



SUPPLY CHAIN PERSPECTIVE

GRAIN



QTLC

QUEENSLAND TRANSPORT
AND LOGISTICS COUNCIL

Overview

Queensland's broadacre and intensive grain growers produce three major types of grains:

- cereals (wheat, oats, barley, sorghum, maize)
- oilseeds (sunflowers, peanuts)
- legumes (chickpea, mungbean, soybean).

These crops are grown in various regions throughout Queensland, from the south-west (near Dirranbandi and St George) and across the Darling Downs, to parts of central and northern Queensland.

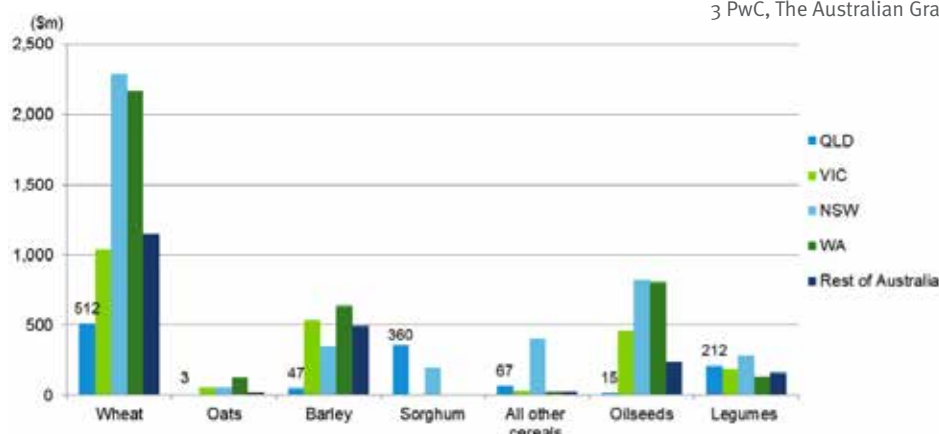
In Queensland, wheat is the most widely grown winter grain and sorghum is the most widely grown grain in summer. Each product is valued at more than \$300m a year to the Queensland economy¹.

The grain supply chain comprises a range of businesses, including:

- grain growers/producers
- mills and feedlot operators
- pre-production businesses such as fertiliser and agronomy service providers
- up-country storage companies (bulk handlers)
- marketing and trading companies.

¹ ABS, Value of Agricultural Commodities Produced, Australia, 2012-13

Figure 2: Value of grain produced, Queensland and Australia-wide



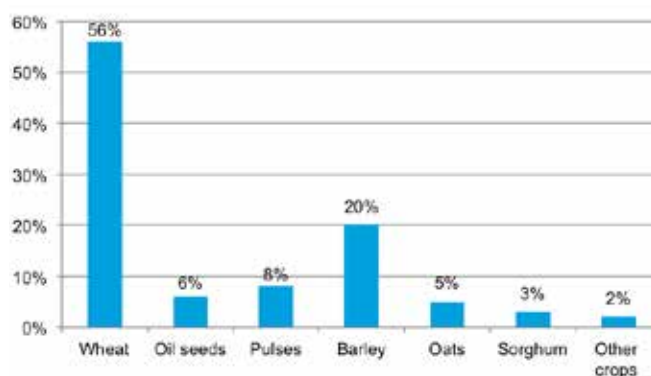
Source: ABS, Value of Agricultural Commodities Produced, Australia, 2012-13

Dimensions

Grain is an important rural industry for Australia.

- Australia produced 42 million tonnes of grain in 2012/13 (3.9 million tonnes from Queensland)².
- Wheat is the largest, by volume and value, and most important grain crop.
- 99% of grain-producing farms are family owned³.
- 71% of Australian grain is exported (in Queensland, 50% is exported).
- A typical grain-producing farm is 2,600 hectares, with around 860 hectares planted each year for grain crops. Total area planted of each crop is shown in Figure 1.

Figure 1: Each crop planted as a percentage of total crop planted area



Source: PwC, The Australian Grains Industry, The Basics, www.pwc.com.au/industry/agribusiness/assets/australian-grains-industry-nov11.pdf

In 2012/13, the gross value of total grain production in Queensland was \$1.2b. The gross value of total grain production Australia wide was \$13.9b. The detailed breakdown of gross value of production by grain type and by jurisdiction is presented in Figure 2.

² ABS, Agricultural Commodities, Australia, 2012-13

³ PwC, The Australian Grains Industry, 2011

The ratio of bulk to container transport of grain in Australia's east coast export market is around 40% by containers and 60% in bulk⁴. In 2012/13, the Port of Brisbane exported 1.97 million tonnes of bulk grains and cereals⁵.

In Queensland, the majority of bulk commodity grain (73.3% of the 2013 crop) is exported through the Port of Brisbane, with the balance handled by the Ports of Mackay (approximately 12.4%) and Gladstone (approximately 14.4%)⁶. The approximate volume of grain exports from Queensland ports is shown in Table 1 below.

Table 1: Grain exports from Queensland ports

| Port | Export tonnes | |
|--------------|------------------|-------------|
| Grains | 2012/13 | % |
| Mackay | 332,850 | 12.4% |
| Gladstone | 386,879 | 14.4% |
| Cereals | | |
| Brisbane | 1,971,579 | 73.3% |
| Total | 2,691,308 | 100% |

Source: Trade Statistics for Queensland Ports, for the five years ending 30 June 2013, Queensland Department of Transport and Main Roads

Note: Brisbane cereals export includes other grains

4 PwC, The Australian Grains Industry, The Basics, www.pwc.com.au/industry/agribusiness/assets/australian-grains-industry-nov11.pdf

5 Port of Brisbane, Import/Export Logistics

Chain Study, Summary Report June 2013

6 Queensland Government, Trade Statistics for Queensland Ports, for the five years ending 30 June 2013

➤ People working in grain

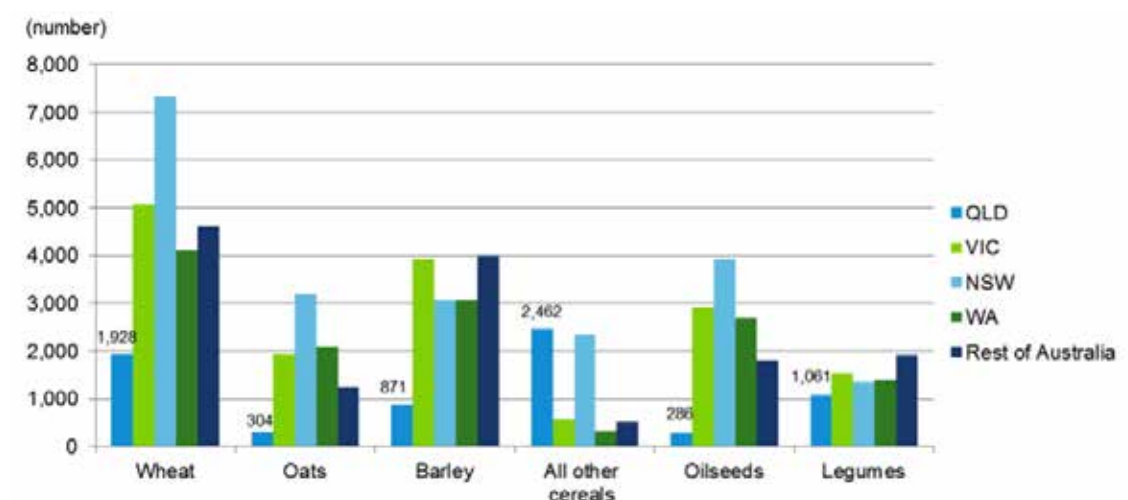
- Approximately 14,600 people are employed in the grain sector.
- 95% of all businesses employ 19 employees or less⁷.

➤ Grain businesses

As at May 2014, there were 6,911 grain businesses in Queensland⁸. The number of businesses in the grain industry for all states is displayed in Figure 3.

7 Primary Industries Standing Committee, Grains Industry National RDE Strategy, 2011
8 ABS, Agricultural Commodities, Australia, 2012-13

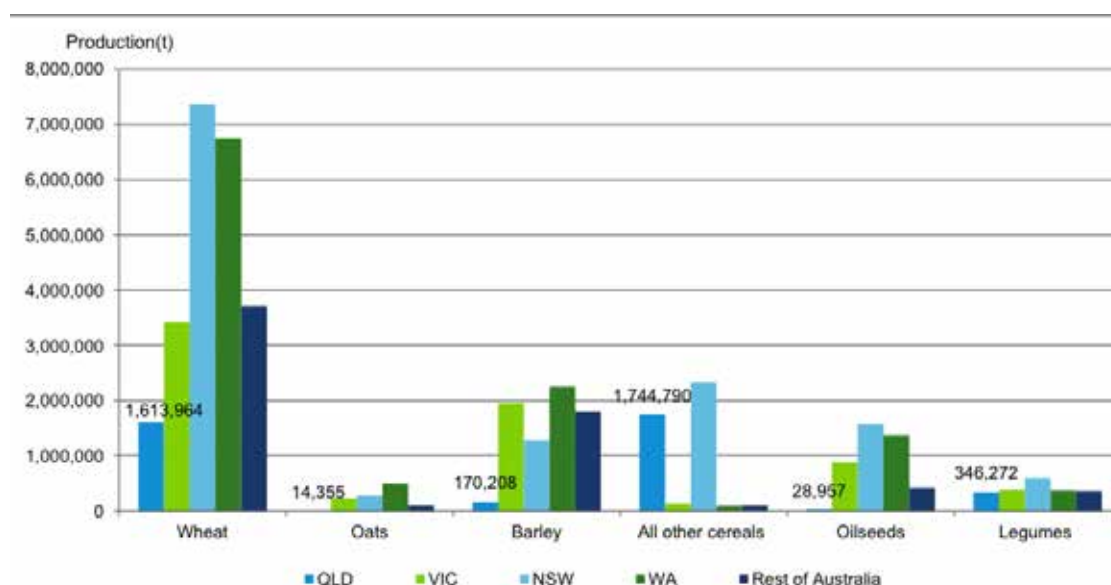
Figure 3: Number of businesses in the grain industry, Queensland and Australia-wide



Source: ABS, Agricultural Commodities, Australia, 2012-13

Queensland’s grain production accounts for approximately 10% of total Australia grain production⁹, as displayed in Figure 4 below.

Figure 4: Volume of grain production, Queensland and Australia-wide



Source: ABS, *Agricultural Commodities, Australia, 2012-13*

⁹ www.qff.org.au/wp-content/uploads/2012/12/Grain-Transport.pdf

Areas of production

The Australian grain industry is geographically defined by three broad agro-ecological regions¹⁰: northern, southern and western.

- Northern region

This region encompasses Queensland and northern New South Wales. It is characterised by summer-dominant rainfall and high inherent soil fertility.

Major grains are wheat and barley, grown in winter, and sorghum and maize, grown in summer.

The region is the largest source of Australia’s premium hard, high protein wheat for export and domestic use¹¹.

- Southern region

This region encompasses south-eastern Australia, including central and southern New South Wales, Victoria, Tasmania and south-eastern South Australia.

Yield potential depends on seasonal rainfall, especially in autumn and spring, and there is less dependence on stored soil moisture than in the northern region.

Crop production systems are varied and include many mixed farming enterprises with significant livestock and cropping activities.

- Western region

This region comprises the cropping areas of Western Australia, where soil fertility is generally low to very low, and yields depend on winter and spring rainfall.

In many areas, large-scale farming and the degree of mechanisation compensates for yields that are low by world standards.

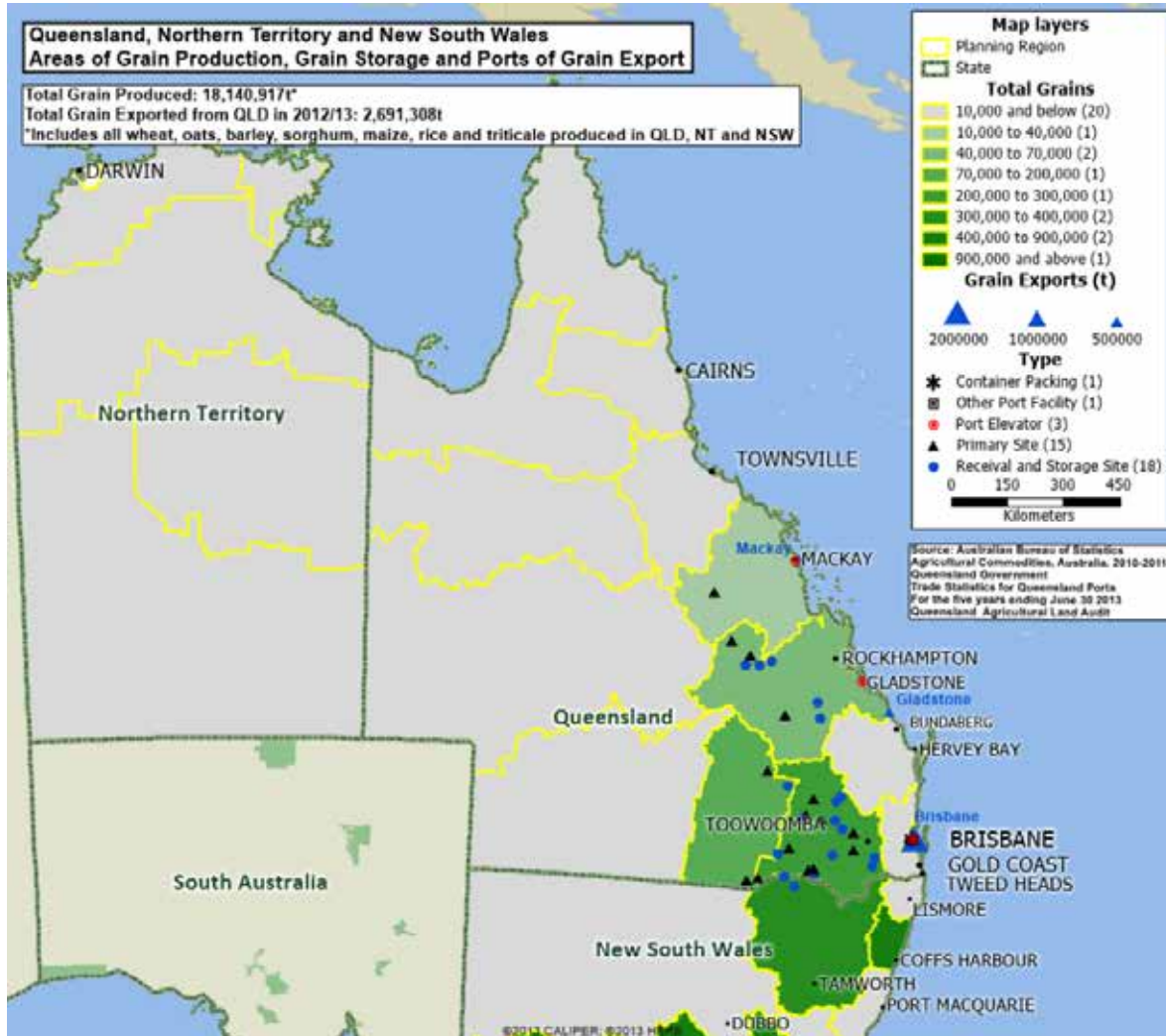
The region has the highest diversity of crop production, including maize, sorghum, tropical pulses, wheat, barley, winter-growing pulses and oilseeds.

¹⁰ Primary Industries Standing Committee, Grains Industry National RDE Strategy, 2011

¹¹ www.grdc.com.au/About-Us/Our-Grains-Industry

Grain production in Queensland is concentrated on the Darling Downs and in Central Queensland, as shown on the map in Figure 5 below.

Figure 5: Grain growing areas in Queensland and northern New South Wales



Source: Australian Bureau of Statistics Agricultural Commodities Australia, 2010-2011, Trade Statistics for Queensland Ports, for the five years ending 30 June 2013, Queensland Department of Transport and Main Roads, Queensland Agriculture Land Audit Statewide Overview, Queensland Department of Agriculture, Fisheries and Forestry, 2013

A detailed breakdown of service areas for each of Queensland grain production region is provided in Table 2 below:

Table 2: Summary of bulk grain production and service areas transported by rail

| Origin/rail head | Tonnes transported | Area serviced |
|------------------|--------------------|--|
| Thallon | 176,396 | Southern Queensland and northern New South Wales |
| The Gums | 105,838 | Surat Basin |
| Meandarra | 105,838 | Western Downs |
| Miles | 105,838 | Western Downs and Surat Basin |
| Talwood | 35,279 | Southern Queensland and northern New South Wales |
| Dalby West | 35,279 | Darling Downs |
| Malu | 35,279 | Darling Downs |

Source: *Import/Export Logistics Chain Study, Summary Report, QTLC, June 2013*

Note: Mount McLaren was not included in the original table.

Points of value add, transformation and consumption

Domestic consumption of grain produced on the east coast is increasing and is centred on livestock feed, food processing (including the milling, malting and brewing industries) and industrial use. The major grains and their domestic uses are as follows.

- Wheat accounts for most of Australia’s grain production, and is a winter crop. It is used for the production of breads, noodles and pastas.
- Oats have a number of different uses, primarily for livestock feed (grazing, seed or hay). Oat seeds are primarily used for animal feed and for human consumption. Barley is similar to wheat and is used for livestock feed and malting (alcoholic beverages). Between 35% and 40% of Australian barley enters the higher value malting market, while the balance is used for livestock feed.
- Sorghum is a summer crop planted in various areas throughout Australia. It has traditionally been used for human consumption and livestock feed. Increasing amounts of sorghum are being used for ethanol production.

- Cottonseed and canola constitute around 90% of Australian oilseed production. Oilseeds are used to produce oils and livestock feed. Generally, oilseed crops are used in rotations as they improve soil health. Recently, various parts of Australia have authorised the production of genetically modified (GM) oilseeds. Segregation of GM crops is creating issues within the industry. Another recent development has been the move towards grazing the crop between planting and harvest. This is being used by growers in high rainfall areas to improve profitability.
- Legumes are annual crops used for human and animal food. Pulses include lentils, lupins and chickpeas. They are primarily used in crop rotations in Australia for their ability to add nitrogen to the soil.

Planting for wheat, oats and legumes generally occurs from April to June, with harvesting from September to January. Planting for sorghum and oilseeds generally occurs from September to January, with harvesting from February to May¹².

The grain supply chain is a series of separate chains operating in geographically specific growing and consumption zones. The participants in the supply chain were outlined in the overview section.

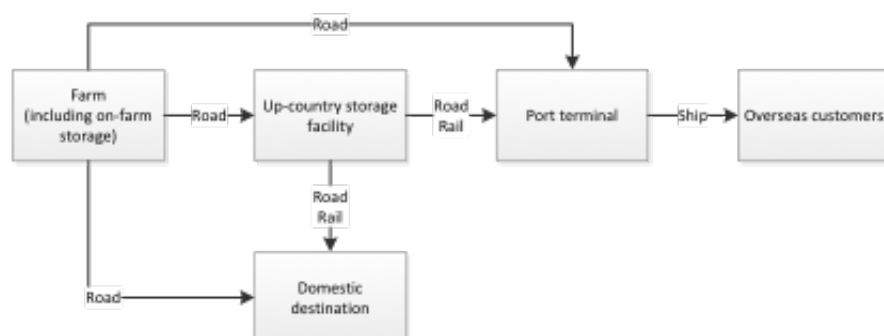
Typical supply chain components for the grain industry are:

- farm production
- truck transport to receiving points
- handling and storage at receiving points
- truck or rail transport to the port (for export supply chain only)
- handling and storage at the port (for export supply chain only)
- loading grain onto a ship (for export supply chain only)
- ship to destination (for export supply chain only).

¹² www.agworkforce.com.au/Australian_Agricultural_and_Farming_Seasons

Figure 6 below demonstrates a typical bulk grain supply chain.

Figure 6: Typical bulk grain supply chain



Source: Productivity Commission, *the Australian Bulk Wheat Export Industry*

As shown in Figure 6:

- The export shipping terminals are serviced by a combination of rail and road transport.
- The domestic supply chains are primarily handled by road transport from on-farm and up-country storage to flour mills and feedlots on a daily basis, to meet a relatively steady demand driven by domestic food demand.

In Queensland¹³, GrainCorp owns and manages the main storage network, with 40 sites and three port terminals (Brisbane, Gladstone and Mackay). AWB GrainFlow also has three modern sites in the south-west area.

There are three export corridors, with the rail link to Brisbane handling the largest rail-based volumes. Smaller volumes are hauled by rail from central Queensland storages to the ports of Gladstone and Mackay.

¹³ Grain Supply Chain Pilot Study, Stage One Final Report, National Transport Commission, www.ntc.gov.au/filemedia/Reports/GrainSupChainStage1Report.pdf

Up-country storage and handling facilities¹⁴

In Queensland, up-country storage and handling facilities consist of:

- storage facilities operated by GrainCorp and independent bulk handlers
- in-farm storage owned by growers.

The storage capacity of the bulk grain handling system in Queensland is 2.5 million tonnes. This is complemented by on-farm storage of about 1.9 million tonnes.

Extra capacity is also provided by grain users (e.g. millers) and temporary storage options (e.g. bags).

The total storage capacity in Queensland greatly exceeds the average annual production capacity.

Ports

Once at port, grain may require fumigation (particularly if it has arrived from outside the bulk grain handling system) and stored while it awaits loading onto a ship. Wheat can also be blended at the port facility to meet specific client requirements¹⁵.

There are four bulk grain export terminals in Queensland, one each at the Ports of Gladstone and Mackay and two at the Port of Brisbane. The operating details of the four terminals are detailed in Table 3, together with the details of other bulk grain export ports throughout Australia.

¹⁴ Productivity Commission, *The Australian bulk wheat export industry*

¹⁵ Productivity Commission, *The Australian bulk wheat export industry*

Table 3: Key metrics of the Queensland bulk grain export terminals

| Port zone | No. of terminals (No. of owners) | Grain exports range MMT (5 yrs) | Grain exports average MMT (5 yrs) (08-09 to 12-13) | Storage capacity ('000 t) | Volume exported/ tonne storage | Loading rate (t/hr) | Days loading | Ship capacity (Max DWT) |
|-----------|----------------------------------|---------------------------------|--|---------------------------|--------------------------------|---------------------|--------------|-------------------------|
| WA | 4 (1) | 7.7-11.4 | 9.9 | 1000 (2500) | 10 x (4x) | 1000-5000 | 4 (est) | 60,000 |
| SA | 6 (1) | 2.3-6.8 | 4.5 | N/A | N/A | 600-2000 | 2.3 | 60,000 |
| NSW | 2 (1) | 2.5-5.7 | 4.1 | 424 | 10 x | 4000-5000 | N/A | 120,000 |
| QLD | 4 (2) | 2-3.3 | 2.6 | 315 | 8 x | 900-2200 | N/A | 70,000 |
| VIC | 3 (2) | 1-5.3 | 3.2 | 413 | 8 x | 650-2500 | N/A | 70,000 |

Source: Australian Export Grains Innovation Centre, *The cost of Australia's bulk grain export supply chains, An Information Paper, January 2014*

Freight movements

Approximately 50% of grain grown in eastern Australia is consumed locally by a range of industries and businesses, resulting in grain travelling in various directions, using numerous modes of transport¹⁶.

The main transport mode for moving grain for export is road transport. In 2012, 1.7 million tonnes of grain and other cereals were exported through the Port of Brisbane. Of this amount, 65% was transported by road and 35% was transported by rail, from growing areas in southern Queensland and northern New South Wales.

An estimated¹⁷60,000 heavy vehicle movements (30,000 return trips) were undertaken to haul grain from consolidation points (silos) to ports in 2010/11.

Table 2 shows the tonnage transported by rail through each of the bulk grain rail terminals, and the area serviced. The available information indicates that, as with road transport, there is a mix of grain types moved by rail. The origins for grain received into the bulk grain rail terminal (i.e. on farm or upcountry storage) extend as far south as the Moree area.

The average distance to port from up-country receiving sites is approximately 250 km. The rail systems linking up-country sites to port are a combination of high-traffic intra and interstate rail lines and low-traffic grain rail lines. In many cases, the up-country rail is used only for moving grain, with little back-loading of wagons.

The road network linking the up-country receiving sites to port is a combination of local roads, state roads and interstate highways. There are multiple port destinations in each state, with a mix of capacities to receive grain through both road and rail transport.

¹⁶ www.aegic.org.au/media/22950/140130%20Final%20AEGIC%20Supply%20Chains%20Report.pdf

¹⁷ Heavy Vehicle Action Plan Stage 2 – Route Identification, Department of Transport and Main Roads, June 2013.

➔ Rail

Australia's grain freight rail networks are localised, with each state effectively operating its own separate network.

Each state has a different mix of gauges, with standard gauge being used for the interstate lines, narrow gauge in Queensland and Western Australia, and standard or broad gauge for the other states. There is limited competition for the rail freight task within each state.

Queensland rail systems used for grain transport are lower-efficiency lines, with 15.75-18 tonnes limit of axle loads compared with the 22 tonnes axle loads on the interstate lines. Consequently, Queensland's rail system carries lower net tonnes per grain train than interstate lines¹⁸.

Railway lines in Queensland have varying speed ratings and constraints, for example limited siding lengths on single-track rail. These constraints limit wagon capacity and train length, and therefore train capacity. Paths for grain trains are limited, and poor on-time performance (not only of grain trains) is common¹⁹.

➔ Road

Much of the road transport of grain is presently undertaken by semi-trailers with a regulation gross vehicle mass of 42.5 tonnes (six axle), or B-Double vehicles with a regulation gross vehicle mass of 62.5 tonnes at 25 m lengths. There is a growing trend to higher productivity vehicles, including A-Doubles. A-Doubles consist of either a Type 1 or Type 2 road train. A Type 1 road train is typically 36.5 m, with a regulation gross vehicle mass of 79 tonnes; a Type 2 road train is typically 55.5 m, with a regulation gross vehicle mass of 115.5 tonnes²⁰. Type 1 road trains known as A-Doubles are approved for transit to the Port of Brisbane under a special permit that specifies a maximum vehicle length of 30 m.

¹⁸ Queensland Government, axle mass limits in Queensland comparison table

¹⁹ Industry sources

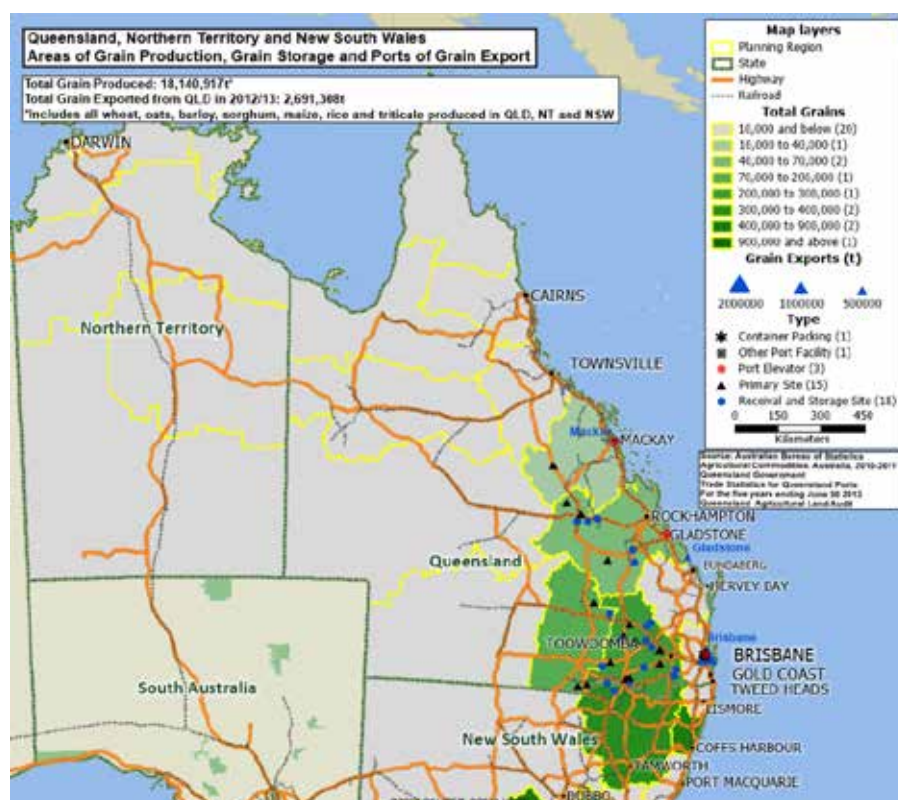
²⁰ Queensland Government, axle mass limits in Queensland comparison table

The grain industry considers that using higher productivity freight vehicles would reduce truck queues and reduce supply chain costs by requiring fewer truck movements per grain harvest.

Main routes

The main routes for grain movement in Queensland, both rail and road, are displayed on the following map in Figure 7.

Figure 7: Major Queensland grain routes



Source: *Moving Freight – A strategy for more efficient freight movement*, Department of Transport and Main Roads

Change in the supply chain

There are a number of foreshadowed trends and changes that may impact the grain logistics chain in Queensland. These include:

- the impacts of climate change, influencing where grains are grown in the future (for reference, see, for example, the Grains Research and Development Corporation, Australian Grains Focus, 2010-2011²¹)
- the continuing shift from rail to road transport, particularly in Queensland.

Historically, the most cost-effective mode of transportation of bulk grain has been rail. However, due to the decline in reliable rail services from the grain growing areas to port, there has been an increasing shift to road transport²².

Higher volume road-based transport options have further impacted on the historical rail monopoly for bulk grain cartage. One of Queensland’s largest grain packers is based in the Darling Downs area and is located approximately 160 km from the Port of Brisbane. The semi-automated 20 foot containerised packing system processes large quantities of different types of grains, while minimising damage to the product. The operator has a fleet of A-Double container skeleton trailers capable of carrying 20 foot and 40 foot containers to the Port of Brisbane in a road train configuration, subject to access regulations²³. This enables loads up to 79 tonnes GVM with a limit of 30 metres truck length²⁴.

²³ www.grainhart.com.au

²⁴ A type 1 road train is typically 36.5 meters with a regulation gross vehicle mass of 79 tonnes.

²¹ www.grdc.com.au

²² IMPEX Summary Report, June 2013, page 28

Road transport is extremely responsive and flexible. Most rail lines that move livestock or agricultural commodities have limited loading points, speed restriction (either due to track condition or geometry), axle mass limits and are vulnerable to closure from flooding. Road transport can move goods from the point of production to export, be mobilised quickly to respond to changes in demand and generally have access to alternative routes in the event of flooding. Rail schedules are determined early in the year and are largely non-responsive to changes in demand such as a good season resulting in increased crop tonnages. Where trains are cancelled due to insufficient volumes, penalties may be incurred²⁵.

The Queensland Government is seeking to enhance rail's place in the movement of agricultural products²⁶. Aurizon, in its submission to the Parliamentary Committee on Transport, Housing and Local Government Inquiry into freight rail use by the agriculture and livestock industries²⁷, notes that agriculture and general freight are key elements of Aurizon's strategic value creation priorities. Aurizon has committed to exploring commercially sustainable investments in these markets, aimed at enabling the organisation to better serve its freight customers.

Due to intense competition from road transport, contestable volumes on general rail freight networks are typically well below those needed to reach efficient scale. As a consequence, the scope for above-rail competition is considered very marginal²⁸.

- The recent trend to increase on-farm storage.

It is estimated that growers on the east coast have an average 11 million tonnes of on-farm storage. GrainCorp (New South Wales, Queensland and Victoria) is among major companies involved in up-country storage and transport²⁹. In July 2013, the Grain Research and Development Corporation published the Economics of On-Farm Grain Storage³⁰, which outlines the costs and benefits of on-farm grain storage. In Queensland, other companies now offer customers freight ex. farm to port, or depot to port options³¹. The relative flexibility and increasing efficiency of road transport will likely become a factor as this trend increases.

- Continued switching in Queensland from mainstream cereal grain crops (wheat, sorghum and barley) to smaller, higher value crops.

Ten-year historical data suggests that around 1.55 million hectares of Queensland land is sown for cereal crops each year. There are now expectations that some switching will occur in the area sown between crops. This is based on market prospect rankings derived by the Department of Agriculture, Fisheries and Forestry, and crop price forecasts.

On that basis, projections for Queensland cereal grain production over the medium term to 2018/19, are as follows.

- Wheat production is projected to fall by 3%, outweighing a 1% increase in price. This will cause annual GVP to fall 2% below the 10-year average to \$351m³².
- Sorghum production is projected to fall by 2%, outweighed by a 10% increase in average price. This will generate an 8% increase in average annual GVP to \$296m.
- Chickpea production is projected to increase by 27%, coupled with a 17% increase in price, taking GVP to an average of \$166m.
- Peanut production is projected to increase by 28%, coupled with a 21% price increase. GVP will be up 56% to \$21m a year.
- Sunflower production is projected to increase by approximately one quarter, outweighed by a 22% lower price than the 10-year average. This will reduce GVP by 1% to \$4.8m.
- Soybean production is projected to increase by approximately 30%, but with an equivalently lower price than the 10-year average. GVP is forecast to fall by 7% to \$6.9m a year.
- Mungbean GVP is forecast to sit 5% below average at \$10m, with a projected 28% increase in production, slightly outweighed by a lower than 10-year average price³³.

Such possible changes in crop production would impact on the supply chain. Factors to be considered include the potential to further utilise flexible road transport solutions, and other issues such as increased requirements for controlled environment transport.

- There is also significant momentum for northern Australia to become the food bowl for Asia. A CSIRO study considering the suitability of northern Queensland for agriculture has found that crops could be grown on irrigated land on a scale three times the size of the Ord River system in Western Australia³⁴. This possibility is not necessarily at odds with the potential for crop substitution.

25 www.parliament.qld.gov.au/documents/committees/THLGC/2013/INQ-RAIL/submissions/009_QTLC.pdf

26 Refer for example, 'Moving Freight' Department of Transport and Main Roads, December 2013

27 www.parliament.qld.gov.au/documents/committees/THLGC/2013/INQ-RAIL/submissions/007_Aurizon.pdf

28 Productivity Commission (2006) 'Road and Rail Freight Infrastructure Pricing', Canberra, p.314; BITRE, Rail Infrastructure Pricing: Principles and Practice (2003)

29 PWC November 2011, page 7

30 www.storedgrain.com.au

31 www.grainhart.com.au

32 18 Agricultural Commodities, Volume 4, Number 1, March quarter 2014, ABARES

33 <https://publications.qld.gov.au/storage/f/2014-06-25To1%3A40%3A27.888Z/soq-ag-report-june-2014-6.pdf>

34 www.csiro.au/fgara

The federal government's Green Paper on Developing Northern Australia was released in June 2014. At the time, Acting Prime Minister, the Hon. Warren Truss MP, noted that the development of northern Australia was a priority for the new Australian Government. He said further growth and investment would have direct benefits across northern Queensland, the Northern Territory and Western Australia, with that prosperity then spreading to all Australians³⁵.

The impacts for freight logistics are yet to be assessed and outlined in detail, given the recent nature of the proposals. It does, however, demonstrate that the dynamics of freight logistics, particularly relating to grain and broader agricultural industries, cannot be understated for the medium term in Queensland.

³⁵ www.minister.infrastructure.gov.au/wt/releases/2014/june/wto84_2014.aspx