4.6. Overview of strategies to improve rural service delivery

Strategy	Description	Examples
Colocation	Locates many services or agencies in one building.	"Wraparound schools" in the United States do this by providing academic support, health and mental healthcare and enrichment opportunities for students within the school.
Collaboration	Agencies work together as part of a network to share information and training.	Rural communities in the United Kingdom share knowledge, institutions and agencies to ensure rural dwellers have knowledge of and access to services.
Co-operation	Different levels of government communicate and work together on multi-agency teams. This form of horizontal co-ordination strives to lower the costs of delivering services and reduce duplication.	Italy created the National Strategy for Inner Areas to involve national, regional and local tiers in implementing its strategic approach to support its rural communities. Integrating national and local activities is helping to remove obstacles to service provision and local development in rural Italy.
Co-production	Involves community and non-profit groups in providing services, ensuring that products and programmes reflect the needs of the community.	In France, rural communities are co-producing solutions for housing and care services through "villa housing" (OECD, 2020[23])This scheme enhances life for the elderly through neighbourhood engagement, providing better services and quality of life for the same cost.

Source: OECD (2020[23]), *Rural Well-being: Geography of Opportunities*, https://doi.org/10.1787/d25cef80-en.

Improving access to housing and accommodation

Access to affordable housing in the Pilbara region has been a longstanding issue. Past surveys on quality of life (in 2016) indicated that 60% of Pilbara residents were planning to move with the aim of accessing more affordable housing (WA Government, 2013[24]). Despite no recent official Pilbara-wide surveys, the 2023 community survey of the city of Karratha ranked housing as a top-three concern, especially with regards to housing availability and insurance costs. Other towns in the region, such as Tom Price, highlighted during the in-person discussions for this study that housing shortage is one of the top deterrents for families considering relocating to the town. Furthermore, housing prices have risen by 25% over 2015-21, with residential vacancies below 1% (PDC, 2022[25]).

The Pilbara housing issue is a complex one rooted in a multifaceted range of causes, including high volatility in a small internal economy that creates uncertainty for long-term investments, a complex land tenure, high cost of construction and property prices and a reactive state policy approach.

The volatility of the economy leads to shortages of affordable housing

A significant detractor to the growth of the residential population in the Pilbara region is the volatility of the residential housing market. The Pilbara's economy is, in fact, one of the least diversified regions across the OECD mining regions (see Chapter 2), which, combined with a small internal market, makes the Pilbara's economy highly vulnerable to external shocks in the extractive industry.

The historic expansion of the residential population in the Pilbara has been highly linked to expansion phases of the resources industry in the region. For example, between 1966 and 1971, the Pilbara's population more than tripled (from 8 017 to 30 002 residents) (ABS, 2022[26]), which coincided with the commencement of the construction of mine, processing and logistics infrastructure of the Pilbara resources industry (see Chapter 2). Between 1990 and 2016, the correlation between total private new mining capital creation and the Pilbara residential population has been higher in the two most populous local government areas (LGAs), Karratha (r^2=0.88) and Port Hedland (r^2=0.85), followed by the smaller LGAs of Ashburton (r^2=0.77) and East Pilbara (r^2=0.80) (ABS, n.d.[27]). Similarly, recent studies have revealed that mining towns in Western Australia are subject to more frequent housing price fluctuations than in cities, as those fluctuations are directly associated with commodity price changes (Miao, 2023[28]).

This volatility creates uncertainty for developers, financial institutions and individuals and, thus, volatility in the housing market. Moreover, the region's economic volatility has also led the state to adopt a conservative approach to residential land release and development without clear anticipatory policies to waive negative cycles.

Land tenure in the Pilbara adds complexity to housing development

The complexity of land tenure in the Pilbara region is part of the challenge. The protracted negotiation, development and approvals process to access land is a function of the complex overlapping interests in Pilbara lands, which constrains the responsiveness of residential land supply.

In the case of the Pilbara, most land that is zoned or suitable for zoning for residential development is held by the Government of Western Australia through a statutory body known as Development WA. Whilst there are areas of freehold title, mainly associated with the various settlements located across the state, these are relatively small areas of land. Indeed, approximately 92% of the Western Australian landmass remains Crown land (WA Government, 2022[29]).

With the exception of small areas in and around the main settlements, virtually all land in the Pilbara region is Crown land (Box 4.3). Crown land can be either unallocated, Crown land that is vacant and has no registered specific use over it, other than potentially an interest in accordance with the Native Title Act 1993 (Cth) – or allocated, Crown Land that is the subject of at least one registered interest but, in many cases (particularly in western areas of the Pilbara region), multiple and co-existing registered interests. Any proposal to undertake an activity on allocated Crown land will be subject to, first, complying with the specifications of all interests in those lands and, second, navigating a process to either gain legal agreement from other interests to extinguish their interest or co-exist with the proposed activity or an administrative process or court determination to compel the other interests to do so.

Box 4.3. Potential interests in the Pilbara allocated Crown land estate

The British Swan River Colony was established in 1829 on the traditional lands of the Whadjuk people of the Noongar nation, an area that is now occupied by the Western Australian capital city, Perth. As with all British Colonies established in Australia between 1788 and 1850, sovereignty over the lands, waters and natural resources of the Swan River Colony and its surrounds were claimed by Britain in the name of the British Monarch (the "Crown") under the legal doctrine of terra nullius (i.e. that the land

was uninhabited and unimproved and hence "belonged to no man") (Mabo v Queensland, 1992[30]) and therefore came under the jurisdiction of British law. As settlers arrived and convicts were released, Crown land was converted to fee simple (freehold, or land held at the exclusion of all others) by the colonial government of Western Australia for the purposes of establishing settlements, industry and agricultural enterprise. As new settlers increasingly ventured out across the state of Western Australia, First Nations people were further dispossessed of their land as the Swan River Colonial Government laid claim to the "waste lands" of the state in the name of the Crown.

Table 4.7. Co-existing interests in allocated Crown land in the Pilbara, 1993-2021

Interest	Legislation and jurisdiction	Summary
Native Title	Native Title Act 1993 (Cth)	A wide range of First Nations land rights, ranging from exclusive native title through to simple rights of land access for cultural and traditional purposes.
Aboriginal Reserve	Aboriginal Affairs Planning Authority Act 1972 (WA)	Land allocated for the use of First Nations interests.
Pastoral Lease	Land Act 1993 (WA)	A lease over land provides the lease with the right to operate a pastoral enterprise characterised by particular operational specifications on the land that is the subject of the lease.
Exploration Licence	Mining Act 1978 (WA)	A licence over land that provides the licensee the right to undertake specified mineral exploration activities on the land that is the subject of the licence.
Mining Lease	Mining Act 1978 (WA)	A lease over land provides the lessee the right to undertake specified mineral extraction and processing activities on the land that is the subject of the lease.
General Purpose Lease	Mining Act 1978 (WA)	A lease over land is granted for common purposes, such as the construction of roads and other infrastructure.
Prospecting Licence	Mining Act 1978 (WA)	A licence that provides the licensee the right to undertake specified prospecting activities on the land the subject of the licence.
Miscellaneous Licence	Mining Act 1978 (WA)	A licence over land that is granted for mining-related infrastructure like roads, powerlines and pipelines, amongst others.
Special Purpose Lease	Land Administration Act 1997 (WA)	A lease over land that is granted according for activities as specified by the terms of the lease.
State Agreements	Legislation specific to the Agreement	Agreements between resource companies that are ratified by the Parliament of Western Australia set out the company's and the state's rights and obligations with respect to specific areas of land.
State Conservation Estate	Biodiversity Conservation Act 2016 (WA)	Crown lands are vested with the Western Australian conservation estate and, therefore, managed in accordance with the state's conservation legislation.
Federal Conservation Estate	Environment Protection and Biodiversity Conservation Act 1999 (WA)	Crown lands that by virtue of hosting environmental values of national interest or environmental values that are the subject of international conservation agreements to which Australia is party, are managed under the National conservation legislation.
Indigenous Protected Area	Caveat	Lands in which First Nations people have a legal interest and have voluntarily vested with the national conservation estate.
Conditional Freehold	Land Administration Act 1997 (WA)	Crown land that has been converted to freehold title but only under specific usage specifications.
Registered Sacred Sites	Aboriginal Cultural Heritage Act 2021 (WA)	Sites of cultural importance to First Nations people that are protected.

Notwithstanding the tenure complexities discussed above, Western Australian government projections indicate that there is ample supply of appropriately zoned land in the main population centres of the Pilbara to cater for current and future demand for residential dwellings. In 2020, land capacity modelling by the

Western Australian Planning Commission (WAPC) identified capacity for an additional 4 400 dwellings over the medium term in Karratha, including 1 770 new dwellings out to 2030. While there is a history of dwelling construction, recent times have seen a dramatic decline in dwelling approvals (WA Government, 2021[31]).

In the case of Port Hedland, as of August 2021, there were over 400 vacant lots on land zoned for residential development. However, the land capacity modelling by the WAPC suggested a medium-term supply of 6 000 dwellings, including 3 200 within the decade. At the end of September 2021, there were 342 residential lots with conditional approval (WA Government, 2022[32]).

Whether developments are driven by the state or via private developers, the aforementioned demand-driven volatility, exacerbated by the supply of land constraints, has contributed to conservative approaches in the state government to residential land release and development. Other OECD studies in mining regions have highlighted the relevance of establishing a one-stop shop at the government level to address and speed up approval decision processes in a framework of complex land use tenures (OECD, 2021[33]).

Low levels of owner occupancy add to the housing issue

The Pilbara housing issue involves numerous stakeholders – aspiring residents, current residents, investors, employers, First Nations communities, builders, subcontractors, etc. Further, it is not clear that market failure exists (i.e. people are still able to live and work in the Pilbara if they choose to do so) and even if market failure is evident, whether it exists to the extent that justifies the investment of scarce public sector resources.

However, the main challenge to residential property development in the Pilbara is more associated with the nature of the residential market: there is limited owner-occupied stock and because demand is driven by the cyclical expansion of the resources industry, the residential property market is volatile in the main population centres, rendering it less attractive to the owner-occupier market.

The portion of residential dwellings that are not occupied by owners (owned by property investors or organisations to facilitate staff accommodation) in Karratha and Port Hedland are 77% and 79% respectively, which is 3 times the state average (28%) (WA Government, 2020[34]; WA Government, 2022[32]).

The high cost of construction is a top challenge in the Pilbara

From a construction perspective, Western Australia is one of the most expensive states in Australia (Townsend & Turner, 2022[35]). In the case of the Pilbara region, this is further exacerbated by the fact that most residential developments are greenfield developments requiring the additional cost of significant headworks, building regulations that require dwellings to be constructed to a prescribed specification with respect to cyclone durability, its remoteness and limited local building services. This results in relatively high residential construction costs and protracted building periods across the Pilbara.

Moreover, during periods of high housing demand, there is typically a significant differential between the market price of a residential property and the valuation that a bank or other financier will place on the property for the purposes of mortgage calculations.

These factors combine to render the purchase of residential property in the Pilbara less attractive and, in many instances, unattainable to people considering relocating and renders employers conservative when considering encouraging employees to relocate to the region.

Overall price volatility of housing is a function of the above-mentioned characteristics of the Pilbara residential property market:

- The relationship between the residential population and expansions of the Pilbara resources industry, whereby relatively large numbers of people move to the Pilbara population centres for work reasons during resources sector expansions and begin to leave once the region passes through peak construction.
- Lags in land release, development zoning and development of new residential stock that is a function of the complexities of co-existing tenure, the fact that most new residential developments are entirely greenfield in nature and limited local residential building service providers.
- Supply constraints are the results of employing organisations, mainly resource companies but also government agencies, owning a significant portion of the residential property stock in the Pilbara region that they rent to their employees.
- Challenges in financing residential developments and housing purchases that are the result of a significant difference between the cost of development or the price of a dwelling and the valuation a financier will use for the purposes of determining loan collateral, as well as the risk associated with the volatility of the local residential market.

Addressing the housing challenges in the Pilbara requires collaboration with flexible and anticipatory planning

Given the multifaceted challenges of the Pilbara's housing market and the characteristics of the regional economy, improving the affordability of housing in the region needs a formal strategy and long-term plan from the state government. As has already been seen in the region, the private sector alone will not step in to fill the housing need in the region. Therefore, a clear government policy to address this issue with co-ordination across different state departments and the support of the mining companies is warranted. This involves firms analysing the extent to which this circumstance justifies the investment of public sector resources to intervene in this market in the region, particularly with a volatile demand for housing that relies on the boom-and-bust periods.

A specific task force or multi-stakeholder group can help understand and scope the issue and develop a clear and implementable housing strategy for the region. In doing so, mining companies could also find avenues to improve housing market conditions in the Pilbara and, thus, the well-being of communities, through common agreements to free up land for housing development close to towns or make it easier for employees to buy company-owned homes for example.

This type of task force or alliance mechanism has been established in other remote OECD mining regions. For example, to address the acute housing shortage in the mining boom of the 2010s, the town of Labrador West, Canada, created the Labrador West Housing and Homelessness Coalition, made up of a diverse range of stakeholders that represent the community. This coalition helped to secure funding and build houses through various activities: i) advocacy targeted at raising awareness among the federal and provincial governments; ii) creation of partnerships to raise funds and help build houses; and iii) provision of support services such as housing counselling. The state government could create this task force or coalition inspired by this example (Box 4.4).

As experienced in other OECD mining regions, the government, in collaboration with mining companies, can set a strategy to make counter-cyclical investments in housing stock and reduce construction cost. In some remote mining towns, like Thompson in Northern Manitoba, Canada, the local government introduced a 5% municipal hotel fee in 2009, where there was a 0% rental vacancy rate, to create a reserve fund to support affordable housing, infrastructure and community safety during bust periods (CCPA, 2009[36]). In other regions like Alberta, Canada, the extractive industry has collaborated to support housing construction in the region.

Another option to improve housing supply and free up new land is to change zoning rules to promote densification. Mining regions such as Dalarna County and Norrbotten in Sweden have partly addressed

housing shortages through densification initiatives such as incentives to increase the occupancy rate in dwellings, construction of apartment buildings and other high-density residential options. It is noteworthy that densification has been trialled in the city of Karratha by way of the Pelago apartment complex (partly underwritten by the Western Australian government in 2012 via the upfront purchase of some units), albeit this development initially found it difficult to maintain full occupancy, likely a function of most longer-term residents being attracted to the Pilbara for its outdoor lifestyle and space. Despite the cultural factor, densification may be an option to attract new generations, single people or immigrants with another cultural lifestyle who are looking for affordability and accessibility to city services within walking distance.

Box 4.4. Strategies in Labrador West to address housing shortages during the 2010s mining boom

Labrador City is a town in western Labrador (part of the Canadian province of Newfoundland and Labrador), founded in 1960 mainly to accommodate employees of the Iron Ore Company of Canada, with a current population of 7 412 (2021). Neighbouring Labrador City is Wabush, a smaller town with a population of approximately 1 964. Together, these towns are known as Labrador West.

The development of these towns (as of the surrounding area known as the Quebec-Labrador region) has been closely tied to the cycles of the iron ore market. During the boom in the early 1970s, the population of Labrador City rose from about 7 600 to about 12 000 in 5 years. Yet, by the early 1980s, a severe economic downturn gripped the region, which culminated in the reorientation of the remaining extraction in mines of Labrador West at much lower levels and ended up in the complete mining closure in the nearby towns of Schefferville (in late 1982) and Gagnon, Québec. That crisis resulted in layoffs and outmigration, especially in Schefferville, which lost 80% of its population in 5 years. This crisis stimulated efforts by the Government of Newfoundland and Labrador to buffer the effects of unemployment, outmigration and the collapse of the private housing market (Rodon, Keeling and Boutet, 2022[37]), which, together with a small ongoing operation sustained Labrador City's population at around 8 000 inhabitants.

After different cycles, the region experienced an important boom in the 2010s, given international demand and the spike in iron ore prices. As a result, housing demand outpaced supply and boosted housing costs (e.g. reported housing gap shortage of 266 units). The housing shortage impacted the growth of local businesses, as many reported challenges to attracting a workforce given the cost of housing, especially impacting entrepreneurs and people working in non-mining activities, which was a particular issue in retaining teachers. In parallel, companies bought houses for their workers and built mining camps with good results in meeting demand from mining workers. Yet, housing demand from companies added further pressure to local prices and the camps created issues among local communities (e.g. in terms of high alcohol use).

Some actions that were undertaken to address the housing issue include:

- The creation of the Labrador West Regional Task Force to address the local housing shortage, which established a table with provincial and local government representatives to find solutions.
- The implementation of a code of conduct to regulate the behaviour of FIFO workers, established by joint work of the local community and mining companies.
- The creation of the Labrador West Housing and Homelessness Coalition by the municipal and provincial governments, made up of a diverse range of stakeholders that represent the community. It helped in its first year to secure funding (from private and provincial sources) to build about ten social housing units.

- The creation of a provincial non-profit organisation, the Newfoundland and Labrador Housing and Homelessness Network, to share information, provide training/seminars and conduct the Provincial Conference on Remote and Rural Homelessness to address issues related to housing and homelessness in rural and remote communities.
- The Newfoundland and Labrador Housing Corporation, the housing arm of the provincial government, incorporated in 1967, has also addressed demand in boom periods by providing emergency shelter for adult men and women in the region.

The housing problems are not fully over in this region as the recent boom in 2020 has reinserted housing pressure and companies are reluctant to build as cautious of the region reverting back to a bust situation, with no the money to sustain or pay back the investment. But as highlighted by the mayor of Wabush, Quebec: "government has a responsibility to provide adequate housing for those who need it, and there's a need to invest in the Labrador West area to avoid people to stay" (Atlantic Canada, 2021[38]).

This case reflects a strong sense of the community's resilience in the face of the downturn. The continued functioning of the mine, although limited at the beginning, is currently providing a new boom to these cities. Labrador City and Wabush have outgrown their "company town" status so there is more diversity ranging from trailer homes to larger bungalows. Even if the town is still totally dependent on mining to survive, people are retiring in Labrador City.

Interestingly, the only surrounding towns that have experienced greater population growth than Labrador West and suffered the least from outmigration during the mining crisis in the 1980s were the First Nations towns of the First Nations communities of Kawawachikamach and Matimekosh-Lac John.

Source: Rodon, T., A. Keeling and J. Boutet (2022[37]), "Schefferville revisited: The rise and fall (and rise again) of iron mining in Québec-Labrador", https://doi.org/10.1016/j.exis.2021.101008; Messina, M., M. Johnston and J. Stinson (2014[39]), *No Vacancy: A Look at the Housing Crisis in Labrador West*, Canadian Research Institute for the Advancement of Women, FemNorthNet, Ottawa, ON; Atlantic Canada (2021[38]), "Iron ore boom has created housing crunch in Labrador West", https://www.saltwire.com/atlantic-canada/news/iron-ore-boom-has-created-housing-crunch-in-labrador-west-100610011/.

Better integrating the Pilbara itinerant workforce

A unique aspect of the total Pilbara population is its large itinerant workforce. This is partly in response to the fundamental barriers to long-term residency in the Pilbara but largely linked to an industry strategy to ensure efficient access to a large and diverse skilled workforce.

Challenges associated with attracting large numbers of skilled workers to reside in the Pilbara, combined with it being a less costly option (for both industry and government) compared to housing staff in the Pilbara, has resulted in organisations in the Pilbara, particularly those in the resources sector, being highly reliant on a FIFO workforce. The FIFO working model has also provided a buffer for governments to develop local community infrastructure during expansions or construction periods (Haslam McKenzie, 2020[40]).

While organisations tend not to disclose the extent of their FIFO workforces in specific locations, as an anecdotal indication, on the night of the 2021 Australian population census,[2] there were a total of approximately 30 000 people in the Pilbara whose current location was outside their normal SA2[3] area of residence. While this figure will include tourists and intra-regional travel, it is reasonable to assume that a significant portion of the 30 000 visitors in the Pilbara region are FIFO employees and contractors. This suggests a significant portion of the total number of people in the region at any one time and, in the case of the more remote Shires of Ashburton and particularly of East Pilbara, a majority of the people are potentially FIFO workers.

These FIFO employees and contractors come from Perth and other regional centres across Western Australia, capital cities and regional centres from across Australia and worldwide. They operate on shift cycles that are variable, with two weeks on and one week off being a common shift rotation (WA Government, 2012[41]), and when on shift, reside primarily in dedicated worker accommodation facilities that are located in or in proximity to settlements or on remote mining sites.

The FIFO employee and contracting framework used by the resources industry in the Pilbara and elsewhere has been controversial in Western Australia. While the resources industry maintains it is essential to retain a skilled, professional and productive workforce in regional and remote areas of operation, regional communities have consistently advocated for measures to permanently locate workers in the regions. Further, more recently, an identified culture of sexual harassment within FIFO workforces has come under significant scrutiny (WA Parliament, 2020[42]). The 2022 Western Australian Government inquiry into sexual assault in the FIFO mining industry titled *Enough is Enough* proposes 24 recommendations that can be utilised by regional governments and industry to improve the culture of mining in the Pilbara and ensure a safe and gender inclusive environment, beyond policies to increase female employees in the sector. This includes addressing gender and power imbalances, alcohol use, poor behaviour, and unhealthy workplace culture that are rife in the FIFO working model.

Generally, some initiatives can be undertaken to help minimise FIFO and reduce associated negative impacts on local communities. First, for practical and occupational health and safety reasons, FIFO worker accommodation (or “camps”) should be located within normal commutable distance of the operation. Where operations are remote, this necessitates the accommodation base also being remote. However, where there is an existing settlement within commutable distance of the operation, models are emerging whereby the FIFO work accommodation can be integrated with the residential community.

This allows FIFO workers and their host communities to benefit from an integrated community lifestyle, supports a stronger local economy by creating demand for local services and suppliers and provides the community with access to FIFO camp facilities that might not otherwise exist in the settlement, such as recreational facilities, creating a more harmonious and welcoming existence. However, particularly in smaller settlements, the provision of such amenities by mining company camps can also potentially crowd out small local businesses.

Indeed, it should be noted that this model, if not well considered and managed, can have negative externalities. For example, in the case of smaller communities, service offerings to the local market from a mining camp potentially compete with local small businesses, crowding the less-resourced local businesses out of the small market and potentially leading to community resentment. To this end, a framework and set of development and operating protocols or standards that define how an effective settlement-integrated FIFO camp is designed and operates could be developed. This should be approached on a continuous improvement basis and can help ensure that FIFO camps remain safe, efficient and sustainable over the long term and that they continue to meet the needs of workers and local communities alike (Box 4.5).

Box 4.5. Better integrating local communities and mining: local lessons from Canada

The Yukon Hire Initiative is a programme introduced by the Government of **Yukon** in Canada with the aim of increasing the number of local workers employed in the mining sector by 20% by 2025. This programme provides incentives such as a 12% tax credit for eligible Yukon resident employees and funding for training programmes for companies that meet certain local hiring targets. The Yukon Mine Training Association has trained over 1 000 local workers since the programme’s inception, offering various courses such as 150-hour surface mining courses and 160-hour underground mining courses.

As a result of the Yukon Hire Initiative, the reliance on non-local FIFO workers in the mining industry in Yukon has been reduced. The local hiring rate has increased from 53% in 2012 to 75% in 2019, indicating that the initiative has been successful in promoting sustainable employment opportunities for local workers in the mining sector. The programme's ongoing efforts to prioritise local hiring and provide training and development opportunities to local workers continue to benefit both the mining industry and local communities.

In **Newfoundland and Labrador,** the Community Liaison Committee (CLC) programme was introduced by the provincial government to promote community engagement and build trust between mining companies and local communities. The CLC programme brings together representatives from mining companies, local communities and government agencies to address social and environmental issues related to mining in the region. Since its inception, the programme has helped develop positive relationships between mining companies and local communities.

For example, in Labrador West, the Iron Ore Company of Canada (IOC) established a CLC in 2010 and, since then, the committee has become a key mechanism for community engagement. In 2018, the IOC reported that 93% of the committee's recommendations were implemented.

Source: HRR Reporter (2022[43]), "Yukon extends Indigenous hiring preference initiative", https://www.hrreporter.com/focus-areas/diversity/yukon-extends-indigenous-hiring-preference-initiative/365560; Yukon (2023[44]), *The Hiring Preference*, Government of Yukon, https://yukon.ca/hiring-preference; Emera (2022[45]), *Community Liaison Committees*, https://www.emeranl.com/maritime-link/community-engagement/community-liaison-committees; Government of Canada (2022[46]), "Saskatchewan mining suppliers expand into global exports", https://www.canada.ca/en/prairies-economic-development/campaigns/success-stories/saskatchewan/mining-suppliers-global-exports.html.

Improving the well-being and self-determination of First Nations people of the Pilbara region

Despite the significant wealth produced in the Pilbara region and some improvement in recent decades, much of the region's First Nations population endure lower than average socio-economic conditions and, in many cases, dire poverty (Chapter 2). From around the time the High Court of Australia determined that Britain's claim to the Australian continent under the doctrine of *terra nullius* was void, the nation, through both legislative reform and jurisprudence, has been navigating a return of rights to its First Nations people.

The fact that, on average and compared to non-First Nations Australians, Australia's First Nations people endure substantial socio-economic disadvantage is a significant national issue (Australian Government, 2020[47]). As with most parts of Australia, the relative socio-economic disadvantage of First Nations people across the Pilbara region is self-evident:

- From a health perspective, across the Pilbara region, 35% of the First Nations population suffer from long-term health issues (such as arthritis, asthma, cancer, dementia, diabetes, heart disease, kidney disease, lung conditions, mental health issues and stroke), compared to 26% of non-First Nations residents. The difference is particularly large in the case of heart disease, diabetes and kidney disease.
- The portion of the Pilbara First Nations working-age population that either did not go to school or did not complete early years of secondary school is substantially higher than is the case for the non-First Nations population and the portion of the First Nations working-age population that completed the final year of secondary school is around half that of the non-First Nations population.
- Higher rates of non-completion of secondary school among the Pilbara First Nations population play out in post-school qualifications. A higher portion of the First Nations population in the Pilbara has achieved the lowest levels of post-school formal qualifications (VET Certificates I or II), with all

higher levels of post-school formal qualifications (VET Certificates III and IV, diploma and advanced diploma; bachelor's degree; graduate diploma or graduate certificate; or postgraduate degree) being characterised by comparatively lower levels of achievement among the First Nations population.

- Lower labour force participation rates among the Pilbara First Nations population and across the Pilbara. The unemployment rate among First Nations communities is significantly higher than that of the non-First Nations population.
- This, in turn, translates to higher welfare dependency from both government and mining companies across the Pilbara First Nations community and substantially lower levels of household income.

Improving well-being of First Nations people in the Pilbara needs a comprehensive approach that supports their connection to country through improved land tenure arrangements, enhances tailored education opportunities, and empowers communities to create their own economic opportunities in the region, and manage the benefits to suit their interests. Many of the strategies and policy guidelines in this section are aligned with the previous OECD policy recommendations to improve business and community economic development outcomes for First Nations Australians at the local and regional levels (Box 4.6) (OECD, 2020[48]).

Box 4.6. OECD policy recommendations from the 2020 OECD report *Linking Indigenous Communities with Regional Development in Australia*

The OECD undertook a study in 2020 to better support economic development outcomes for First Nations Australians, which provided policy recommendations to the Australian Government around three main areas:

1. Developing statistical frameworks and data governance for First Nations well-being.
    - Introduce a consistent First Nations business identifier that acknowledges the stage of maturity of the Australian First Nations business sector into the Australian business registry system, the tax office and business surveys undertaken by the Australian Bureau of Statistics (ABS).
    - Develop an online platform for local First Nations communities to disseminate data tools, build capacity and share lessons and good practices.
    - Increase the frequency of the National Aboriginal and Torres Strait Islander Social Survey (NATSISS) from every six to every four years to provide more timely data about First Nations populations.
2. Creating an enabling environment for First Nations entrepreneurs and small businesses.
    - Increase opportunities for First Nations-owned businesses in the public procurement market by harmonising First Nations procurement rules across jurisdictions and providing effective capacity-building support for entrepreneurs and small and medium-sized enterprises to participate in public procurement markets.
    - Prioritise the implementation of recommendations identified in the 2014 investigation by the Council of Australian Governments on how to reform First Nations land administration.
    - Consider support for the establishment of First Nations-owned local financial institutions (modelled on Canada and the United States) with an initial capital injection from the government.
3. Implementing a place-based approach to economic development that empowers First Nations Australians.

- Strengthen the capacities of local First Nations institutions to promote community economic development, including by expanding the range of institutional capacity-building activities.
- Work with the local government sector on developing good practice guidance and tools on the role of local government in First Nations community and economic development.
- Embed a place-based approach in the operational model of the National Indigenous Australians Agency (NIAA) regional network, including by rescoping roles, training and mentoring to develop more entrepreneurial skills and capabilities in community development, among others.
- Establish a model for shared local decision-making that enables agreements on local area outcomes and pooling of budgets between levels of government.

Some of these recommendations have already been taken into account, while others are still in progress of implementation or analysis.

Source: OECD (2020[48]), *Linking Indigenous Communities with Regional Development in Australia*, https://doi.org/10.1787/ab4d8d52-en.

Reducing subordination of First Nations land to other land interests

A key component of the Australian Government's response to First Nations people's well-being gaps has been the implementation of a form of land tenure known as Native Title. Proclamation of the Native Title Act 1993 (Cth) – the key component of the Australian Government's policy response to the Mabo High Court decision[4] – provides a platform for traditional owners in the Pilbara region to reassert some rights over their traditional lands. The Federal Court of Australia can determine native title claims by traditional owners as either exclusive or non-exclusive. Where native title is exclusive, the traditional owners can occupy the native title lands at the exclusion of all others. However, exclusive native title rights do not amount to full legal ownership of land or waters, and they cannot be sold. For example, if a mining lease or pastoral tenement is issued by the government, activities permitted by the lease can be carried out regardless of the existence of Native Title.

Furthermore, where native title is determined as non-exclusive, the tenure is shared with other land users, such as the holders of mining tenements or pastoral leases (Box 4.7). In a vast majority of cases, whilst the traditional owner holders of non-exclusive native title will have some specific rights with respect to the native title lands, their tenure is typically subordinate to that of other land users. Regardless of rights, third parties wishing to conduct activities on determined native title lands are required to enter into Indigenous Land Use Agreements (ILUAs) with the traditional owners.

In addition to mining tenements and native title tenure, much of the landmass of the Pilbara region is also the subject of pastoral leases that support extensive grazing of cattle and sheep that also intersect with mining tenements and native title interests (Box 4.7).

Box 4.7. Intersection of land tenure in the Pilbara

The following Figures 4.3 and 4.4 illustrate the intersection between pastoral leases, registered native title claims, native title determinations and ILUAs.

Figure 4.3. Intersection of native title claims, determinations and ILUAs with mining tenements in the Pilbara region

Figure 4.4. Intersection of native title claims, determinations and ILUAs with pastoral leases

Source: (Western Australian Government Department of Planning, Lands, and Heritage, 2022[49])

Regardless of its limitations, First Nations groups and mining companies have entered into arrangements that allow miners to access native title lands for the operation of mines, rail networks, ports and other infrastructure in exchange for royalty payments that are made into trusts for which traditional owner groups are beneficiaries. This substantial and growing resource can potentially be mobilised in the interests of economic empowerment of First Nations people in the Pilbara region.

However, the current system can hamper self-determination as it relies on a network of charitable trusts that holds royalties on behalf of traditional owners. This paternalistic model replicates the welfare system as traditional owners need to seek approval to access their funds. These challenges present an opportunity for the Australian government to design, alongside First Nations people, a revised model that empowers traditional owners to manage their own money and encourages enterprise and job creation.

Given the Pilbara's significant First Nations population, extensive native title footprint and substantial financial capital held in trust, the state government and other stakeholders in the Pilbara region have an opportunity to show leadership in Australia in advancing the economic and governance empowerment of First Nations people. The United Nations Declaration of Rights of Indigenous People's principles of self-determination and Free, Prior, and Informed Consent should play a central role in guiding reforms to mining land use in the Pilbara and its impact on First Nations people. Transforming these considerations into actionable initiatives will render the Pilbara a safer and more prosperous place for First Nations people to work, raise their families, and practice culture. The Pilbara can therefore become a good benchmark for the relationships among First Nations people and mining for Australia and other OECD mining regions.

An immediate opportunity in this regard is land management and conservation. As the mining industry progresses, an increasing number of mines are commencing closure phases, requiring land and ecosystem rehabilitation. Enabling First Nations people to apply Traditional Ecological Knowledge (TEK) to the design and implementation of this rehabilitation effort enhances their influence in governance, allows them to lead the restoration of their traditional lands and, through a fee-for-service model, achieve economic outcomes – a framework that is becoming increasingly prevalent across Australia (Barnes, Holcombe and Parmenter, 2020[50]). Further, emerging new sectors such as renewable energy provide an opportunity for the region to reset its First Nations economic participation paradigm.

Box 4.8. First Nations collaboration with mining companies: The Land and Sea Management Program of the Amrun Project

The Amrun Project, located in Queensland, Australia, is a significant collaboration between multinational mining corporation Rio Tinto and First Nations landowners, specifically the Wik-Waya elders. This collaboration encapsulates an agreement from Rio Tinto to satisfy its environmental responsibilities and contribute to land and ecosystem rehabilitation as the mine moves towards its closure phases.

The programme's pertinence stems from the central role it provides First Nations communities in the application of TEK for land and ecosystem rehabilitation in mining-affected areas. The Land and Sea Management Program (LSMP), a segment of the broader Communities, Heritage and Environmental Management Plan, functions as a direct conduit for this application. The LSMP actively involves Wik-Waya landowners in the design and implementation of annual land, sea and cultural heritage management strategies. Through this platform, First Nations landowners leverage their longstanding knowledge of local species and habitats to guide environmental monitoring and management efforts. In addition to responsive measures, the LSMP also incorporates proactive initiatives, such as the establishment and management of environmental buffer zones around mining sites to safeguard the adjacent natural environment from potential mining-related impacts.

Since 2019, the last years of the Amrun Project's construction phase, the LSMP has produced tangible outcomes. Members have started obtaining professional certifications, demonstrating enhanced skills in environmental management and land administration. However, beyond fostering individual development, the programme has empowered remote First Nations communities to actively participate in the mainstream economy through meaningful roles and vocational opportunities in land conservation and ecosystem rehabilitation.

Source: Barnes, R., S. Holcombe and J. Parmenter (2020[50]), *Indigenous Groups, Land Rehabilitation and Mine Closure: Exploring the Australian Terrain*, Centre for Social Responsibility in Mining, University of Queensland, Brisbane.

Leveraging education to improve integration of First Nations people in regional development

The significant portion of First Nations residents in the Pilbara who are not engaged in the workforce or are unemployed represent a considerable latent workforce capacity that can be activated for the purposes of enhancing regional productivity and economic diversification. Ensuring local First Nations children leave school with an adequate level of education and training is a key step in activating a local First Nations workforce.

Research has shown that traditional knowledge transfer methods are often more effective than mainstream education models for significant sections of the First Nations community. This highlights the importance of

recognising and valuing diverse approaches to education that align with cultural traditions and practices. The region should investigate attracting local investment from organisations such as Studio Schools of Australia to establish broader education options for First Nations students across the region.

Existing education models are partly failing to deliver for a very large portion of First Nations children. The relationship between First Nations peoples and non-First Nations citizens continues to be strained as the result of entrenched and visible racism and demonstrable inequality. Both challenges must be addressed via the education system for the region to flourish. Therefore, in the first instance, to ensure First Nations youth have the scholarly foundation, cultural connection, and pride to prosper as adults in the region, new education models for First Nations children that are designed by First Nations people and incorporate traditional ways of transferring knowledge and skills need to be implemented.

Local First Nations knowledge and cultural teachings, as articulated and delivered by local First Nations elders and educators, must be integrated into the mainstream educational curriculum for all grades so that awareness and understanding are embedded into the fabric of the region.

Furthermore, education can be a means to improve social cohesion. Communities will continue to be divided and unaware of the multi-generational impacts of systemic inequality on First Nations people if there is a lack of mainstream education regarding the historic and current lived experience of First Nations communities. The education system is key to tackling this divisiveness and is well positioned to be a strong and embedded bridging mechanism that can help to drive social cohesion and pride in the unique and valuable knowledge and culture of First Nations people. This will be for the benefit of all members of society and can create a means of driving an inclusive and fully functioning economy.

Also, there is a need for the Pilbara First Nations Capacity Building Program to improve capabilities and skills identification and development. It should include:

- Further development of post-secondary educational funding programmes in partnership with state and federal governments and industry to advance First Nations engagement in all levels of the economy.
- Specific training to develop business and conduct joint venture partnerships.
- Financial literacy.

Improving royalty systems to better suit First Nations people's self-determination and protect cultural heritage

First Nations groups with native title are required to establish a Prescribe Body Corporate (PBC), which is an Aboriginal Corporation that acts on their behalf. In the Pilbara, PBCs receive royalty payments and benefits from iron ore and petroleum companies for use of their lands. These payments are delivered to charitable trusts that are held by Land Councils and can be requested and distributed by the PBC according to their rules. It is important to note that not all PBCs are governed by First Nations people.

Benefit sharing agreements are negotiated privately between traditional owners and resource companies and establish the terms of land use and appropriate compensation. There are currently an estimated 21 such agreements with 14 traditional owner groups amongst the three main iron ore producers in the Pilbara (BHP, Fortescue Metals Group and Rio Tinto) with the first of these agreements entered into in 1996-97.

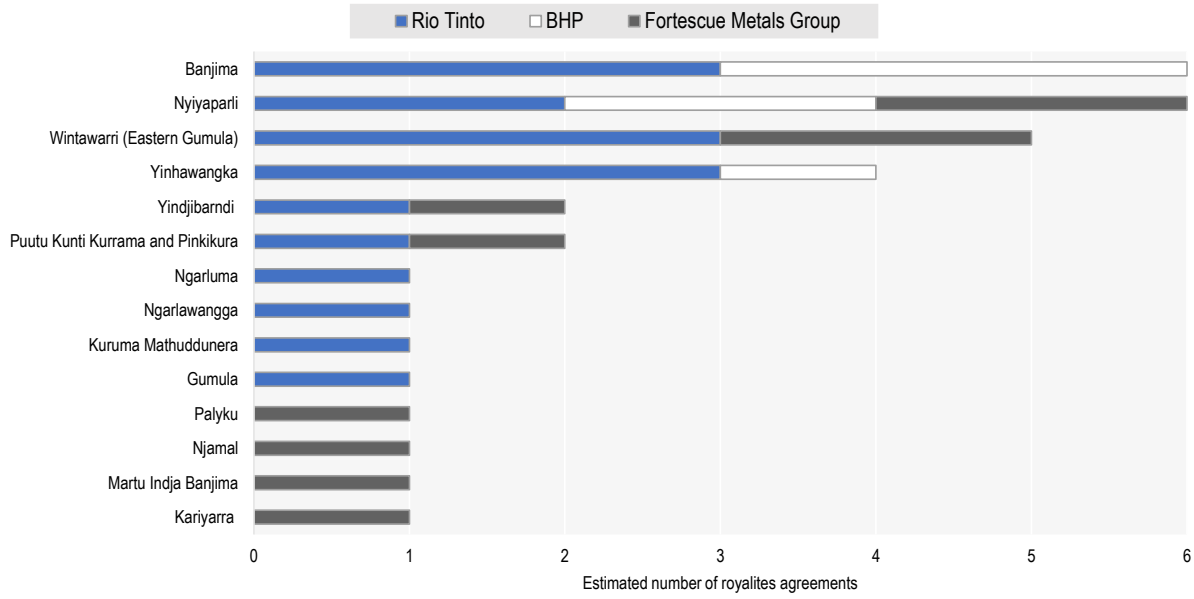
With ad valorem royalty rates understood to be in the vicinity of 0.3 to 0.5% of production derived from traditional lands, the charitable and direct benefits trust associated with these structures have accumulated significant wealth over the past decade – estimated billions of dollars in total – wealth that will continue to accumulate over decades to come.

Despite this, early negotiations have been criticised for not delivering adequate compensation to First Nations communities for use of their lands in comparison to the wealth generated through mining activity.

However, in recent years and following Rio Tinto's destruction of Juukan Gorge in 2020 (a 46,000 year old sacred rock shelter) (Rio Tinto, 2022[51]), benefit sharing agreements across the Pilbara between mining companies and First Nations communities have started to be updated to provide greater benefits to communities, respect for cultural heritage, and relationship building based on trust. This includes modernisation of existing impact-benefit agreements and going beyond royalties to include the creation of social and cultural projects in partnership with First Nations communities, such as the modernisation agreement between Rio Tinto and Yindjibarndi Aboriginal Corporation based on a partnership that will deliver community, commercial, and culture projects to the Yindjibarndi people (Rio Tinto, 2022[52]).

Figure 4.5 summarises the estimated number of royalty agreements with key First Nations groups in the Pilbara region with the main iron ore producers.

Figure 4.5. Estimated number of royalty agreements between First Nations groups and the top three iron ore producers in the Pilbara region



Source: Australian Government (2022[53]), Derived database queries as at December 2022, Native Title Tribunal, Register of ILUAs, Australian Government

However, the current trust system brings challenges, most notably in terms of coordination and promotion of self-determination. Many First Nations communities struggle to navigate the current trust system as it follows "mainstream" values and processes that are familiar to non-First Nations Australians, yet do not reflect First Nations ways of doing business. This makes navigating the system difficult and can result in mismanagement of trusts by both First Nations people and non-First Nations people (Blue and O'Faircheallaigh, 2018[54]). Additionally, the constrained nature of charitable trusts disempowers communities as opportunities for engagement with the economy and the right to self-manage funds is removed (Lombardi and Cooper, 2015[55]).

An alternative system for native title royalties that grants autonomy to First Nations peoples is likely to have positive socio-economic impacts on communities. For instance, control over restrictions on alcohol led by Aboriginal women in Fitzroy Crossing and Halls Creek resulted in a significant decline in alcohol-related hospital admissions, while government interventions regarding alcohol restrictions were less effective (Hudson, 2011[56]; Gray and Wilkes, 2011[57]). Furthermore, compulsory income management programmes for individuals receiving government benefits in Australia and New Zealand were found to be ineffective as

they limit opportunities for self-determination (Humpage, 2016[58]). This highlights the significant potential of First Nations autonomy in delivering community programs and managing financial resources. Communities require co-designed royalty systems that centre self-determination and suit First Nations values and practices as well as capacity building in financial literacy so funds can be adequately managed to meet collective interests.

The Pilbara would also benefit from analysing the disparities between native title holders and other First Nations communities. This is important to ensure regional development empowers all First Nations people and allows for economic participation external to native title determination.

The actions to improve First Nations well-being need to be co-developed with and overseen by First Nations people

In the spirit of self-determination and the "nothing about us without us" principle, any follow-up or proposed outcomes in response to these recommendations need to be agreed to by, co-developed with and overseen by the region's First Nations people to ensure their traditions, values, perspectives, lived experiences and objectives remain central to all themes covered, processes and outcomes.

According to discussions during the meetings of this study with First Nations people and suggestions by First Nations people of other OECD countries, supporting a space where the Pilbara's First Nations people, local governments, industry and the broader community can discuss main needs, challenges and priorities for the well-being of First Nations people could be a first step to reach common solutions and strategies. This space can take the form of a First Nations conference or summit in the Pilbara to address topics including:

- Truth telling:
  - History of dispossession, massacres, incarceration, eugenics and family separation, segregation and impacts of resultant welfare dependency.
  - Specific focus on the impact of mining on the destruction of cultural values and traditions.
  - Nature of intergenerational trauma and its impact.
  - Pathways to healing: the role of tradition, culture, art, education and governance in healing.
- First Nations visibility in the Pilbara region:
  - Greater integration of cultural learning and understanding in mainstream education curriculum, community programmes and industry workforce training programmes, with regional First Nations people as programme and content developers.
  - Pathways to greater involvement in regional decision making.
  - Ensuring First Nations people's perspectives and interests are embedded in civic, environmental, and regional economic decision-making processes at the local government, development agency and industry levels.
- Pathways to economic self-determination:
  - Resources industry, including closure and rehabilitation.
  - New frameworks for participation in new sectors, such as renewable energy.
  - First Nations unique enterprise – tourism, TEK-oriented food production and land and ecosystems restoration, etc.
  - Examining opportunities for self-determination and independence via alternative deployment or application of trust funds.

Concluding remarks

The Pilbara's remoteness and hot weather will remain challenges to substantially growing the local residential population. This, combined with the specific human resources needs of the industry on which its economy is entirely dependent – the resources industry – means that it is also highly probable that FIFO communities will also continue to be a characteristic of the total population of the Pilbara region, together with the negative externalities it brings to local communities in cost of living and housing markets.

However, the recommendations of this report help build the conditions to diversify the regional economy and phase out the short-term development approach brought by the high reliance on the resource industry and the void of a coherent and realistic long-term development vision for the region. Putting the goal of improving people's well-being at the top of the development agenda will help both the productivity of a sustainable mining sector and the liveability and attractiveness of the Pilbara communities. It involves focusing on improving access to quality services and affordable housing and enhancing growth opportunities and self-determination of First Nations people. All this needs to be framed under a long-term master plan that builds on the needs of the Pilbara's communities and provides them with the financial and policy tools to decide their futures, with sound co-ordination of state departments and mining companies towards the same goal: leaving a legacy in the Pilbara beyond resource extraction.

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Notes

[1] Traditional lands refer to lands that form part of the traditional territory of a First Nations community of which they have historically used and occupied and continue to use and occupy. See more here: https://www.lawinsider.com/dictionary/traditional-lands#:~:text=Traditional%20Lands%20means%20those%20lands,a%20map%20attached%20as%20Schedule%20%E2%80%9C

[2] The Australian Population and Housing Census is a comprehensive population and socio-economic survey of all Australians undertaken by the Australian Bureau of Statistics every five years. The most recent census was undertaken on 10 August 2021.

[3] Statistical Areas Level 2 (SA2s) are medium-sized general-purpose areas built up from whole Statistical Areas Level 1 (SA1s). Their purpose is to represent a community that interacts together socially and economically. In the case of the Pilbara region, there are four SA2 regions, approximating the boundaries of the four Pilbara LGAs.

[4] [1992] HCA 23, (1992) 175 CLR 1.

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Mining Regions and Cities Case of the Pilbara, Australia

Located in the state of Western Australia, the Pilbara is a large region and one of the least densely populated within the OECD. The Pilbara's mining sector is a top supplier of iron ore in the world, which has fuelled the economic growth of both the state and the country. While Pilbara's industrialisation is relatively recent, dating back to the 1960s, First Nations peoples have inhabited the region for approximately 50 000 years.

Despite the wealth generated by mining and extractive industries, the Pilbara faces important challenges to improve its attractiveness and well-being standards, especially for First Nations and non-mining workers. Well-being challenges also stifle growth opportunities and responsible mining investments in the region.

The green transition presents the Pilbara with an opportunity to diversify its economy and improve well-being conditions of its communities, while becoming a strategic player in the global shift towards more sustainable mining. This study offers guidance on how the Pilbara can shape a more inclusive and sustainable development model that supports economic diversification and prioritises improving the living conditions of its communities, particularly First Nations.

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