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Australian Export Grains Innovation Centre

Australia's grain supply chains

Costs, risks and opportunities

Department of Primary Industries and Regional Development

GOVERNMENT OF WESTERN AUSTRALIA

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

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AEGIC is an initiative of the Western Australian State Government and Australia's Grains Research and Development Corporation

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We acknowledge that the help provided does not constitute endorsement of the report's content, findings, or recommendations which are the responsibility of the authors.

Please note

1. For international comparisons, export and import values vary depending on exchange rates and the information source.
2. All units cited in this report are metric measurements. Of particular note, the unit tonnes is a metric tonne (1000 kilograms).

Authors

Dr Peter White | Senior Projects Manager

Dr Chris Carter | Economic Analyst

Professor Ross Kingwell | Chief Economist

Australian Export Grains Innovation Centre

3 Baron-Hay Court, South Perth, Western Australia 6151

P: +61 8 6168 9900 **E:** admin@aegic.org.au

aegic.org.au

Department of Primary Industries and Regional Development, Government of Western Australia

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Contents

Acronyms

ABS	Australian Bureau of Statistics
ACCC	Australian Competition and Consumer Commission
AEGIC	Australian Export Grains Innovation Centre
AQIS	Australian Quarantine and Inspection Service
CBH	Co-operative Bulk Handling Ltd
CIF	Cost, insurance and freight
CFR	Cost and freight
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAWR	Department of Agriculture and Water Resources
EPPRD	Emergency Plant Pest Response Deed
EPR	End point royalty
FIS	Free-in-store
FOB	Free-on-board
GRDC	Grains Research and Development Corporation
GTA	Grain Trade Australia
NAT	Newcastle Agri Terminal
NRS	National Residue Survey
PHA	Plant Health Australia
RD&E	Research, development and extension
SLA	Statistical Local Area
USDA	United States Department of Agriculture

Abbreviations

Aus	Australia
Can	Canada
ha	hectare
km	kilometre
mmt	million metric tonnes
mt	metric tonnes
t	tonnes
NSW	New South Wales
SA	South Australia
Qld	Queensland
Ukr	Ukraine
US	United States of America
Vic	Victoria
WA	Western Australia

Foreword

In 2014 AEGIC published the first of its supply chain reports on the cost of Australia's bulk wheat export supply chains. Substantial investment, reorganisation and regulatory change was still occurring within the Australian grain industry in response to the removal of the single wheat marketing desk in 2008. The report described these changes as well as the structures and costs involved in the bulk export of wheat and showed that supply chain charges were the single largest cost item for a grain producer in a typical year.

That report became widely cited by a range of organisations in the commercial, regulatory, research and advocacy sectors of the grain industry (as examples see: Brookfield, 2014; Morrison, 2014; DAWR, 2014; GrainCorp, 2015; ACCC, 2016; Kalisch Gordon, 2016; Kingwell, 2017). The report provided important background information to the SA government's inquiry into bulk grain export supply chain costs in SA (ESCOSA, 2017).

Reorganisation and new investment in Australian supply chains has continued since the 2014 report. Providers of grain handling and export services have moved away from auctions to allocate capacity at ports towards offering long-term agreements. The ACCC administers the new Port Terminal Access regulations and continues to lighten controls by granting exemptions. There have been ongoing reductions in the number of upcountry receival sites operated by the main grain handling and storage service providers and many farmers continue to increase their on-farm storage. Rail regeneration programs have been implemented in Vic and NSW, while some rail lines have been closed in SA and WA. New port developments and commercial agreements have significantly increased port loading capacities in WA, NSW and SA. Road maintenance and road and highway upgrades have occurred to facilitate use of higher capacity trucks. Containerisation continues to be a significant export avenue for wheat, especially in NSW and Vic, offering new opportunities to meet the changing demands of customers.

International supply and demand for wheat has also expanded rapidly over the past decade, providing market opportunities and increased competition. Australian wheat production in 2016-17 reached record levels, allowing higher volumes of exports that tested the capacity of Australia's storage and handling system.

Low-cost grain producers in the Black Sea region and Argentina have emerged as alternative sources of grain. Russia is now the world's leading wheat exporter and has established strong competitive positions in Australia's traditional markets. Fortunately, accompanying this increased supply has been the continued expansion of demand for wheat in Asian countries caused by growing populations, rising incomes and changing consumer preferences.

This report responds to calls from grower organisations, representatives of trading companies and government agencies for an update of the 2014 study. Grain handling service providers were consulted during its preparation and provided useful information and feedback. We have updated our analysis of wheat supply chains to describe the current structures and costs and asked how well they serve Australian farmers striving to compete against low-cost producers while meeting the quality preferences of an increasingly discerning Asian market. This report aims to provide a better understanding of the factors affecting the nature and costs of export grain supply chains in Australia. We also look beyond the current situation to consider how supply chains might evolve to embrace emerging and future opportunities while also being affected by technological change.

View AEGIC's past reports

Recommendations

Since 2014 AEGIC has analysed the supply chains of several competitors to the Australian grains industry (Canada, Ukraine, Russia and Argentina). The recommendations below draw on this research in addition to the review of the 2017 grain supply chains presented here. These recommendations identify important areas of reform that are likely to produce enduring benefits to the Australian grains supply chain.

Ensure least-cost grain paths are developed and maintained

First, better coordinate road regulation, planning and investment in roads to facilitate effective planning and investment by grain supply chain owners and operators. Second, proactively maintain vigilance over least-cost grain pathways to prevent encroachment of incompatible urban development leading to future conflict and contest over land use. Australia's population continues to expand and become increasingly urbanised, so there is a risk to freight access and maintenance of operational flexibility of some port terminals. Planning, zoning, regulation and development decisions affecting freight corridors, port access and grain terminal operations require careful ongoing oversight. The cost of failure over this issue, at all levels of government, could be high in real terms for growers and users of the supply chains.

Align wheat breeding, varietal classification, grain assessment systems and grain handling to support the export of Australian wheat to differentiated, premium markets

Wheat exports from Australia and domestic marketing are likely to involve greater segregation, especially as on-farm storage increases. Hence, it is vital that all stakeholders (breeders, varietal classifiers, grain handlers) have incentives that align to deliver the types of Australian wheat most preferred in differentiated, premium markets.

Ensure there are sufficient incentives for R&D investment to improve the cost-efficiency of supply chains

Technological improvements that lead to productivity improvements and reduced supply chain costs are important mechanisms to increase the competitiveness of Australian supply chains. Whether existing providers of supply chain services have sufficient incentives to commit funds to R&D that may yield valuable outcomes requires further examination.

Supply chain owners should consider making the basis of component charges clearer, to increase confidence in supply chains and improve perceptions of fairness

Greater transparency regarding the basis of component charges — including infrastructure use and efficiencies — could become a point of competitive advantage and a pathway to lessened regulation and associated costs. Information can be provided to an independent third party to maintain commercial sensitivity.

Key findings

Costs stable

Despite major investments by many stakeholders, the real costs to users of most export grain supply chains in Australia have remained stable or slightly decreased, compared to the situation in 2014. There are differences between states in the effective cost to grain producers of supply chain services (see sections on ***Supply chain operations: Financial performance indicators – page 44*** and ***Trends in port terminal operations – page 70***).

Costlier than most

Australian supply chain costs are higher than most of its competitors, except for Canada. Transport from upcountry receival sites to port and port charges are generally the highest components of supply chain costs (see sections on ***Costs and charges – page 17*** and ***Competitiveness of Australian supply chains – page 84***).

Regulation

Regulation of wheat exports has been a requirement for transitioning out of the single wheat marketing desk but has reduced flexibility for providers of bulk handling services, imposing additional costs on users of the bulk handling system, and caused some confusion among customers for Australia's wheat. Tensions remain within the industry about the need for regulation (see sections on ***Regulation of grain exports – page 35*** and ***Port regulation – page 66***).

Code of conduct

Moving to a voluntary code of conduct under general competition law, including sufficient transparency and monitoring, may assist Australian supply chains to develop the flexibility required to meet future challenges from increasingly competitive low-cost wheat exporters in the Black Sea region and Argentina (see sections on ***Port regulation – page 66*** and ***Competitiveness of Australian supply chains – page 84***).

Long-term freight planning

Coordinated long-term planning for high-capacity freight corridors to avoid conflict with urban development will be an important ongoing requirement to continue to progress and capture the benefits of improved efficiency of grain road freight (see sections on ***Freight – page 50*** and ***Port regulation – page 66***).

Location

Spatial change in grain production, improvements in harvest technology and seasonal volatility are affecting the nature and cost of Australia's export grain supply chains. Low-yielding locations distant from port are likely to become increasingly expensive relative to high-yielding locations near to port (see section on ***Wheat production and export from Australia – page 22***).

Farm storage

Increased farm storage capacity, particularly in eastern Australia, is changing the demand for upcountry commercial storage of grain. This is affecting scale efficiencies for service providers and stimulating the restructure of commercial storage networks (see sections on ***Grain storage – page 38*** and ***Trends in port terminal operations – page 70***).

Grain quality

Stewardship of grain quality is an important consideration for the Australian industry as the range of grain storage options and pathways to markets increase. The Australian grain industry needs to consider how to best ensure stewardship obligations are understood, accepted and maintained throughout the industry (see section on ***On-farm storage – page 38***).

Containerised exports

About 10 per cent of Australia's export wheat is in containers. About half of these containerised wheat exports are from Victoria (see sections on ***Export in containers – page 28*** and ***Port containerisation facilities – page 69***).

Excess port capacity

Excess port terminal capacity is prevalent in some locations in eastern Australia (see sections on ***Structure of Australian grain handling and export systems – page 29*** and ***Grain port terminals – page 64***).

Eastern states complexity

Pathways for transporting grain in NSW, Vic and Qld are multidirectional, servicing domestic and export markets, and requiring a different network structure to the port-based grain catchments of WA and SA. When combined with large annual variations in grain exports, greater competition and a higher proportion of exports in containers, infrastructure planning and supply chain investment on the east coast becomes complex (see sections on ***Wheat production and export from Australia – page 22*** and ***Freight – page 50***).

Business transparency

The reporting of business segment performance of the main companies providing supply chain services is sometimes poorly enunciated. Greater transparency in reporting will build trust in service providers (see sections on ***Regulation of grain exports – page 35*** and ***Port regulation – page 66***).

Costs can be reduced

Reducing Australia's supply chain costs is feasible and imperative, through synergistic infrastructure investments and emerging innovations involving automation, information technologies and organisational change (see section on ***Emerging innovations and technologies within supply chains – page 82***).

Costs need to be reduced

Impetus for greater cost-efficiency in Australia's grain supply chains arises from Australia's grain export competitors who are undertaking major investments in their supply chains. These investments, when combined with attractive sea freight rates, have enlarged the reach of grain from low-cost competitors such as the Black Sea and Argentina (see sections ***Sea freight – page 74*** and ***Competitiveness of Australian supply chains – page 84***).

Image courtesy: GRDC

Executive summary

This report examines recent changes to the nature and cost of export grain supply chains in Australia. Since AEGIC's review of Australia's export grain supply chains in 2014, substantial investment in many of those supply chains has occurred, along with mostly beneficial regulatory change. Accompanying these changes have been other trends in improved harvest technologies — a gradual unfolding of climate change, and agronomic improvements — all of which additionally impact on supply chain costs.

In compiling this report, we have used consultants and industry experts to assist us. We have also requested contributions from industry participants on particular topics. We appreciate and have valued the supply chain service providers who have helped ensure, wherever possible, that information in this report is accurate and relevant.

The costs of Australia's export grain supply chains are affected by seasonal variability in grain production, and increasingly by shifting climate patterns. The volatility and change in climate affect the spatial distribution of crop production, which in turn affects export grain supply chains. Increased crop intensity and greater absolute increases in grain yields are occurring in higher rainfall zones. By contrast, reduced cropping and constrained yield advancement characterise some low rainfall locations often distant from port.

This report examines three supply chain structures, representing how most Australian grain is exported. These structures all end with grain being loaded onto a ship. The three options are: (i) traditional, where a farmer delivers harvested grain to a local receival site owned by a bulk handler. This grain is aggregated at port; (ii) direct, where harvested grain is delivered by a farmer directly to port; and (iii) on-farm, where grain is first placed into on-farm storage rather than local storage and then is eventually shipped out. These three structures are examined against the backdrop of 12 farm locations selected to represent the geographical spread of grain production and the resulting flows of grain to export. Because wheat remains by far the main grain exported from Australia, the cost estimates of the various supply chains are based on wheat.

There is a wide range in the costs of export grain supply chains in Australia with many factors contributing to the costliness of each supply chain. Key influences on costs include distance to port, efficiency of receival and storage, duration of storage, type of haulage, ease of ship loading and time of shipping. For the sites considered, when traditional export occurs – whereby the farmer delivers harvested grain to a local receival site owned by a bulk handler and then the grain is aggregated and loaded onto a ship – supply chain costs vary from $56/t to $110/t. In most cases, the freight to port is the major component of the supply chain's total cost.

Across many sites, the real costs of export grain supply chains, compared to the situation in 2014, have remained stable or slightly decreased. However, the direction and degree of changes in the costs of using supply chain services differ between sites and between states. For example, Co-operative Bulk Handling (CBH)'s rebate of charges to growers who use its facilities has reduced the effective costs of most Western Australian growers' supply chains over the past two years.

Wheat represents 60 per cent of the value of grain exported from Australia over the past 10 years. WA is Australia's largest wheat exporting state, exporting 6.9 million metric tonnes (mmt) of wheat per annum, on average, from 2006 to 2016 (or over 50 per cent of Australia's wheat exports). During 2012-16, canola exports have increased in importance, becoming 16 per cent of the value of all grain exports. Unsurprisingly, WA ports feature among the top-ranked ports for grain export, with Kwinana being by far the top-ranked port, exporting almost 5mmt of all grain annually. After WA, SA is the next largest wheat exporter, with an average 2.6mmt of wheat exports, contributing 18 per cent of Australia's average wheat exports. WA also has the most wheat-dominant export trade with about 80 per cent of its grain exports being wheat. This compares to about 40 per cent for Qld and about 50-60 per cent for the other states.

Victoria exports the most wheat in containers, accounting for about half of all containerised wheat exports from Australia since 2010. Similarly, over this period, about 51 per cent of Victoria's total wheat exports have been in containers compared to 30 per cent and 37 per cent for Qld and NSW respectively; and less than 4 per cent for WA and SA.

Since AEGIC's previous report in 2014, there have been ongoing reductions in the number of upcountry receival sites operated by the main companies providing grain handling services and many farmers continue to increase their on-farm storage, in spite of its greater cost compared to many commercial warehousing opportunities. The major service providers are concentrating their businesses around high-capacity, efficient and strategic sites and have undertaken major investments in their networks and operations to maintain and improve their fitness for purpose and to deliver business efficiencies. The net outcome of these investments has been little alteration in the costing of these network services.

Old and new grain receival and loading infrastructure in southern NSW.

In 2014 there were 623 receival sites in Australia yet by 2016 the number had declined substantially such that the major commercial grain handlers now retain fewer than 480 sites — and many of these are rarely used and destined for closure over the next decade. Many sites now only open in years with large harvests. For example, in SA, 80 per cent of the grain was received in only about 30 sites in 2016, while in WA, in the bumper 2016 harvest, 76 of the 178 sites were designated as surge sites. Across the Australian network of receival sites, 227 are classified as primary sites.

Rail regeneration programs have been implemented in Vic and NSW, while some rail lines have been closed in SA and WA. New port developments and commercial agreements have further increased port loading capacities in WA, NSW and SA. Road maintenance and road and highway upgrades have occurred, facilitating use of higher capacity trucks.

Grain Trade Australia (GTA) has around 200 ordinary grain trading company members. Of these, the top six companies are responsible for about 80 per cent of the wheat exports from Australia. CBH is the largest, exporting about 30 per cent of Australia's wheat followed by Glencore with a 17 per cent share. The dominant wheat exporters are also integrated marketing and bulk handling companies.

Since the deregulation of wheat marketing in 2008, Australia's major bulk handlers are all now agribusiness companies offering integrated marketing and grain handling services. Four of the six major integrated marketing and grain handling companies (representing nearly 60 per cent of total wheat exports) are foreign-owned.

Industry experts estimate that over the past five years the amount of grain stored in good-quality steel silos in NSW, Qld and Vic has doubled. Significant amounts of grain have moved from temporary, or poor quality, shed storage into higher quality facilities that can be gas-sealed, fumigated or aerated. More than 80 per cent of an average harvest can now be placed in permanent storage on-farm in these states. On-farm storage in SA and WA is much less, but continues to grow, albeit at a slower pace. About 240,000t of permanent storage have been added annually in WA over the past few years and more than 30 per cent of an average harvest can be stored on-farm in either permanent or short-term storage. Hence, despite the major grain handlers closing some receival sites, the total capacity to store grain has increased across Australia due to farmers' increased investment in on-farm storage, and upgrades to service providers storage at strategic sites.

On a per tonne basis, the cost of using smaller on-farm storage is usually more than the cost of the service provided by large commercial grain handlers. Large-scale, high-quality farm storage can be less costly than several commercial warehouse service providers, though does not include the risk management services bundled into the commercial storage cost. Hence, depending on the type of farm storage and the nature of the commercial warehouse service provider, the trend towards increased investment in farm storage can either increase or decrease a farmer's supply chain costs. This trend comes with an increased risk to growers from adverse events when storing grain on-farm, as the risk is not transferred to a commercial service provider. What is apparent is that farm

storage does facilitate harvest logistics and helps underpin flexibility in targeted grain marketing, from which many farmers derive commercial advantages.

Due to opaqueness in the financial reporting of Australia's major grain handlers and marketing agribusinesses, it is not feasible to identify their profit centres and business segment cost structures. The exception is CBH. Its Storage and Handling Division accounts for three-quarters of CBH's pre-tax profit and generates the largest profit margins of its business segments. Furthermore, due to CBH's cooperative structure, this division is tax-exempt, so this unit accounts for an even larger percentage of after-tax profit. All other divisions are subject to company taxation.

Over the five years to September 2017, CBH profit margins in storage and handling (before applying rebates) have ranged from 15 per cent to 33 per cent and grain receivals have ranged from 9mmt to almost 17mmt. CBH has distributed an increasing proportion of its income as rebates. By driving down costs in its Storage and Handling Division, CBH remains competitive against new entrants into grain storage and handling in WA.

In international competitiveness rankings, the quality of Australia's road infrastructure ranks 35th in the world, the same as its ranking for the quality of its rail infrastructure. Australia's road infrastructure ranking is considerably higher than that of several of its main grain export competitors — Argentina (96), Russia (114) and Ukraine (133) — although still behind France (7), the US (10) and Canada (22).

Australia's road quality ranking could be higher if investments in regional road infrastructure were better coordinated, with a greater emphasis on economic prioritisation. Unfortunately, road investments have often been more linked to political rather than strategic economic imperatives. Consequently, often these investments are not the most efficient means to deliver lasting low-cost grain paths.

In contrast to the quality of its road infrastructure, Australia's railroad infrastructure ranks very poorly compared with that of most of its major grain export competitors. Australia sits at 35th — on par with Ukraine (37) but well behind France (5), the US (10), Canada (16) and Russia (23). The only competitor that ranks substantially lower than Australia is Argentina, positioned at 83rd, which, after decades of severe underinvestment in its rail infrastructure, is now embarking on a staged renovation with an initial $2.8b spend on its northern rail line, and this is well on the way to completion. The Argentinian government's stated aim is a complete recovery of its freight network by 2035, when 20,000km of track will have been renewed. Much of the investment involves private-public partnerships.

Australia has 18 ports mostly located within 400km of production areas and often with just one, or sometimes two, major port terminal service providers. The average distance to port from upcountry receival sites is about 250km (longer in NSW and shorter in SA). Most ports have a significant catchment area where road transport costs are competitive with rail costs.

Many port terminals are operated by dominant incumbent grain handlers who since deregulation have developed or enlarged their marketing arms. The business segment performance of these large firms is increasingly opaque. The Australian Competition and Consumer Commission (ACCC) is of the view that it is important to monitor the practices and competitive environment of these incumbents and not just report on their port operations (ACCC, 2018).

Tensions remain within the industry about the need for the current port access regulations. Supply chain owners should consider making their component costs, charges and performance metrics visible across the supply chain to increase confidence in supply chains and improve perceptions of fairness. This information can, as in the Canadian system, be provided to an independent third party to maintain commercial sensitivity.

> Greater transparency could become a point of competitive advantage for the industry and a pathway to lower regulation.

Australia is geographically close to its primary markets for wheat and this provides a benefit to the industry through reducing the cost of delivering grain to those markets. Since early 2016, there has been a lift in sea freight rates. Combined with the decline in real prices of grain, this increase has meant that sea freight as a share of calculated cost, insurance and freight (CIF) values has risen. If shipping rates climb further in 2018, then the advantages of geographical proximity to major wheat customers become more forceful. This would bestow further advantages to EU and Black Sea wheat being exported to northern African and Middle East markets. South-East Asian markets would be more commercially attractive to Australian suppliers, and North Asian markets would become more attractive to Canadian and Pacific north-west US wheat marketers. While a higher freight price may lead to some insulation for Australia from competition in South-East Asia, the likelihood of seeing conditions that would lead to a continued strong uplift in sea freight rates is low, at least in the foreseeable future. Moreover, and more importantly, despite the possible changes in sea freight costs, Black Sea wheat will remain preferred in some of Australia's key, price-conscious, South-East Asian markets due to its lower costs of production and cost-efficient supply chains.

Innovation in shipping and associated support services is likely to eventually place downward pressure on sea freight rates. Improvements to engines, better propeller performance and high-tech coatings, as well as friction-reducing air cushions and even skysails will reduce the fuel needs of ships in the future.

The main operating costs for grain storage and handling, transport and port terminal services are labour, safety and energy costs. Accordingly, any innovation that reliably and cost-effectively reduces these key costs is likely to be embraced by these service providers. Illustrations of automation likely to be more fully embraced within grain supply chains include:

- driverless chaser bins that deliver grain from farmers' fields to on-farm storage or grain trucks;
- autonomous cartage of grain from upcountry bunkers to adjacent rail loading facilities;
- grain rail wagons that automatically load and unload
- driverless shuttle trains;
- greater automation of grain receival and grain quality assessment; and
- fully automated grain container port operations.

A fundamental issue affecting the development of innovations and technologies applicable to grain supply chains is whether existing providers of supply chain services have sufficient incentives to commit funds to R&D that may yield valuable outcomes. This important issue deserves a separate review. Australia, by international comparison, already has relatively expensive supply chains. Developing and applying innovations and technologies is one way of reducing the expense of supply chains. A corollary is the need to ask: Are there sufficient incentives for R&D investment to improve the cost-efficiency of supply chains? In this report, we recommend that this question be answered. If impediments to R&D investment in supply chains can be identified, then policy or institutional changes need to occur to address any such impediments.

In summary, since 2014, despite the endeavours of supply chain owners and operators, the real costs of many export grain supply chains in Australia have remained stable or only slightly decreased. Importantly, there are differences between states in the effective cost to grain producers of supply chain services, with WA grain growers benefiting from CBH's rebate policy in the past two years.

What should concern the Australian export grain sector is the high cost of its grain production and supply chains relative to those of its emerging competitors. Moreover, significant investments are underway in these competitors' supply chains that will further challenge the Australian industry. The Australian export grain industry needs to carefully consider how best to strategically respond to this ongoing competitive challenge.

LEFT: Loading wheat into rail wagons at Oaklands, southern NSW, for transport to port.

Methodology

Overview of Australia's supply chains

There is no single grain supply chain for Australia. Various supply chain options are available in all states, with grain being exported in bulk or containers through 25 port terminals spread around Australia's coastline. Grain is delivered to each port via road or rail, or their combination.

The costs of using these modes can differ across regions and even within a region; and can be seasonally dependent. For these reasons, the supply chain costs presented in this report should be taken as being broadly representative rather than being fixed in nature or magnitude.

The cost of a supply chain in this report is interpreted as the difference between the free-on-board (FOB) price of the grain, net of production costs. That is, the cost that would be associated with storing grain after harvest and moving it from the farm onto a ship. An explanation of the pricing points is presented in Figure 1.

This report also includes comment on the cost of shipping grain to Australia's key markets, although these costs are not included as a component of the supply chain costs within Australia. Shipping costs are set on a global market and there is limited capacity for the Australian industry to affect these costs.

Although the primary focus of this report is to clarify the cost components of export grain supply chains in Australia, it needs to be noted that many components are best viewed not simply as cost items but rather as service activities. Just because a service can be provided at a low price does not necessarily mean that service is fit-for-purpose. Indeed, it needs to be noted that farmers, freight service providers and grain handlers have invested millions of dollars in recent years in maintaining and upgrading assets that underpin Australia's grain supply chains. As pointed out by Kingwell (2017), higher yielding wheat varieties, improved agronomy and greater work rates of farm machinery lead to huge volumes of grain needing to be carted and stored each day of a modern harvest. Accordingly, millions of dollars need to be spent ensuring on-farm and off-farm assets are increasingly fit-for-purpose in delivering and storing that rapidly harvested grain. Hence, the cost of a service within any supply chain needs to be weighed against the value or benefit it generates, including risk management.

Services such as managing pests, checking for contaminants, assessing and segregating grain based on its quality and so on, can protect or add to the value of Australian grain in the market. It is simplistic thinking to view the components of a supply chain as costs to be avoided or slashed. Rather, they are a portfolio of services whose value proposition requires regular review. With that important caveat, the nature and cost of components of export grain supply chains across Australia are described in the following sections.

This report also presents trends within various parts of export grain supply chains, and how those trends may affect participants. It also briefly outlines how supply chains might alter in coming years and be affected by technological change.

It is simplistic thinking to view the components of a supply chain as costs to be avoided or slashed. Rather, they are a portfolio of services whose value proposition requires regular review.

Figure 1 **Pricing points through the Australian grain supply chain**

Our approach

Wheat is by far Australia's principal export grain. Accordingly, we describe bulk export grain supply chains for wheat. Three supply chain structures are examined (Figure 2). These are not the only options available to farmers but they are representative of most of the grain exported from Australia.

1. **Traditional** — Grain is delivered by a farmer into a local receival site, owned by a bulk handler. The bulk handler is responsible for storing that grain on-site, and transporting it from bin to port, using the preferred method (road or rail). The grain is aggregated again at port, moved into a shipping position, then onto a vessel and shipped to the receiving port.
2. **Direct** — Grain is delivered by a farmer directly to port, where it is aggregated, moved into a shipping position, then onto a vessel and shipped to the receiving port. Grain in this supply chain bypasses the upcountry receival network. It relies on the farmer having access to a port that will accept direct deliveries.
3. **On-farm** — This supply chain replaces the storage node in the traditional supply chain with on-farm storage. This has implications for the activity of transporting grain, as the farmer can decide when, and whether, to deliver grain into the bulk handling system. The on-farm storage supply chain has several differences to other chains, such as the risk profile inherent within it. There are still common components, such as the delivery to port and the costs associated with using the port infrastructure.

These different supply chain options are not available to all growers, and there are different cost items within each grain-growing region. For each of the supply chains that are available within each region, we present the likely costs, using a set of fixed locations to represent some typical supply origins. The locations are chosen to illustrate the costs within each chain. The locations we selected are presented in Figure 3.

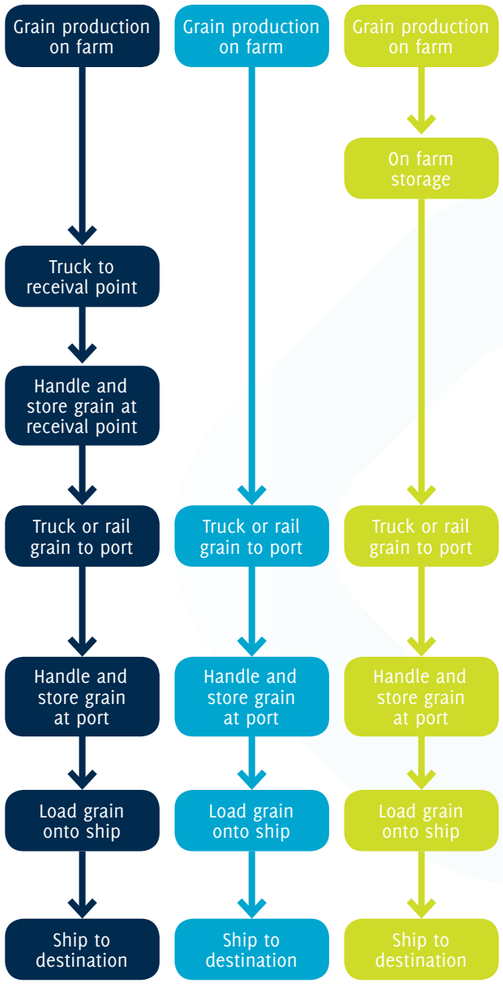


Figure 2 Overview of the three types of supply chains presented in this report

Logic behind our approach

The approach taken within this report differs slightly from the 2014 report by Stretch et al. (2014). This shift is in response to feedback received through the consultation process of the previous report. This method allows the comparison and discussion of supply chain costs on a node-by-node basis across Australia without explicitly pitching the costs of any one supplier of bulk handling services against another, which is not the intent of this study.

In compiling this report, we have used consultants and industry experts to assist us. We have also requested contributions from industry participants on particular topics. We appreciate and have valued the supply chain service providers who have helped ensure, wherever possible, that information in this report is accurate and relevant.

Figure 3 Locations used within the analysis in this report

Costs and charges

This report presents publicly available data and published reference prices. Published prices indicate the cost to an Australian wheat producer of using various export grain supply chain services. We recognise that in some cases discounts to the reference prices are provided, particularly to large growers or traders as regular users of particular supply chains. The size of these discounts is generally not publicly available. Similarly, we do not know the cost of providing supply chain services, and we have not attempted to estimate these. Our aim is to provide improved visibility of supply chain charges and provide some explanation as to why these may legitimately vary in different regions and zones. For example:

- In most cases, the distance of a production region from port increases the cost of freight services for that region's supply chain.
- For port terminals not exempt from the regulatory provisions of the Port Access Code (the Code'), their port fees will reflect some additional regulatory burden.
- Some farmers are not only users of supply chain services but also co-owners of those businesses and the ownership structure can affect the net cost of using the supply chain services.

By illustration, and as discussed later in this report, most grain farmers in WA are members of CBH, the dominant provider of grain handling and marketing services in WA. Particularly in recent years, WA farmers have received rebates of charges when using CBH services, which effectively offsets a proportion of the farmers' future costs of using CBH supply chains. Hence, in this case, there can be a difference between the charges farmers face for using a supply chain and the net cost they incur.

Figure 4 shows supply chain costs of various locations when commercial upcountry storage is used while Figure 5 shows supply chain costs when farm storage is used and then grain is delivered direct to port. In Figure 5 we have used the direct-to-vessel model CBH provides where discounts of $3.80 and $3.50 to the receival fee and storage and throughput fee respectively are provided.

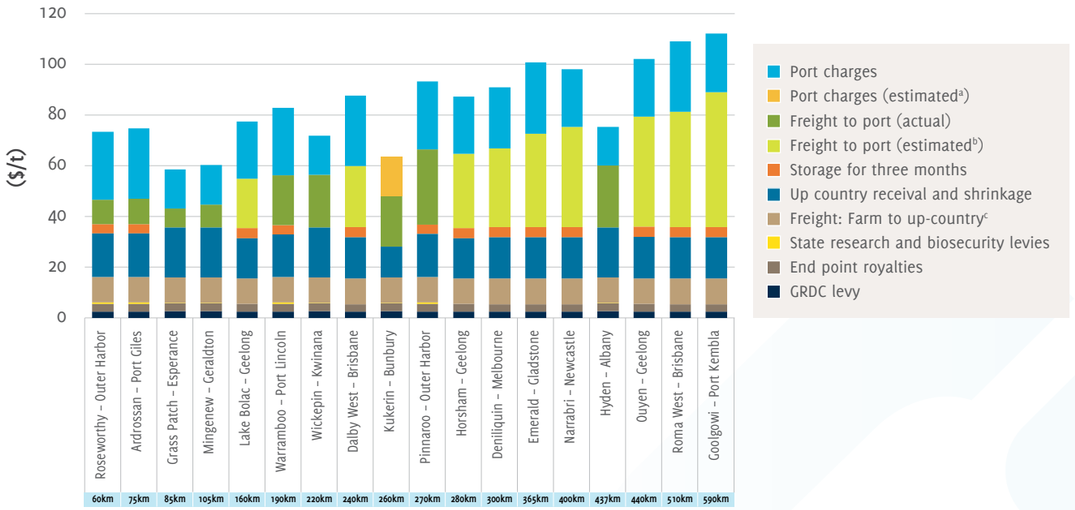


Figure 4 Comparison of total wheat supply chain costs[1], assuming grain is delivered to commercial upcountry storage and outurned after three months[2]

Notes: [1] The export select discount of $0.60 has been applied to Viterra supply chains.

[2] Port charges for Viterra vary throughout the year. We have applied charges for export at February 2018.

[a] Vessel loading charges at port for Bunge in WA are not publicly available. These are an internal charge for Bunge that should be reflected in the price offered for the grain. We applied the CBH port charges to cost of the Bunge's supply chain as an indicative estimate of these charges.

[b] GTA location differentials have been used to estimate freight charges for NSW, Vic and Qld. We acknowledge that location differentials are not freight rates and, in some cases, they are an inadequate estimate due to the large variation in freight charges that can occur in these states. Industry experts indicate actual freight rates may be higher or lower than GTA location differentials. GrainCorp execution rates offered to pool providers in 2017–18 were on average 9% lower than GTA location differentials (see Figure 42 on page 60).

[c] Cost of freight from farm to receival site was estimated at $10.10 per t based on a 30km journey at $0.12 per km plus a $6.50 turn around cost.

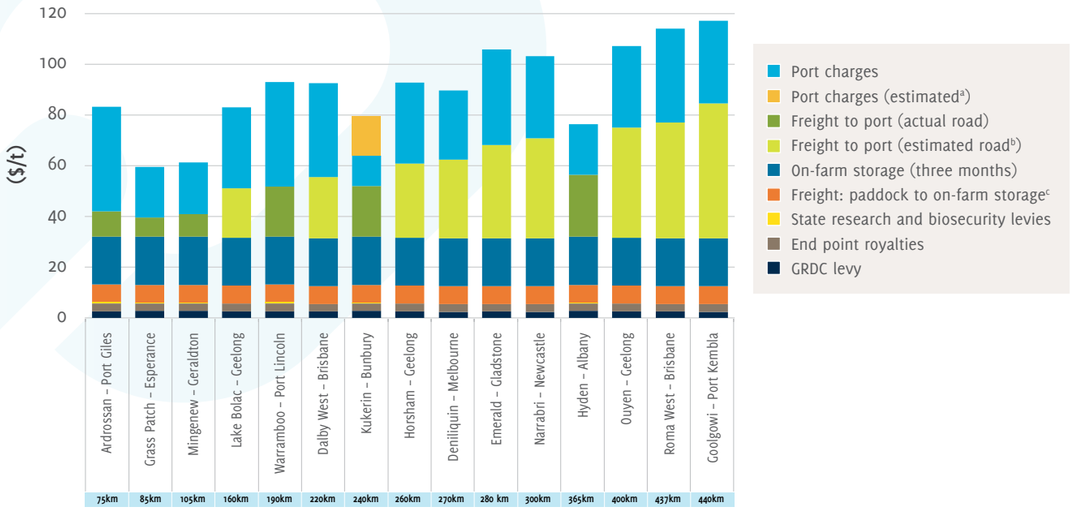


Figure 5 Comparison of wheat supply chain costs, when grain is stored on-farm for a period of three months, then delivered direct to port [1]

Notes: [1] Port charges for Viterra vary throughout the year. We have applied charges for export at February 2018.

[a] Direct charges at port for Bunge in WA relate only to receival fees. Vessel loading charges for Bunge are not publicly available, so do not appear here. These are an internal charge for Bunge that should be reflected in the price offered for the grain. We have applied the CBH vessel loading charges to Bunge's supply chain costs as an indicative estimate of these charges. CBH costs use the direct-to-vessel model where discounts are applied to the receival and storage and throughput fees.

[b] GTA location differentials have been used to estimate freight charges for NSW, Vic and Qld. We acknowledge that location differentials are not freight rates and, in some cases, they are an inadequate estimate due to the large variation in freight charges that can occur in these states. Industry experts indicate actual freight rates may be higher or lower than GTA location differentials. GrainCorp execution rates offered to pool providers in 2017–18 were on average 9% lower than GTA location differentials (see Figure 42 on page 60).

[c] Cost of freight from paddock to on-farm storage was estimated at $10.10 per t based on a 5km journey at $0.12 per km plus a $6.50 turn around cost.

Image courtesy: CBH

As is apparent in Figure 4 and Figure 5, there is a large variation in total costs with a range of factors contributing to this variation so that straightforward comparisons between individual supply chains is not always meaningful. Subsequent sections of this report provide some explanation as to why costs and charges legitimately differ between service providers; however, adequate information is not available in all cases. For example, distance to port is a significant component of the total cost of the export supply chain but the cost of transport in Queensland, NSW and Vic is difficult to estimate. We have used location differentials published by GTA but these are not freight rates (see Box 3 on page 62) and have not been updated for the past five years. We are aware that actual freight rates in these states are variable and at times may be up to $5–10/t higher or lower than the published GTA location differential. GrainCorp execution rates offered to pool providers in 2017–18 were on average 9% lower than GTA location differentials (see Figure 42 on page 60). Nevertheless, it is apparent that for sites in NSW that are about 600km from port, total supply chain costs are more than $100/t. In SA and WA, where the distances to port often range from 100km to 200km, the cost of using the supply chain is closer to $50–$80/t, dependent on location (Figure 6).

While the relationship between distance and cost is nearly linear across all states (with similar slope irrespective of the state), the differences in the fixed-cost component of each supply chain does impart groupings dependent on the state. For instance, there is a distinct difference in the costs of the supply chains between WA and other states, where the distances between the receival sites and ports are similar. The fixed costs relate to those static per tonne costs at receival sites and ports, as well as the levies and storage costs.

Bulk loading of grain into the ships hold at port.

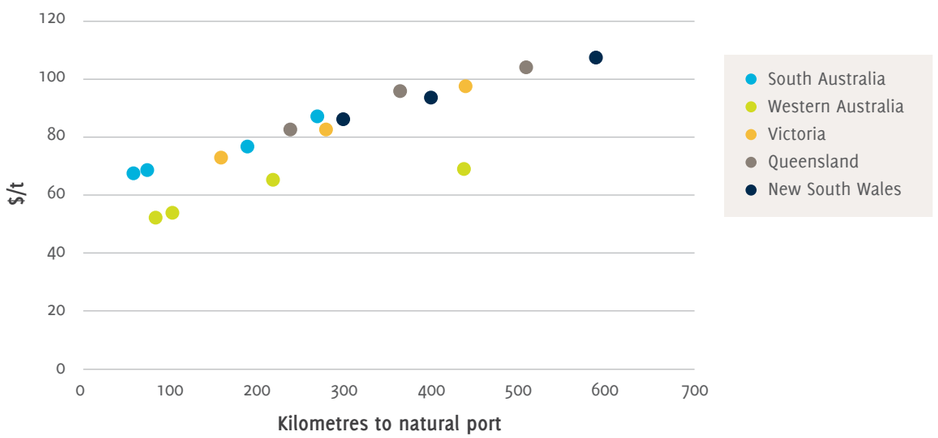


Figure 6 Plot of distance to port and cost of the supply chain for each of the examined supply chains (except Bunge, WA), grouped by state

Distance to port is a significant component of the total cost of the export supply chain but the cost of transport in Queensland, NSW and Vic is difficult to estimate.

Wheat production and export from Australia

Location of cropping

Over the past 10 years, the Australian grain crop has been produced on about 24 million hectares (ha), which is more than double the crop area in the early 1990s (ABARES, 2017).

Cropping areas in all states are dispersed along the coast making freight distances from the production areas to coastal ports relatively short for many growers (Figure 7). Distances from grain receival sites to port by road are generally shortest in SA, averaging about 144km and longest in NSW averaging about 418km[1]. Very short minimum distances to port occur in Vic, SA and WA where a good proportion of receival sites are located close to ports. This contrasts with Qld and NSW where the closest receival sites are 120km and 210km respectively from the closest port.

The expansion of the cropping area, as mentioned above, over the past 30 years has occurred at the same time as there has been a shift in rainfall zones southward and westward of about 100–400km (Figure 8). The shift in rainfall has seen crop yields grow at a faster rate in the medium and high rainfall zones compared with low rainfall areas. These effects combined seemed to have caused a shift in the location of cropping (Figure 9).

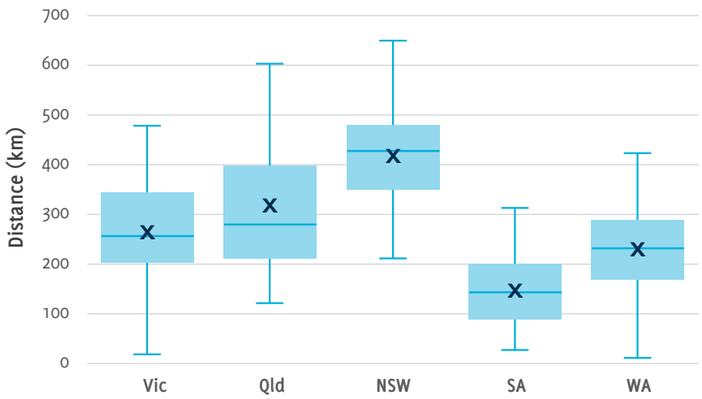


Figure 7 Distance by road from receival site in each state to the closest export port.

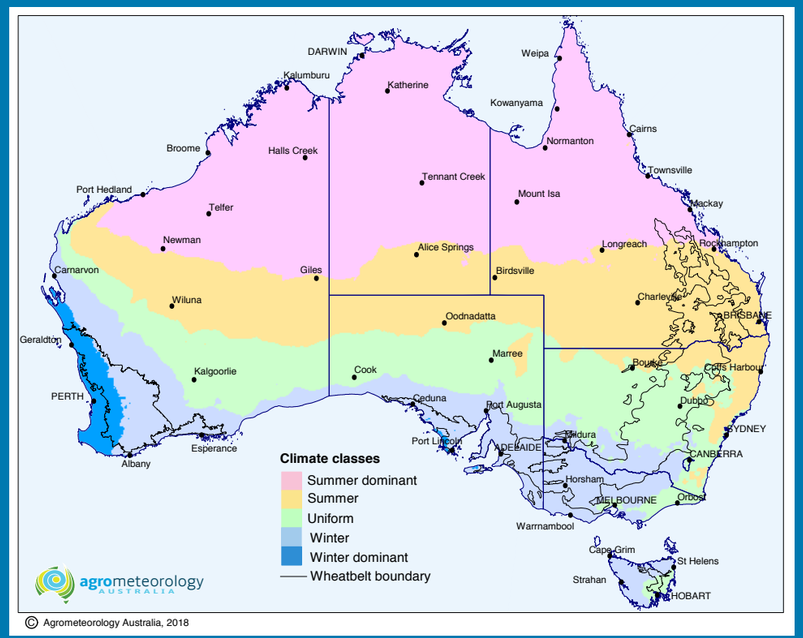
Note: Mean distance indicated by 'X', median distance indicated by horizontal line. The box indicates distances for 50 per cent of all values bounded by the 1st and 3rd quartiles. The full range of distances is indicated by the upper and lower bars.

Source: AEGIC and GTA

[1] Determined using Grain Trade Australia's location differential tables and calculating the shortest distance by road from the receival site in each state to the natural port (http://www.graintrade.org.au/location_differential_tables)

Australia seasonal rainfall zones

Based on rainfall data 1900–99



Australia seasonal rainfall zones

Based on rainfall data 2000–17

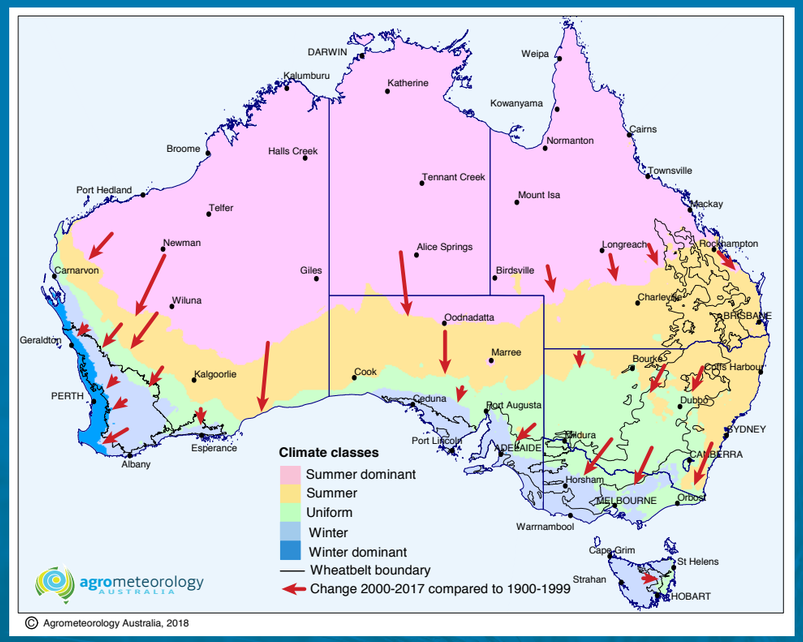


Figure 8 Shift in Australian rainfall zones from 20th century (top) to the first 17 years of the 21st century (above).

Source: Agrometerology Australia

In general, the amount of cropping activity in high rainfall zones closer to the coast is increasing while, at the same time, cropping activity has decreased in inland areas (Hughes, et al., 2017). Recent evidence from the Australian Bureau of Statistics (ABS) further indicates that the crop area is now declining in some regions, such as the northern parts of the Western Australian cropping zone and eastern parts of NSW (Hughes et al., 2017). If continued, these trends will have a substantial impact on Australian grain supply chains, both in terms of the location of major infrastructure and the profitability of transport routes of grain to port.

A strategic shift towards greater cropping intensity in higher rainfall zones closer to ports, combined with greater absolute increases in crop yields in these zones, will reduce supply chain costs and make Australian grain more internationally attractive. The spatially sobering corollary for grain export is the likelihood of increasingly divergent supply chain costs between low-yielding locations distant from port and high-yielding locations near to port. Where this is the case, the change in supply chain cost and hence commercial margins may be offset to some extent through corrections to land values.

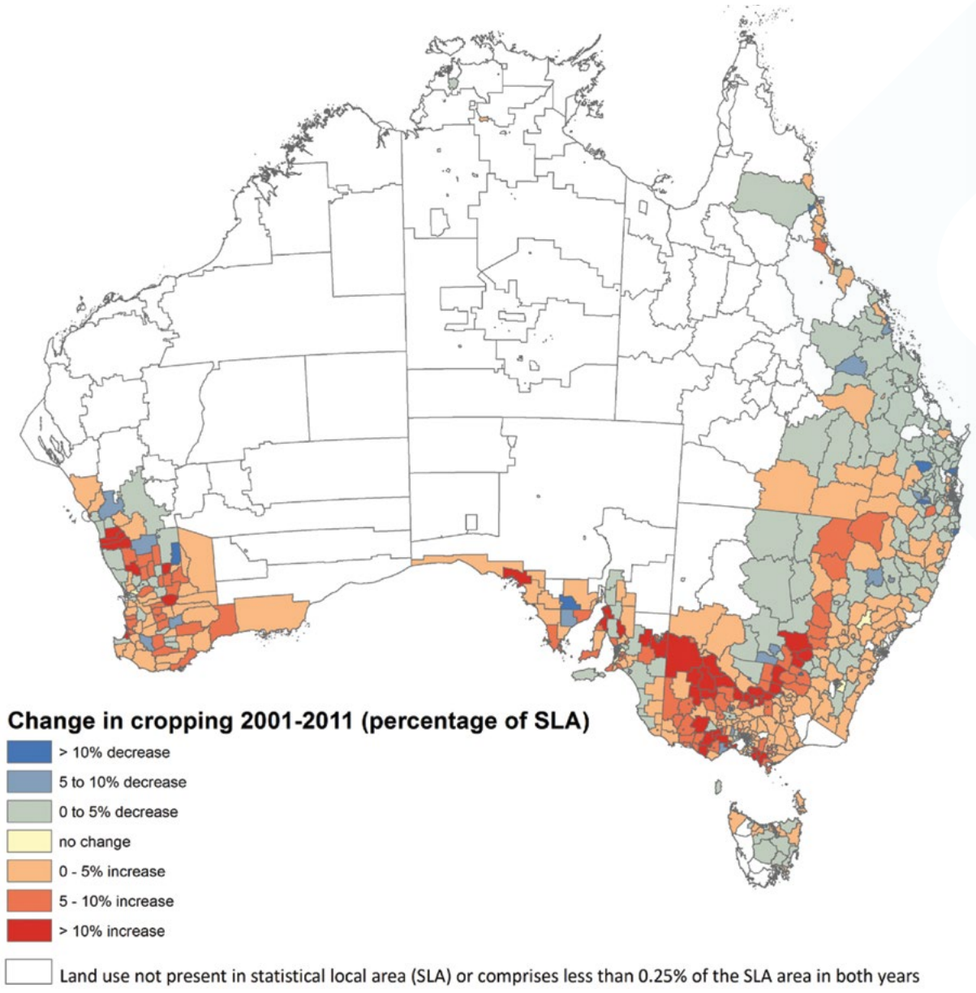


Figure 9 Percentage change in cropping area by Statistical Local Area (SLA) between 2000-01 and 2010–11

Source: Hughes et al. (2017)

Grain production and export

Australia produced a record grain and oilseed crop in 2016 of 63mmt (ABARES, 2017). The record harvest was due to a very large winter crop of nearly 60mmt, which was about 18mmt more than the winter crop five-year average from 2012 to 2016. Domestic consumption of grain in Australia has remained steady at about 14mmt with the surplus being exported principally to Asia (Figure 10).

The dominance of Asia as a destination for Australian grain exports has increased over the past 10 years, with a decline in grain exports to the Middle East. The countries of South-East Asia, China and other North Asian countries, together in 2016, received more than 75 per cent of all Australian grain exports, up from about 60 per cent in 2006 (Figure 11). This dominance is partly due to the increased demand for grain from Asia combined with the increased availability of cheap grain from Black Sea producers competing with Australian grain in the Middle East (see Kingwell et al., 2016a and 2016b).

Wheat dominates Australian grain exports, representing 60 per cent of the value of grain exported from Australia over the past 10 years (Figure 12). However, the proportional value of wheat exports has decreased from about 64 per cent of total exports in 2006-11 to about 54 per cent in 2012-2017. A rise in the proportional value of canola and pulse exports from a total of 17 per cent to 29 per cent has been the main counterbalancing shift in export grain values over this period. Europe, China and India have been the destinations for much of this increase.

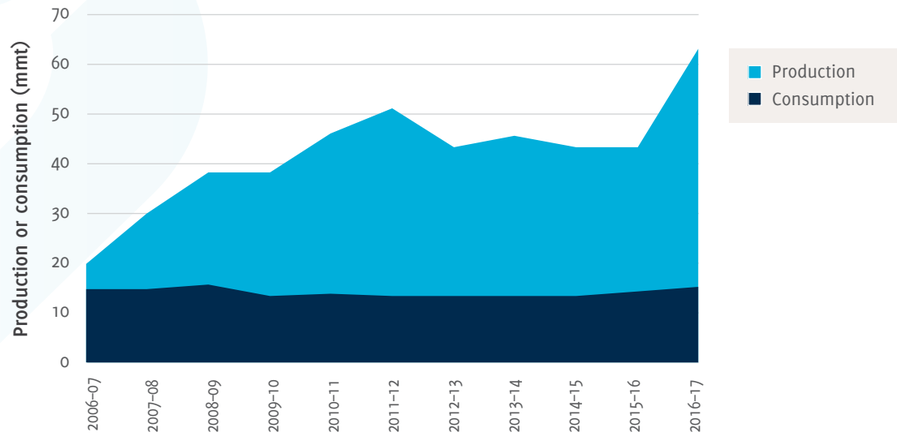


Figure 10 Australian grain and oilseed production and domestic consumption, 2006-07 to 2016–17

Source: USDA, 2017


Image courtesy: Ben White

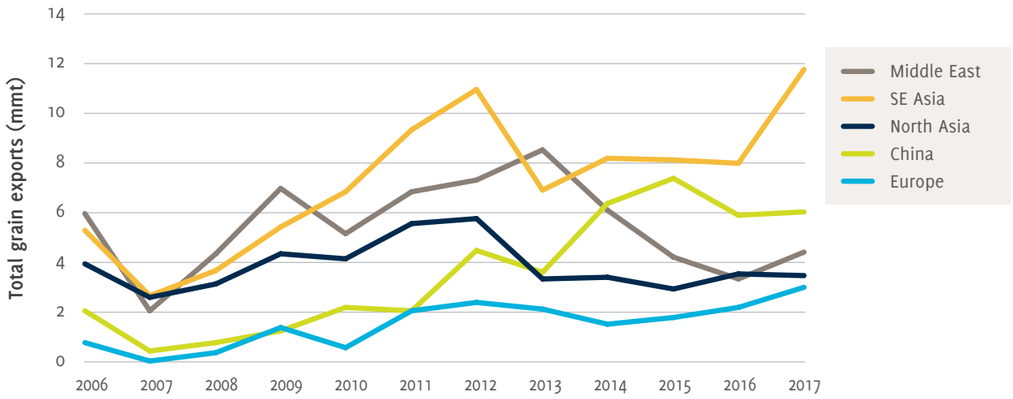


Figure 11 Exports of Australian grain by region, 2006–17

Source: ABS

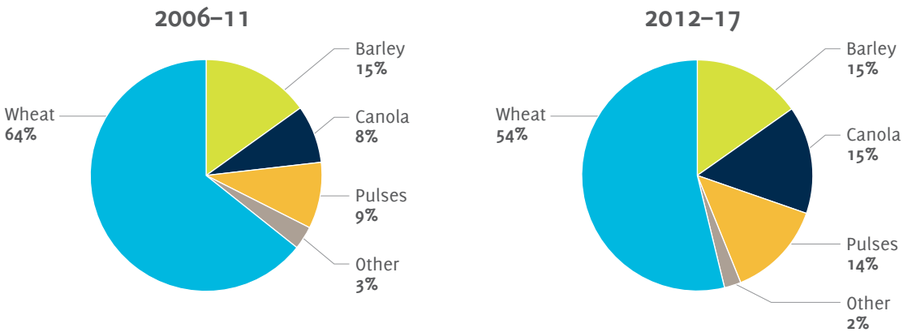


Figure 12 Shifts in the total proportional value of Australian grain, average of 2006–11 compare to average of 2012–17.

Source: ABS

Production and export of wheat

Countries of South-East Asia have been the most important destination for Australian wheat for at least the past 10 years and in 2017 these countries imported 60 per cent of Australian wheat, up from 44 per cent in 2006 (Figure 13 and Figure 14). Indeed, South-East Asian countries take little other than wheat from Australia, with wheat making up more than 95 per cent of the total volume of Australian grain exported to these countries in 2017.

WA is the largest wheat exporting state in Australia with about 6.9mmt of wheat exported annually from 2006 to 2017, which was about 50 per cent of total Australian wheat exports for this period (Figure 15). SA was the next largest wheat exporter with about 2.6mmt exported annually and contributing 20 per cent of total wheat exports.

Both WA and SA have relatively small domestic markets with a large proportion of their total production exported: 88 per cent and 72 per cent for WA and SA respectively from 2006-16. This contrasts with the other wheat producing states (NSW, Qld and Vic) where domestic consumption can often take more than 50 per cent of total production. Consequently, the variation in the volume of wheat exports from WA and SA is lower than for NSW, Qld and Vic.

Usually, domestic demand in NSW, Qld and Vic is satisfied before export demand is met. This amplifies the natural variation that occurs in total annual production in each state because, in low production years, wheat that may otherwise have been available for export goes to satisfying domestic demand. Hence, exports fall by a higher proportion than total production. This is illustrated by the coefficient of variation in wheat production and exports for states in Australia (Figure 16). Variation in production across states is somewhat similar, although variation in exports is substantially higher in NSW, Qld and Vic compared with WA. Variation in exports increases the risks and reduces returns from investments in supply chain infrastructure.

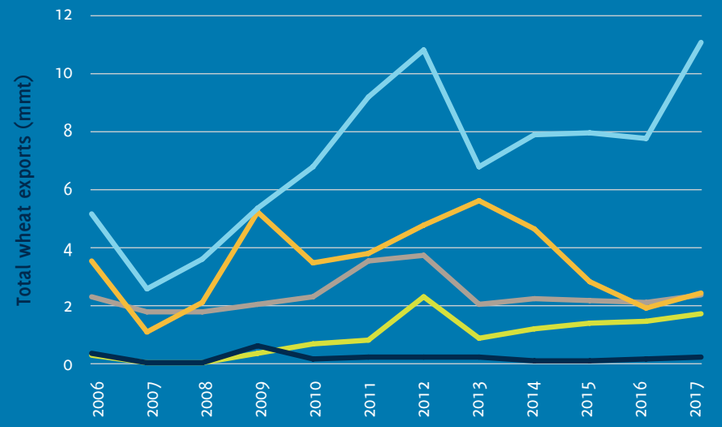


Figure 13 Volume of Australian wheat exports by region, 2006–17

Source: ABS

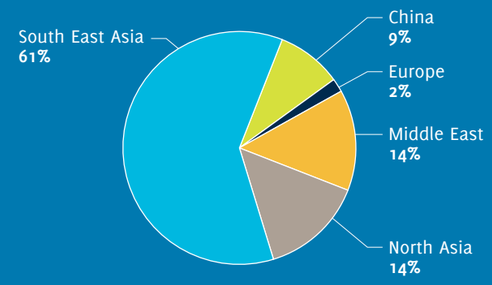


Figure 14 Distribution of the value of wheat exported from Australia by region, 2017

Source: ABS

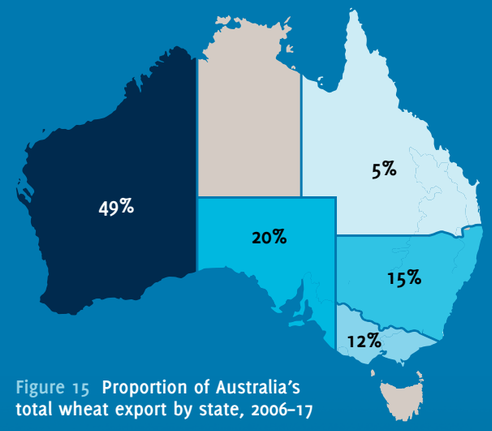


Figure 15 Proportion of Australia's total wheat export by state, 2006–17

Source: ABS

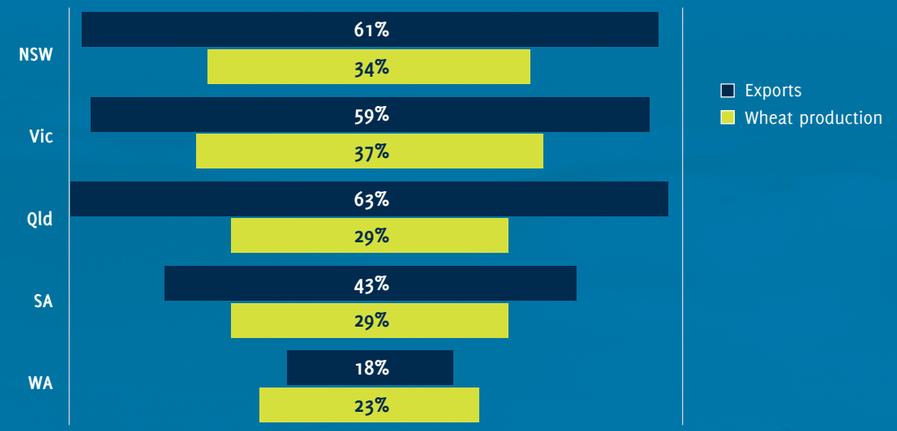


Figure 16 De-trended coefficient of variation in annual wheat production and exports from Australian states, 2006–16

Source: ABS and AEGIC

Export in containers

Export of wheat in containers is more heavily weighted towards South-East Asia than bulk wheat exports (Figure 17). Export of grain in containers has been steady at about 2–2.5mmt from 2008 to 2016 (ACCC, 2017b), with about 72 per cent exported to South-East Asia.

Victoria exports the most wheat in containers, accounting for about half of all containerised wheat exports from Australia since 2010 (Figure 18). Over this period, about 51 per cent of Victoria's total wheat exports have been in containers compared to 30 per cent and 37 per cent for Qld and NSW respectively and less than 4 per cent for WA and SA.

Export of wheat in bags and containers was deregulated in 2007 before the deregulation of bulk exports in 2008. WA and to a lesser extent SA saw a noticeable increase in export of containerised wheat during this period, which subsequently fell away, whereas container exports in Vic and NSW steadily built to their current levels of 1.2 and 0.8mmt respectively. Relatively low container prices during 2007 and 2008 (Productivity Commission, 2010) and, according to industry experts, a greater capacity to export wheat in containers from WA relative to Vic and NSW at the time, contributed to WA's initial spike.

Since 2010, a lower differential in the cost to export wheat in bulk versus containers in Vic and NSW compared with WA (partly due to the lower cost of bulk export supply chains in WA) favour the economics of container exports from these two states and have maintained the dominance of Vic and NSW in container export volumes. In addition, increases in containerised wheat exports from WA runs into limitations in the supply of containers, further increasing the cost of container exports from WA.

Packing wheat into containers.

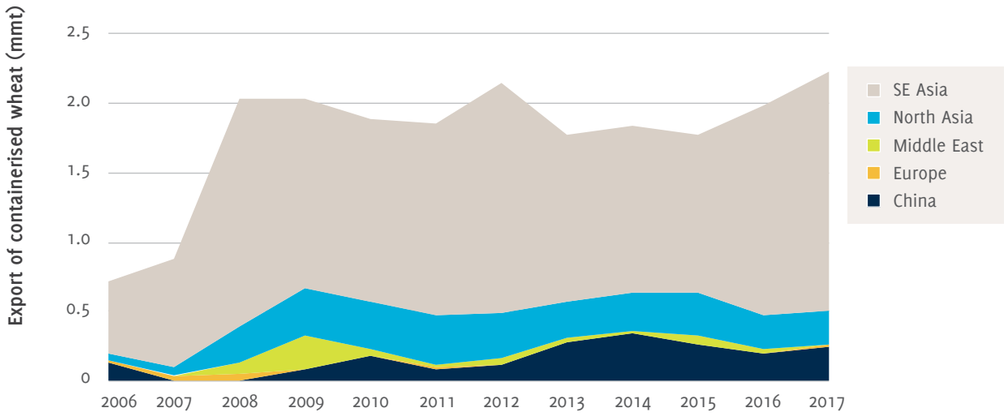


Figure 17 Volume of Australian wheat exports in containers by region, 2006–17

Source: ABS

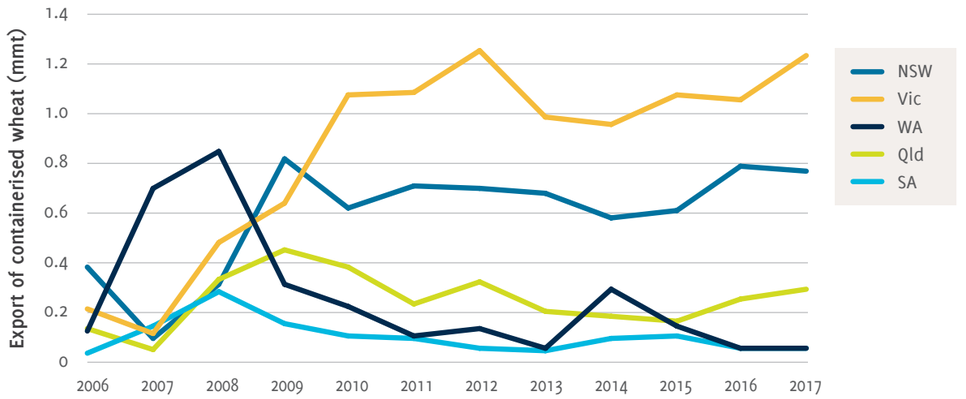


Figure 18 Export of containerised wheat by state, 2006–17

Source: ABS

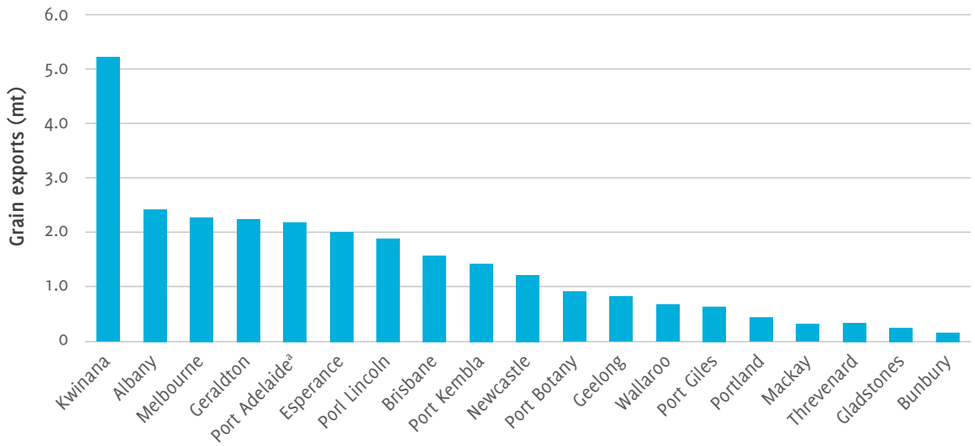


Figure 19 Total mass of grain exported from Australian ports annually, averaged from 2008–09 to 2016–17

Note: Where multiple service providers operate at a port (see Figure 22), figures indicate total mass of grain exported by all service providers (bulk and containers).

[a] Port Adelaide include both Inner Harbour and Outer Harbor

Source: Ports Australia

There are large differences in the total volumes of grain exported through Australian ports which will impact on the per tonne operating cost. Kwinana is by far the largest grain exporting terminal, averaging about 5mmt annually from 2008–09 to 2014–15 (Ports Australia, 2017), which was more than twice the next largest grain export port (Figure 19). About 73 per cent of the grain exported through Kwinana was wheat. After Kwinana, the next 10 largest ports annually export about 1–2mmt of grain each.

Structure of Australian grain handling and export systems

GTA listed nearly 200 ordinary trading company members for Australia in 2017. Of these, the top six companies exported about 80 per cent of wheat from Australia during 2013–14 to 2015–16. CBH is the largest, exporting about 30 per cent of Australia's wheat, followed by Glencore with a 17 per cent share (Figure 21). The export share of the remaining four companies — Cargill, GrainCorp, Emerald Grain and Plum Grove/Mitsui — was on average about 8–12 per cent each. Over this three-year period, the dominance of the top six exporters has declined slightly from 86 per cent down to 76 per cent.

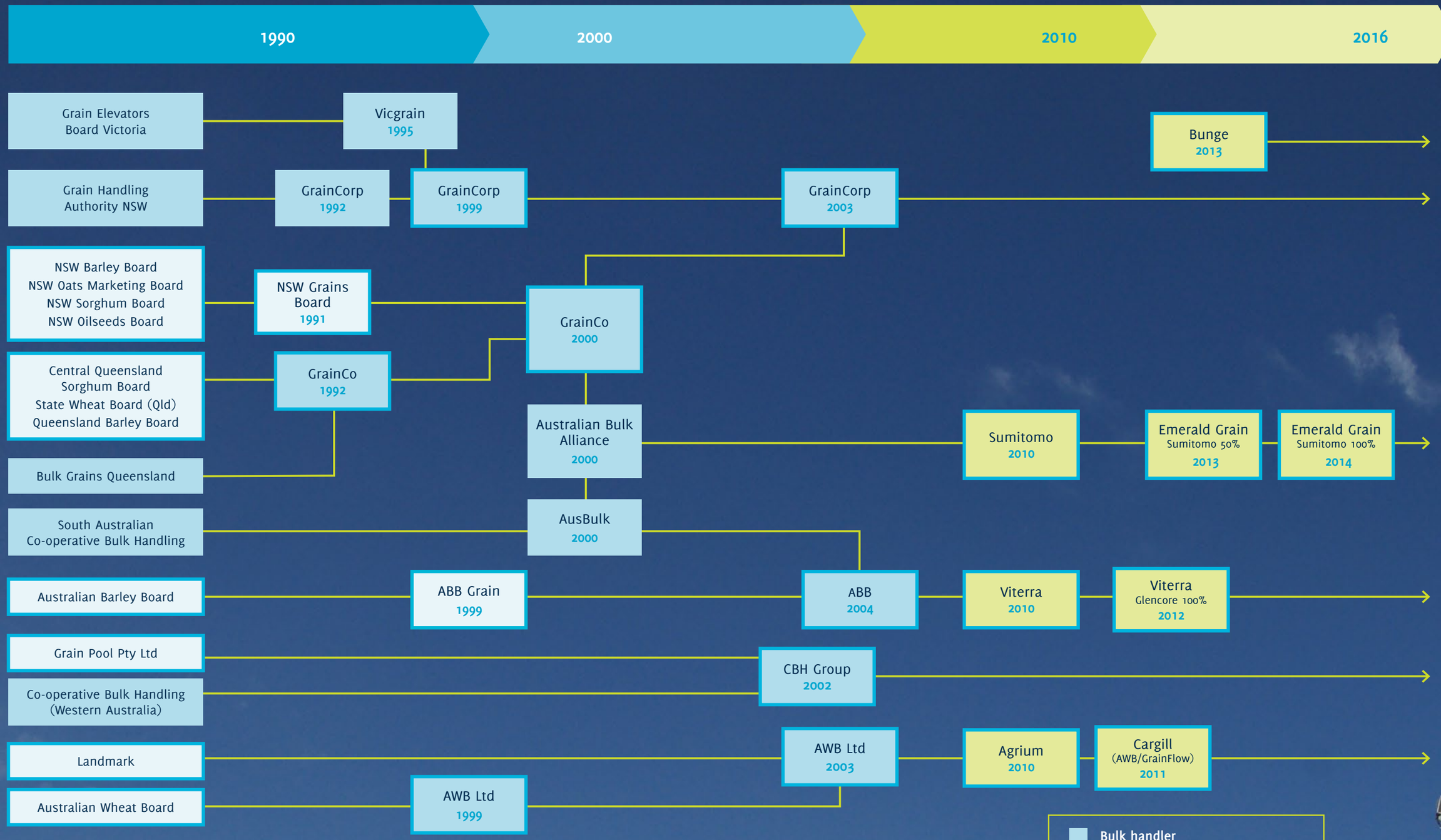


Figure 20 **Major companies involved with handling Australian grain and the changing ownership structures over the past 30 years (note: small or prospective new entrants, mentioned below, such as the COFCO partnership with Emerald Grain and Cargill through Quattro ports are not fully represented here).**

Source: Adapted from Kalisch Gordon et at (2016) and Productivity Commission (2010).

Image courtesy: Ben White

The dominant wheat exporters are also integrated marketing and grain handling companies. Plum Grove/Mitsui is the only top six wheat exporter that is not also a grain handler. Kalisch Gordon *et al*. (2016) shows the reorganisation of the structure and ownership of Australian supply chains over the past 30 years. The number of major grain handling companies has been reduced with the deregulation of wheat marketing in 2008 and they are all now integrated marketing and bulk handling companies and four of the remaining six (representing nearly 60 per cent of total wheat exports) are foreign-owned (Figure 20).

Regionally, the presence of the major integrated marketing and bulk handling companies is even more dominant than for Australia as a whole. The recent entrance of new companies with new port infrastructure into Australian grain supply since 2014 has only slightly challenged the position of the incumbents, particularly for CBH in WA and Viterra in SA.

The bulk handling division of CBH owns and controls almost all the warehouse storage and port loading infrastructure and a good proportion of the grain freight capacity, its trading division marketed 40 per cent of all grain exported in 2015–16. Its next biggest marketing competitor in WA is Glencore, which marketed about 17 per cent of the wheat exported from WA in 2015–16. The only bulk handling competitor for CBH is Bunge, which owns and controls a port loading terminal at Bunbury and two grain receival warehouse sites nearby. Bunge's port loading facilities currently have a capacity of 500,000t per year but have shipped about 150,000–270,000t of wheat annually since beginning operations in 2014. This represents less than 5 per cent of the grain exported through port terminals operated by CBH.

A similar situation occurs in SA with Viterra, the bulk handling arm of Glencore, controlling over 90 per cent of the state's port export capacity and the majority of its grain receival, storage and transport capacity. Glencore also markets about 36 per cent of all grain exported from SA, which is nearly three times its nearest competitor, CBH. Several new port loading facilities have been proposed for SA, but most of these are small or have not yet come to fruition. Patrick established a mobile port loading facility at the inner harbour of Port Adelaide in 2015 with the capacity to export about 250,000t per year. The facility has been used by Cargill to export about 200,000t of wheat from its GrainFlow storage and handling sites directly onto ships. The facility is now operated by the LINX Cargo Care Group and in response to the high 2016 production year exported about 400,000t of grain in 2016–17 (ACCC, 2017b), although the potential capacity of this facility indicated by the ACCC was about 1.5mmt. Semaphore similarly established a mobile grain loading facility in 2015 at Port Adelaide's inner harbour, providing capacity to load about 220,000t of grain, which was exceeded in 2016–17 with the export of more than 300,000t.

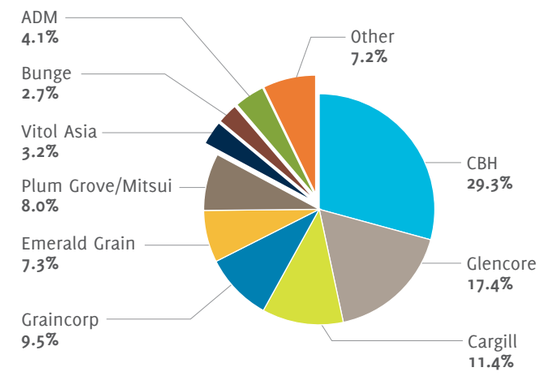


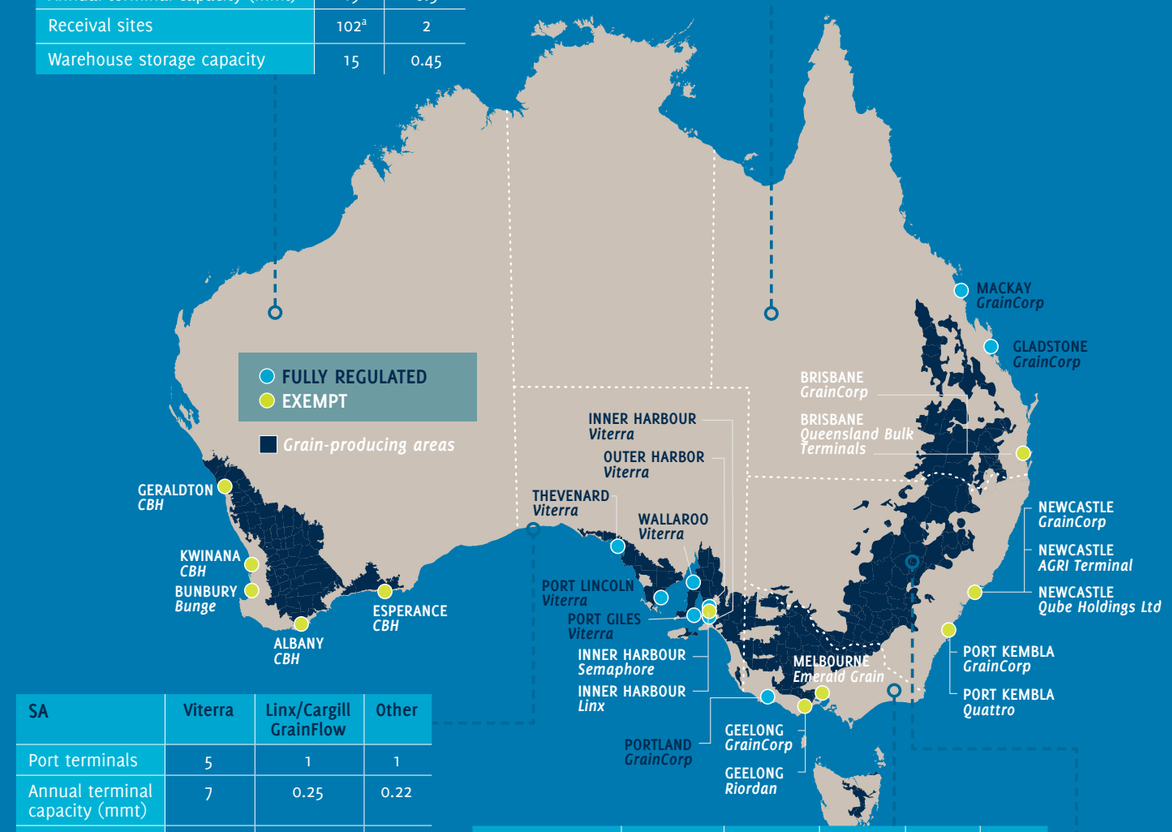
Figure 21 Main Australian wheat exporters, 2013–14 to 2015–16

Source: Australian Crop Forecasters (ACF)

Mobile ship loader located at Port Adelaide's Inner Harbour.

WA	CBH	Bunge
Port terminals	4	1
Annual terminal capacity (mmt)	19	0.5
Receival sites	102[a]	2
Warehouse storage capacity	15	0.45

Qld	GrainCorp	Wilmar/ Gavalon	Cargill GrainFlow	Other
Port terminals	3	1	0	0
Annual terminal capacity (mmt)	3.2	1	0	0
Receival sites	23[b]	0	4	5
Warehouse storage capacity	5	0	1	1



SA	Viterra	Linx/Cargill GrainFlow	Other
Port terminals	5	1	1
Annual terminal capacity (mmt)	7	0.25	0.22
Receival sites	103	4	3
Warehouse storage capacity	11	1	0.5

Vic	GrainCorp	Cargill GrainFlow	Emerald Grain	Viterra	Other
Port terminals	2	0	1	0	1
Annual terminal capacity (mmt)	5.2	0	2	0	0.15
Receival sites	44[b]	4	7	3	14
Warehouse storage capacity	4	3	2	1	2

Figure 22 Main grain export infrastructure in Australia 2018 showing ports that are fully regulated or exempt from parts 3–6 of the port terminal access code of conduct.

Notes: [a] Does not include an additional 76 surges sites.

[b] Does not include currently non-operational sites, some of which would be capable of reinstatement to grain receival and storage status if required.

Source: GTA, company websites, estimates from industry experts

NSW	GrainCorp	Cargill/Cofco/ Emerald Grain/ Quattro	Glencore/ CBH/AGRI	Other
Port terminals	2	1	1	1
Annual terminal capacity (mmt)	6.2	2.5	1.5	1
Receival sites	91[b]	11	2	40
Warehouse storage capacity	10	4	2	45

Bunge's storage and port loading facilities in Bunbury, Western Australia.

Construction of a new port facility at Lucky Bay on the Eyre Peninsula began in 2018 and will create alternative export capacity to Viterra's facility at Port Lincoln. The consortium behind this new facility plans to transhipping grain in small vessels from the port to larger vessels in the Gulf St Vincent. Grain will then be transferred to the larger vessels for export.

Similarly, the establishment of a new multi-user port on SA's Eyre Peninsula at Cape Hardy has been proposed and if it proceeds will create additional export capacity. The proposal relies on the viability of Iron Road Limited's Central Eyre Iron Project, involves multiple partners including Emerald Grain and a newly established small farmer cooperative, the Eyre Peninsula Co-operative Bulk Handling. It is not clear yet whether the facility is likely to be established and begin operating.

Ownership and control of grain export infrastructure is more diverse in Vic and NSW, where substantial new port facilities have been established and are operating, but grain handling is still dominated by GrainCorp. In these states, GrainCorp controls about 50–70 per cent of the port and warehouse storage capacity and is also the largest marketer of grain. In 2015–16 GrainCorp marketed and exported about 20 per cent of the grain from NSW and about 40 per cent from Vic. GrainCorp controls nearly all the port capacity for bulk grain export in Qld.

The Newcastle Agri Terminal (NAT) is located at the Port of Newcastle's Carrington terminal and was the first major grain port development in NSW since the early 1990s. Small amounts of grain were shipped through the facility in 2014, and this has increased to more than 1mmt in 2017. Glencore and CBH are two of the major owners in the port terminal, which currently also includes Riverina stock millers as well as the management team (CTC Terminals). NAT has about half the export capacity of GrainCorp's port terminal in Carrington.

Quattro's new grain terminal at Port Kembla is a significant new addition to the grain export infrastructure in NSW. The port has an annual loading capacity of 2.5mmt. The principal mode of grain intake for the terminal is rail and, while it accepts grain from all exporters, its main clients are its partners: Cargill, COFCO and Emerald Grain. Over the past three years, about 2.9mmt of grain has been exported through this port compared with 3.8mmt at GrainCorp's competitor facility at Port Kembla.

As shown in Figure 22, there are many grain accumulators competing against the main integrated marketing and grain handling companies on the east coast. Their presence increases bid pressure on farmers' grain, and when combined with the east coast's large domestic market, supply chains are more complex and less solely focused on delivery to port when compared to supply chains in WA or SA. Grain marketing and use of supply chain infrastructure on the east coast has a far greater focus on the domestic market particularly when compared against WA with its main focus on export markets and therefore delivery to port. Supply chains in SA similarly has a strong focus on export markets and delivery to port, although when production on the east coast is very low, such as in 2018, grain can be diverted from SA to service the domestic markets. This grain is often transported by road and rail bypassing the SA ports. This contrasts with WA where grain still passes through export ports even when bound for the east coast domestic market. The situation is further complicated on the east cost by the large volume of containers flowing into eastern Australia, attractive back-loading rates make export of grain in containers more commercially feasible on the east coast (see Figure 18).

Regulation of grain exports

Deregulation of wheat marketing in 2008 with the dismantling of the Australian Wheat Board's single desk allowed new companies to export wheat in bulk from Australia. New entrants, however, lacked the infrastructure to accumulate and export wheat, which was mostly owned and controlled by the existing bulk handling companies operating under the single desk. New marketing entrants were therefore concerned that the incumbent infrastructure owners, who now also began exporting wheat, would restrict access to their infrastructure, particularly port terminal capacity, to the detriment of these new entrants. A mandatory access test was introduced through the *Wheat Export Marketing Act* in 2008 to regulate access to port terminals.

Provision was made for the access test to lapse following recommendations of the Productivity Commission, which reviewed the Act in 2010 (Productivity Commission, 2010). The Commission found that the test assisted by making access easier, timelier and less costly than it otherwise would have been but also predicted that these benefits would diminish over time, leaving only the costs of regulation. They recommended that the Act in its entirety be removed and to allow wheat exports to revert to regulation using general competition law in Australia (Part IIIA of the *Competition and Consumer Act 2010* (Cwlth)). It also recommended that a voluntary code of conduct be agreed within the industry and that all grain export terminals should comply with continuous disclosure rules and publication of an agreed set of information metrics. After further inquiry and review (see DAWR, 2014), the *Wheat Export Marketing Act* was replaced with a mandatory code of conduct, the *Port Terminal Access (Bulk Wheat) Code of Conduct*, in September 2014 (Table 1).

The introduction of the mandatory code in 2014 has slowed the normalisation of wheat export regulation in Australia and is currently being reviewed to assess the necessity for its continuance (DAWR, 2018a). Exemptions to the significant sections of the mandatory code (parts 3–6) have already been granted by the ACCC and the Federal Minister of Agriculture. At the time the Code was being reviewed in 2018, most port terminals had received exemptions. Only those operated by Viterra in SA as well as three ports operated by GrainCorp remained fully regulated (see Figure 22). It appears unlikely that there will be major changes to the Code over the next two years. DAWR (2018a) state in the release of their interim findings from the review that, despite the range of views, no strong evidence or arguments had been put forward indicating the need for substantive amendment of the Code, its operation or coverage.

Regulation of wheat exports has been necessary to ameliorate equity and competition concerns from growers and new exporters while transitioning out of the single desk, but has imposed additional costs, reduced flexibility and caused some confusion among customers for Australia's wheat (see Box 1 for an explanation from Viterra's standpoint). The direct costs of complying with the former access test were estimated at between $500,000 and $700,000 per operator per year (DAWR, 2014). The mandatory code at its introduction was estimated to impose a lower direct cost of $360,000 per year for operators subject to the full provision of the Code and only $20,000 per year for exempt operators.

In its interim report on the review of the mandatory code, the Wheat Port Code Review Taskforce confirmed that: '*Parts 3 to 6 of the code impose direct costs and reduce operational efficiency at non-exempt terminals. This has had negative effects on both PTSPs and exporters that have not been able to execute at short notice.*' (DAWR, 2018a). It is in the grain industry's general interest to reach agreement to enable the move to a voluntary code under general competition law, allowing for sufficient transparency and monitoring. This will enable Australian supply chains to develop the flexibility required to meet future challenges from increasingly competitive low-cost wheat exporters in the Black Sea region and Argentina.

Table 1 Summary of the main parts of the *Port Terminal Access (Bulk Wheat) Code of Conduct* (DAWR, 2018a)

Parts 1 and 2 — disclosure rules
• Deal with exporters in good faith. • Publish a daily statement about ships due to load at the port (shipping stem). • Publish standard information about how they allocate capacity and manage demand for their services (port loading protocol). • Publish standard terms and reference prices available to all exporters.
Parts 3–6 — further obligations
• Allocate available port terminal capacity through a mechanism that applies equally to all exporters (capacity allocation system approved by ACCC). • Have an access agreement in place when providing services. • Publish certain information on their websites, such as the amount of capacity available on a weekly and annual basis, performance indicators and grain stocks at each port terminal. • Undertake a process for amendments to port loading protocols, including the requirement to consult. • Comply with dispute resolution processes (including mediation and arbitration).

BOX 1

Wheat export regulation in South Australia: the view from an operator of ports still subject to the mandatory access code

All major port terminal service providers in Australia currently allocate capacity through long-term agreement. However, there are differences in the level of regulatory scrutiny that service providers are subject to, depending on whether an exception to the *Port Terminal Access (Bulk Wheat) Code of Conduct* has been applied. Major differences relate to:

- the number of years forward that capacity can be sold;
- the tonnages that must be reserved for 'short-term' applications;
- restrictions on the amount of demand from a client in a particular period or at a particular port;
- the ability to respond to individual clients' requirements;
- the degree of flexibility provided to be able to react to market conditions at any given time; and
- the ability to adjust the capacity allocation method in a timely manner.

In addition, the application of the Code through the regulator results in reduced flexibility, an increase in costs and the loss of demand compared with ports that are less heavily regulated.

For example, delays in moving port allocation capacity from an auction system to long-term agreements in SA imposed a significant resource and cost burden on the industry.

Allocating port terminal capacity through auction was producing outcomes that were both undesirable and unsustainable.

Growers, exporters and Viterra called for a new system that would provide the industry with greater certainty, remove the distorting effects of the auction system and align more closely to that being offered through other port terminal service providers elsewhere in Australia.

Viterra proposed a long-term capacity allocation system with reserves being set aside for allocation on a short-term basis. This would be effected through long-term agreements with customers and an amount of short-term capacity available on a first-in, first-serve basis. It took over 18 months for the regulator to approve the new system. During this period, exporters were required to use an auction system that they considered to be costly and promoted both uncertainty and inefficiencies.

At the same time, long-term agreements were introduced in WA and other states on the east coast where port terminal operators had obtained (or would obtain) exemptions. As a result, some exporters that may otherwise have committed to exporting grain from SA entered into long-term agreements to export grain from port terminals in other states or from other origins.

The lengthy period to approve the new system involved a high degree of regulatory scrutiny. This resulted in a further dilution of the long-term capacity offering when compared to other states. Additional uncertainty arose due to the ACCC reserving the right to issue an objection notice against the new allocation system within the first year of its operation.

Allocating port terminal capacity through auction was producing outcomes that were both undesirable and unsustainable.

Grain storage

On-farm storage

Over the past two decades, the amount of grain stored on-farm and the rationale for that storage have changed (Kingwell, 2017). Farms have become more crop dominant, often with greater input intensity, especially in favourable years.

In many locations, the portfolio of crops and varieties has increased and supplementary grain feeding of animals is commonplace. These trends increase the need for additional farm storage for seed and for grain feeding. Furthermore, improved marketing options have encouraged many farmers to invest in more on-farm storage to facilitate grain marketing.

Industry experts estimate that over the past five years the amount of grain stored in good-quality steel silos in NSW, Qld and Vic has doubled. Significant amounts of grain have moved from temporary, or poor quality, silo and shed storage into higher quality facilities that can be gas-sealed and fumigated. More than 70 per cent of an average harvest can now be placed in permanent farm storage in northern NSW and Qld (Watson and Watson, 2017). Farm storage in SA and WA is at a lower level than in these other states but continues to grow, albeit at a slower pace. About 240,000t of permanent storage have been added annually in WA over the past few years and more than 20 per cent of an average harvest can be stored on-farm in either permanent or short-term storage (e.g. grain bags). These trends, particularly that towards increasing high-quality storage on farms, is supported by GRDC's 2017 grower survey that indicates up to 18mmt can be stored in sealed storage in 2017 (Watson and Watson, 2017).

Growers in eastern Australia have diversified marketing choices for their grain and are incentivised to invest in farm storage. The likelihood of persistent drought in eastern Australia gives mixed-enterprise farmers strong incentive to store grain on-farm to maintain the condition of their animals and to facilitate retention of a core breeding flock or herd during drought. Grain-only farmers have incentive to store grain on-farm to capitalise on a spike in grain prices when droughts occur. Additional farm storage also facilitates harvest logistics.

In contrast to eastern Australia, in SA and WA there is less rationale for growers to invest in farm storage (Watson and Watson, 2017). As pointed out by the ACCC (2017b), the benefits to exporters of operating within a network create a disincentive for growers to invest in farm storage. This is particularly the case in WA due to CBH's cooperative structure and the magnitude of its rebates, especially in recent years, offered to growers who use the CBH storage and handling network.

Other factors that incentivise growers to deliver into warehouse systems include the transfer of the risk from the grower to the grain storage service provider regarding grain hygiene, grain classification and ownership transfer of the grain. Major grain handlers, like CBH, generally use the same fumigants available to farmers although if required they can use grain insect control options not available to farmers that improve the management of grain hygiene. They also have sophisticated internet-based transaction systems that facilitate easy, secure and rapid commercial transactions of grain.

Finally, stewardship of grain quality is an important consideration for the Australian industry as the range of grain storage options and pathways to markets increase. The greater opportunities to market grain comes with obligations to safeguard Australia's reputation as a reliable origin for safe, high-quality grain. The Australian grain industry needs to consider how to best ensure stewardship obligations are understood, accepted and maintained throughout the industry.

Large arrays of good quality steel silos for grain storage is becoming an increasingly common site on Australian farms.

Industry experts estimate that over the past five years the amount of grain stored in good-quality steel silos in NSW, Qld and Vic has doubled.

Image courtesy: Ben White

Cost of farm storage

Table 2 shows that the cost of farm storage varies according to the type of storage, with large flat-bottom silos being the cheapest at $13.6/t per annum. Compared to the costs of warehouse storage offered by the major service providers, on-farm storage is often more expensive (Table 3). Silo or harvest bags, for example, have relatively high inload, outload and monitoring costs per tonne. Conversely, for very large operations, farm storage may offer cost advantages against several commercial warehouse service providers.

Further consideration is the level of service provision. Table 3 lists warehouse storage charges for the standard services noting that each service provider has different specified standard services. In some cases, extra fees apply for service outside of the standard offerings (e.g. outside of standard operating hours or outturn to third parties). Growers may be motivated to keep part or all of their grain on-farm to avoid extra fees and maintain their operating flexibility.

Finally new, high-quality storage options and contracting services are being developed that may reduce the cost of grain storage on-farm in the future.

Table 2 Costs of different types of farm storage, 2017–18

Item		Small cone bottom	Large cone bottom	Small flat bottom	Large flat bottom	Harvest bags
On-farm storage (3 months)	**$/t**	**19.5**	**16.2**	**17.3**	**13.6**	**27.2**
Bin capacity	**t**	**75**	**200**	**500**	**3000**	**250**
Variable costs (assuming one turn per year)						
Repairs and maintenance						
Auger (apportioned per bin)	$	7	18	46	279	375
Bin	$	140	224	378	630	0
Handling						
Preparation and hygiene	$	40	60	159	239	80
Aeration	$	20	40	200	1200	0
Inload cost	$	25	66	166	995	83
Outload cost	$	17	44	111	663	166
Monitoring and managing cost	$	119	119	239	239	318
Insect management	$	23	60	150	900	50
Cost of bags	$	–	–	–	–	875
Shrinkage (spilt/lost) grain	$	188	500	1250	7500	3125
Total variable cost	**$**	**578**	**1132**	**2699**	**12,645**	**5072**
Total variable cost	**$/t**	**7.7**	**5.7**	**5.4**	**4.2**	**20.3**
Annualised fixed costs						
Apportioned depreciation of auger/bag loader	$/y	24	65	163	977	525
Depreciation of bin	$/y	364	1024	3060	14,280	875
Opportunity cost of auger or bag loader	$/y	23	60	151	907	244
Opportunity cost of bin	$/y	473	960	2588	12,075	88
Total fixed cost	**$**	**884**	**2110**	**5961**	**28,239**	**1731**
Total fixed cost	**$/t**	**11.8**	**10.5**	**11.9**	**9.4**	**6.9**

New, innovative grain storage systems, such as this small bunker style farm storage system are being developed for farm storage of grain.

Cost of receival and warehouse storage

Ongoing rationalisation of warehouse storage networks by major grain handlers designed to concentrate storage of grain into fewer, more efficient sites has been a theme of Australia's storage and handling system over the past five years. In 2014 there were 623 receival sites in Australia (Stretch *et al.*, 2014). This number declined to 536 sites in 2017 (see Table 4). Additionally, many sites only open in large harvest years. For example, in SA 80 per cent of the grain was received by only about 30 sites in 2016. In WA, the number of CBH receival sites open for harvest has declined steadily each year from 170 sites in 2014 to 123 sites in 2018. Fewer than 90 sites usually receive about 90 per cent of grain delivered to CBH. As well as fewer sites opening, CBH plans to reduce the total number of sites it operates. In early 2016, CBH announced its intention to reduce its network to 100 sites. Over the next decade, 102 of CBH's sites will attract no further investment and are planned to be phased out as their useful life comes to an end.

The situation in eastern Australia is more diverse than in WA or SA. GrainCorp announced the restructure of its receival network in 2014 with the intention to gradually move to operating only 100 receival sites. In 2017 it opened 158 sites.

In comparison smaller grain handlers (Cargill GrainFlow or Emerald Grain) or standalone grain storage enterprises operated about 90 sites. Combined with the rapid move to on-farm storage in eastern Australia, GrainCorp now receives less than 50 per cent of the harvest, and this proportion continues to decline each year. Across the Australian network of receival sites, 227 are classified as primary sites responsible for accommodating the bulk of the Australian grain receivals.

Despite the closure of sites, the total capacity to store grain has increased across Australia. This has been partly due to an increase in on-farm storage in all states, but particularly in NSW, Vic and Qld, and an increase in warehouse storage capacity in SA and WA. Since 2013 Viterra has built an additional 1.1mmt of storage capacity while CBH has added 2mmt of permanent storage capacity and 1mmt of temporary storage capacity. The extra storage has enabled the Australian grain industry to manage a record harvest in 2016–17 and to have the ability to store about 25 per cent more than an average harvest.

The charging structure varies substantially between warehouse storage providers (Figure 23). CBH does not charge growers or grain accumulators for storage of the new season's crop. GrainCorp and Cargill GrainFlow charge a flat monthly rate but do not charge growers for the first month of storage. Viterra charges discounted rates to both growers and accumulators for the first part of the season, which then increases towards the back half. Charges from all providers rise steeply in October for carryover grain going into the new season.

Table 3 Upcountry receival and storage fees for three months charged by the major providers of grain storage services, 2017–18[1]

		CBH	Viterra	Bunge	Cargill GrainFlow NSW/Vic/Qld	Cargill GrainFlow SA	GrainCorp	Emerald Grain
Receival at upcountry storage	$/t	10.80	12.90 –13.65[a]	10.80	9.50	9.75	7.40	12.30
Storage for three months[d]	$/t	0.00	3.65	0.00	4.07	3.09	3.97	4.95
Shrinkage, rate	%	0.50	0.60	0.50	0.70	0.60	0.70	0.70
Shrinkage and dust cost[c]	$/t	1.25	1.50	1.25	1.75	1.50	1.75	1.75
Outturn fee	$/t	7.50	2.95–3.40[b]	0.00	4.80	6.10–6.55[b]	6.66	2.10
Discounts[e]	$/t	0.00	0.60	0.00	0.00	0.00	0.00	0.00
Total cost	**$/t**	**19.55**	**20.26–21.47**	**12.05**	**19.29–21.06**	**20.86-21.31**	**20.67**	**21.10**

[1] Fees are listed for standard services provided by each provider. Specified standard services will vary with each provider and extra charges may apply. The names and purpose of the fee varies between service providers. The names we have used to identify the fees here may be different from the name used by the service provider: for example, the outturn fee is used in this table to indicate the storage and throughput fee for CBH.

[a] Receival fees for Viterra vary between Tier 1 ($12.90) or Tier 2 ($13.65) sites.

[b] Outturn fee varies between rail (lower figure) and road (higher figure).

[c] Based on a grain price of $250/t.

[d] CBH does not charge for storage until 1 October following harvest. For other providers of upcountry storage, the charges for three months storage have been estimated based on an assumption of who owns the grain for those three months, given there are different storage charges for growers and accumulators. The charges are calculated assuming that 45 per cent of grain delivered by growers to warehouse storage is sold to accumulators after the first month, 70 per cent after the second and 80 per cent after the third.

[e] Viterra provide a discount of $0.6/t to the fee charged to users of its export select service. We have not included rebates provided by CBH that do not provide a discount to the fee charged, but provide a return later to growers who use their services.

Table 4 Change in number[1] of major[2] providers' receival sites

Sate	Grain handler	Year 1998	2010	2017
NSW	**GrainCorp**[a]	265	173	91
	Cargill GrainFlow[b]	nd[c]	10	11
	Other	nd	nd	42
Vic	**GrainCorp**	257	73	44
	Emerald Grain	nd	4	7
	Cargill GrainFlow	nd	4	4
	Other	nd	nd	17
Qld	**GrainCorp**	87	36	23
	Cargill GrainFlow	nd	4	4
	Other	nd	nd	5
SA	**Glencore/Viterra/ABB**	116	114	103
	Cargill GrainFlow	nd	4	4
	Other	nd	nd	1
WA	**CBH**	200	197	178
	Bunge	nd	nd	2
Total		**925**	**619**	**536**

[1] The number of sites open each year may be less than the total number of sites provided depending on the size of the harvest, for example the figure for CBH in WA includes 76 surge sites that are only opened in large harvests.

[2] Receival sites provided by small companies are not included, particularly in NSW and Vic.

[a] The grain handler in bold font is the region's principal grain handler.

[b] The first listed entity for each handler is the current owner.

[c] nd — no reliable data

Source: Based on Productivity Commission (2010) and information from grain handler company websites.

About 45 per cent of grain delivered to warehouse storage is sold to accumulators after the first month, 70 per cent after the second and 80 per cent after the third. The differential storage charges for grain accumulators and growers have been applied at these ratios to estimate the storage cost for three months in Table 3 and Figure 24.

Total charges for upcountry grain receival and storage published by the major service providers in Australia have all increased in nominal terms over the past five years. Assuming three months' storage and ignoring charges for dust and shrinkage, the charge varies from about 2.6 per cent to 14.2 per cent (shrinkage and dust charges are ignored because the shrinkage rates have remained unchanged but the charge has varied simply because the grain price has changed). Taking inflation into account (about 7.4 per cent over this period), charges in real terms have decreased for Emerald Grain and CBH by about 4.4 per cent and 1.6 per cent respectively, increased for GrainCorp and Cargill GrainFlow by about 2.9 per cent and increased for Viterra by about 6.3 per cent (Figure 24).

The increases in charges for Viterra have been higher (8.2 per cent in real terms) for their Tier 2 sites with outturn by road (not shown in Figure 24), although it should be noted that in the Viterra network most grain is delivered to Tier 1 sites and is outturned by rail. Contributing to the increase in total fees charged by Viterra has been a reduction in the export select rebate of nearly 50 per cent. Viterra has stated that funds saved from reducing the rebate, which is usually paid directly to exporters, have been used to lower freight rates (see the section on ***South Australia*** on page 55), a component of the supply chain that is more visible to growers.

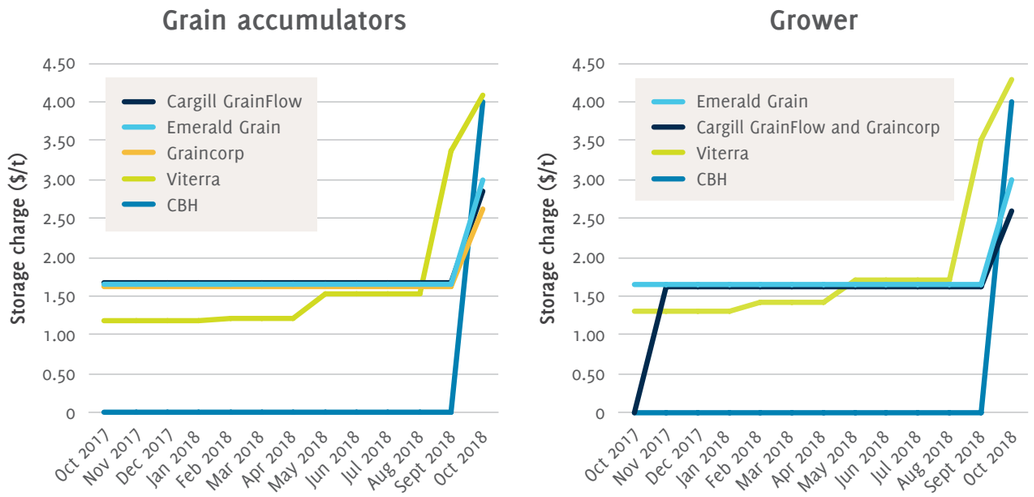


Figure 23 Monthly storage charges for wheat listed by major providers of warehouse storage

Note: In SA, Cargill GrainFlow storage charges for grain accumulators are the same as those listed by Viterra. Listed charges for Cargill GrainFlow for growers in SA are the same as those in NSW, Vic and Qld. Carryover charges for October 2018 are indicative only.

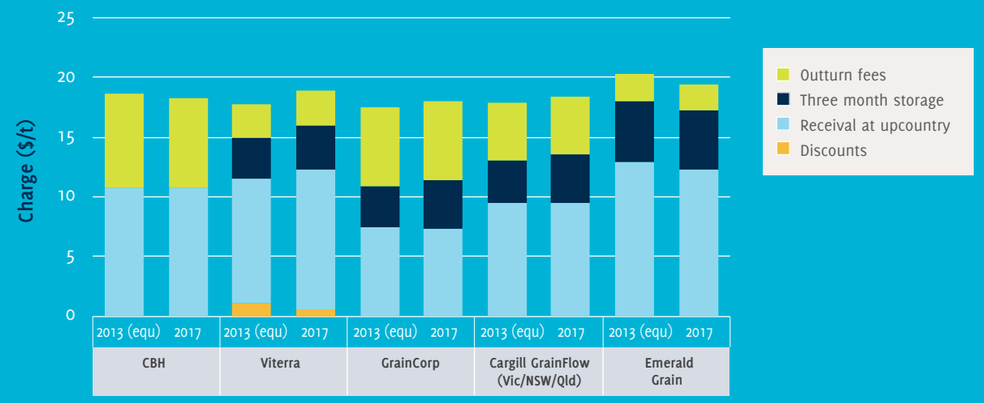


Figure 24 Upcountry and receival charges in 2013 (adjusted to 2017 equivalent prices based on changes in the Australian CPI) and in 2017–18 of the major providers of grain storage services

Note: In SA, charges are based on T1 sites and outturn by rail. The discounts provided by Viterra have been subtracted from the receival at upcountry charge. For CBH, the outturn fee is derived from the proportion of the export shipping fee that was allocated to the storage and throughput fee when this charge was created in 2017 (see Box 2). Cargill GrainFlow fees only relate to NSW, Vic and Qld. Three-month storage has been estimated using the method explained in Table 3.

BOX 2

CBH fee structure

CBH changed the structure of its fees in 2017 by introducing a storage and throughput fee. This fee arose from splitting the previous export shipping fee into a port terminal shipping fee and a storage and throughput fee. This allowed for the elements of outturn and storage that were previously embedded within the export shipping fee to become more explicit and accounted for under the upcountry storage and handling system. In Figure 24, we have split the export shipping fee charged in 2013 in the same proportion this charge was subsequently apportioned by CBH to derive a storage and throughput fee for 2013.

ABOVE: Unloading grain from rail wagons at the CBH grain terminal at Kwinana.

BELOW: Low cost overflow grain storage bunkers in NSW with earthen floor and mounds to retain the grain and old tyres securing the tarpaulins.

Financial performance indicators

Over many years CBH and GrainCorp have released detailed financial statements about their businesses. These statements reveal that, although the genesis of their separate businesses was in grain handling, their businesses have expanded and diversified into off-shore activities and have embraced grain marketing, grain trading and value-adding investments. By illustration, not widely known or appreciated, is the important and reliable contribution to GrainCorp's profits from its malt operations. More widely known are CBH investments in flour milling in Indonesia. All major suppliers of supply chain serices, CBH, GrainCorp and Viterra, have needed to offer their chain services through a challenging period of deregulation when a few sellers of Australian grain to overseas customers were replaced by over 20 sellers of Australian grain, some of whom were also making investments in supply chain infrastructure. All the while, these businesses have been buffeted by climate-induced production volatility and large swings in grain prices and currency movements.

CBH

Drawing on its published financial statements, some key things to note from its 2016–17 statements are:

- Storage, handling and freight costs per tonne, in real terms, are one-third lower than the average of costs from 2009 to 2011. Storage and handling costs are now as low as $5/t and freight is $11/t, respectively.
- Marketing and trading expenses on a per tonne traded basis have increased in real terms, relative to the average of costs from 2009 to 2011, but importantly, trading revenues have greatly increased, with much more grain being sold CFR (cost and freight), providing an opportunity for more value capture.
- Wages and salaries per tonne handled, in real terms, are 18 per cent lower than the average of costs from 2009 to 2011. In real terms, total expenditure on wages and salaries has increased by 60 per cent compared to the average cost of labour from 2009 to 2011. Until recently, when CBH embarked on some down-sizing, permanent staff numbers had remained around 1100 employees.
- Depreciation and amortisation have increased from $67m in 2008–09 to $357m in 2016–17, signalling increased renewal and additional investment in plant and equipment.

Drawing on Figure 25 and Figure 26, Storage and Handling, which is CBH's largest division, accounts for three-quarters of CBH's pre-tax profit and generates the largest profit margins of its business segments. Furthermore, due to CBH's cooperative structure, this division is tax-exempt, so this unit accounts for an even larger percentage of after-tax profit. All other divisions are subject to company taxation.

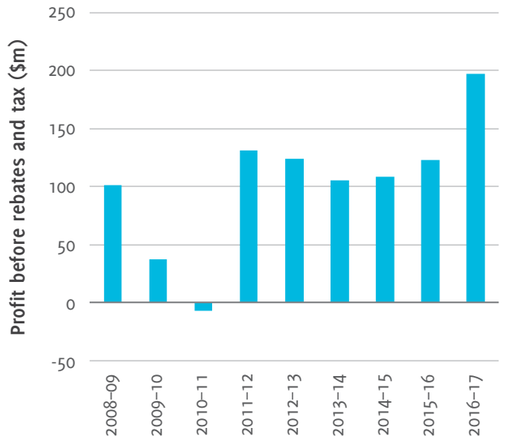


Figure 25 CBH profits before rebates and tax for Storage and Handling, 2008–09 to 2016–17

Source: CBH annual reports

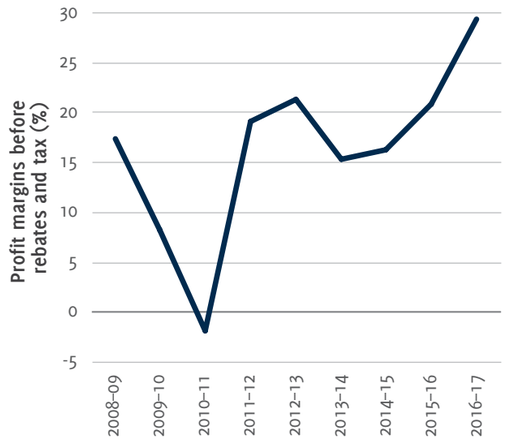
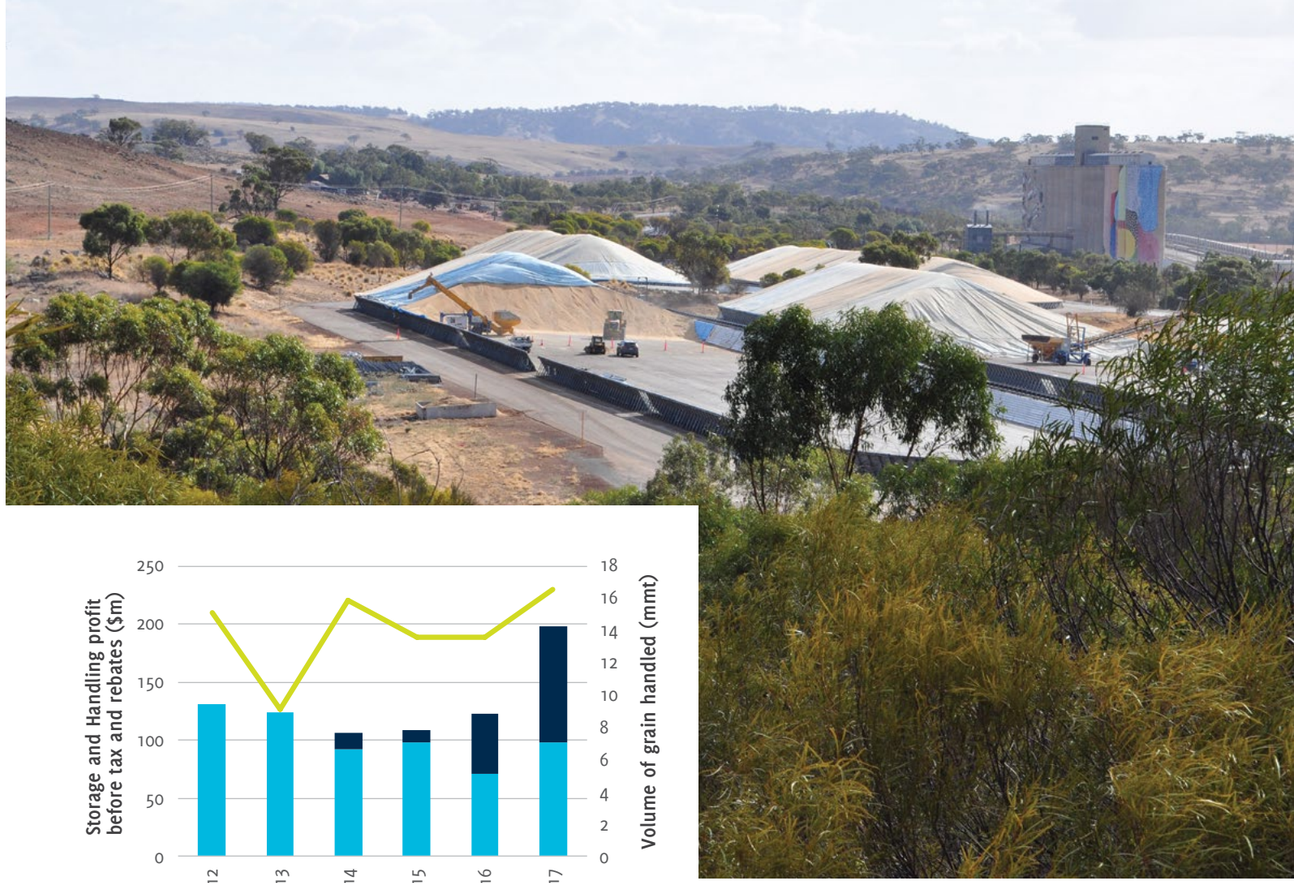


Figure 26 Percentage of CBH profit margins from Storage and Handling before rebates and tax

Source: CBH annual reports

Over the five years to September 2017, profit margins in Storage and Handling (before applying rebates) have ranged from 15 per cent to 29 per cent while grain receivals have ranged from 9mmt to almost 17mmt. CBH has distributed an increasing proportion of income as rebates to growers as shown in Figure 27.

Note that in 2016 there was a change in accounting treatment whereby rebates now align to the year of performance rather than recognised in the year after when claimed.



ABOVE: CBH grain receival site at Northam.

Figure 27 CBH Storage and Handling profit before tax and the volume of grain handled, 2011–12 to 2016–17

Source: CBH annual reports

Storage and handling is capital intensive with a property, plant and equipment asset base having a written down value of $1.6b and incurring around $80m per annum in depreciation expense. CBH has continued to reinvest at least its depreciation expense, which has led to CBH's storage and handling asset base being maintained around $1.4b. Due to the high fixed-cost nature of the business, it appears that delivered grain volumes need to be 6.5–7mmt to break even as demonstrated in the 2010–11 year.

Excluding the low volume years of 2010–11 and 2012–13, the storage, handling and logistics expenses per tonne received, as shown by the dark blue line in Figure 28, have declined only slightly since 2014–15 to be just under $41/t in 2016–17. Over the same period, revenues have declined from $50/t to $47/t.

CBH remains competitive against new entrants into grain storage and handling in WA. For example, Bunge has operated a grain terminal at Bunbury for three years yet has recorded a $1.4m loss in calendar 2016, bringing its total losses to $4.8m over its three years of operation in WA.

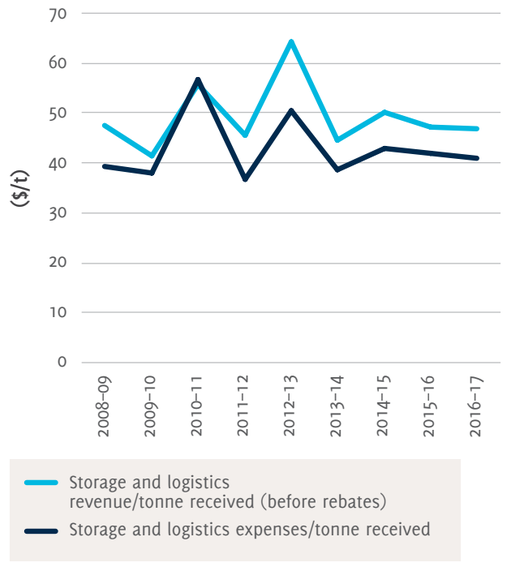


Figure 28 CBH storage and logistics revenue and expense, 2008–09 to 2016–17

Source: CBH annual reports

GrainCorp

GrainCorp's *Annual Report 2017* gives a brief history of the company, saying:

» *GrainCorp started in 1916 under the Grain Elevator Act and was administered as a branch of the New South Wales Government's Department of Agriculture. The Company led the development of Australia's first bulk grain handling system with the construction of 200 country elevators linked by rail to shipping terminals at Sydney and Newcastle. By October 1989, the Company had gone through several changes and was known as the Grain Handling Authority of NSW ('GHA'). At this time, the GHA was corporatised and became the NSW Grain Corporation. The NSW Grain Corporation was privatised in April 1992 and sold to the grain grower owned Prime Wheat Association that became GrainCorp. GrainCorp listed on the Australian Stock Exchange in 1998.*

GrainCorp has grown through acquisition and organic growth. GrainCorp acquired Victorian based Vicgrain in 2000, Queensland based Grainco in 2003, an international portfolio of malt businesses from United Malt Holdings in 2009, edible oils businesses Gardner Smith and Integro Foods in October 2012 and Cryer Malt, an Australasian distributor of craft brewing ingredients, in 2017. In 1996, GrainCorp was the first Australian bulk handler to trade grain in the Australian domestic market, and in 2008 commenced exporting wheat to international markets following the removal of the export single wheat desk. (p.16).

Given the nature of GrainCorp, it is no surprise that its storage, logistics and port services are the main source of its business profits in most years (see Figure 29). Not widely known is the important and reliable contribution to GrainCorp's profits from its malt operations.

GrainCorp is subject to a 30 per cent company tax rate and has a policy to pay out 40–60 per cent net profit after tax (NPAT) as dividends through the cycle.

Between 2008–09 and 2016–17, GrainCorp's Storage, Logistics and Ports Division was frequently the most profitable segment of the business, often generating pre-tax margins above 15 per cent (see Figure 30). The exception in that period was between 2013–14 and 2015–16 when the division was the worst-performing segment, delivering losses into the business. In 2016–17 when receivals rebounded strongly to 15mmt, profitability returned to the Storage, Handling and Ports Division. Profits from storage, handling and port services are volatile and are mostly a function of the size of the grain harvest in eastern Australia. By contrast, the profits generated by malt operations are relatively stable and moderate in size.

In its 2017 annual report, GrainCorp states:

» *"In August 2017, GrainCorp's Storage and Logistics and Marketing businesses were combined into a single 'Grains' business unit. For the majority of the 2017 financial year, Grains operated as two separate business units — Storage and Logistics and Marketing. To reflect the operations of the year, GrainCorp has continued to report the financial results for the two business units separately."* (p. 50).

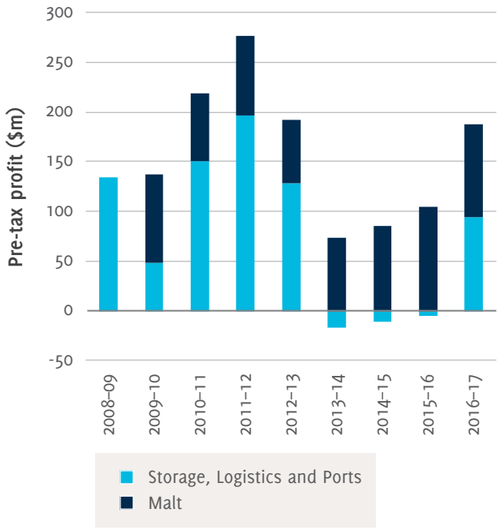


Figure 29 The pre-tax profits of GrainCorp's Storage, Logistics and Ports division and Malt division, 2008–09 to 2016–17

Source: GrainCorp annual reports

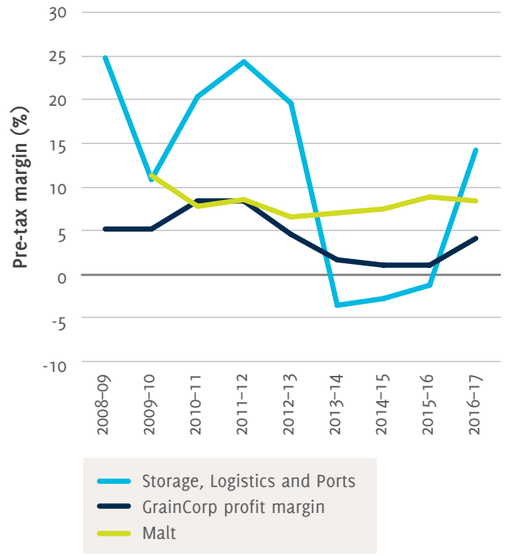


Figure 30 Percentage of GrainCorp pre-tax profit margins for its Storage, Logistics and Ports division and malt division, 2008–09 to 2016–17

Source: GrainCorp annual reports

It is of some concern, given the importance of grain handling, storage and ports to Australia's grain industry, that the business performance of the main companies providing these services is increasingly becoming opaque.

A likely implication is that in future years, the storage, handling, ports and marketing divisions will report as a single division, thereby detailed external financial analysis of the performance of each business component will be more difficult.

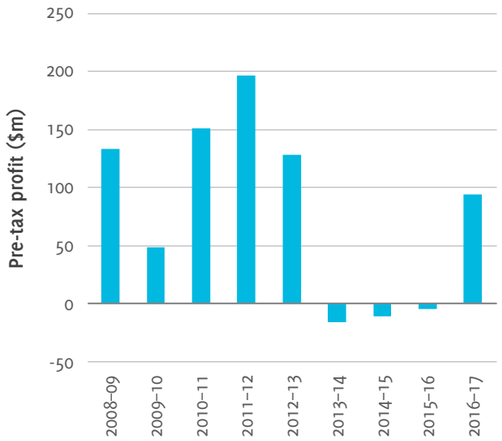


Figure 31 GrainCorp's key divisional pre-tax profits, 2008–09 to 2016–17

Source: GrainCorp annual reports

It is of some concern, given the importance of grain handling, storage and ports to Australia's grain industry, that the business performance of the main companies providing these services is increasingly becoming opaque. These are services whose costliness crucially affects farm profitability. Moreover, these businesses rely on infrastructure investments by governments, yet governments will have reduced insights about the profit drivers within these same businesses that press for government investment and action. As shown in Figure 31, the financial performances of the storage, logistics and ports division can vary greatly.

The deterioration in the Storage, Logistics and Ports Division's profitability over the three years from 2013–14 was largely due to lower receivals (see Figure 32). GrainCorp received 42 per cent of east coast production in 2014–15 and 2015–16. Furthermore, the division incurred large rail costs due to low utilisation of GrainCorp's fixed take-or-pay contracts with the rail operator as lower harvest volumes generated lower volumes for export. Consequently, the division has averaged a $10m loss over the past three years compared to an average $158m pre-tax profit in the three years prior, yet pre-tax profit rebounded strongly in 2016–17.

Figure 33 shows the revenue and expenses per tonne received. It highlights that revenues per tonne have plateaued around $45/t tonne since 2013–14 and expenses per tonne remain at similar levels, although in 2016–17 they declined to be under $40/t, leading to a rebound in pre-tax profit. Profits have contracted from an average $12/t received during the five-year period to 2012–13 to a loss of $2/t for the subsequent three years to 2015–16. In 2016–17 profit increased to $6/t.

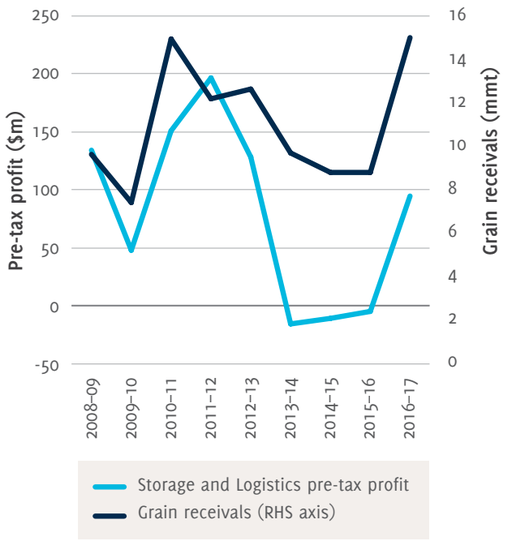


Figure 32 GrainCorp's Storage and Logistics pre-tax profit and grain receivals, 2008–09 to 2016–17

Source: GrainCorp annual reports

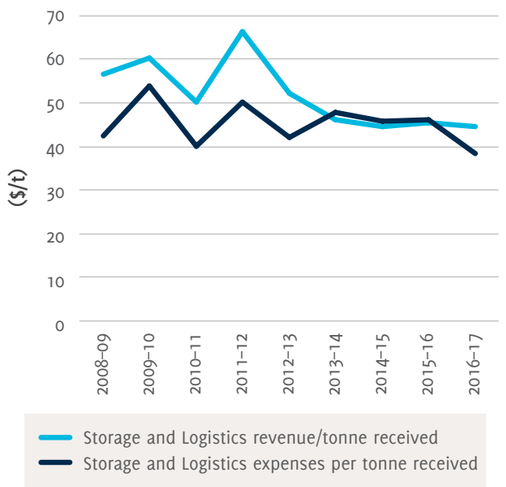


Figure 33 GrainCorp's Storage and Logistics expenses and revenue, 2008–09 to 2016–17

Source: GrainCorp annual reports

Part of the reason for improved profitability in 2016–17 was a more efficient use of GrainCorp's receival network. Its 2017 annual report notes:

» *"During harvest, Storage and Logistics operated approximately 160 silos with an average of 70,000mt receivals per site, a strong improvement in network efficiency compared to the previous year (~180 sites, ~40,000mt/site)."* (p. 9).

The significant turnaround in profitability in 2016–17 highlights the high fixed-cost base to storage, handling and ports and the importance of volume leverage through the infrastructure that generates around $56m per annum in depreciation. Furthermore, GrainCorp shares the rail infrastructure with other users and takes out fixed take-or-pay contracts, which become very expensive when volumes are not high. Furthermore, GrainCorp has stated in its 2017 annual report that there was a "*negative impact to earnings of approximately $20 million due to supply chain disruption.*" (p. 20). These disruptions were associated with an extended industrial dispute that affected GrainCorp's Victorian rail provider. The costs of rail charges are not disclosed in the financial statements of GrainCorp.

Trends in grain storage on farms

As farm businesses, if either mixed-enterprise or grain-only farms continue to increase in size, then investment in grain storage on-farm, especially in eastern Australia, will become increasingly commonplace. Given that the annualised fixed cost of large, high-quality on-farm storage represents nearly half its total cost, the decision to move to on-farm storage is hard to reverse once it has occurred, because a large part of the cost is committed upfront. In addition, larger farms with improved storage infrastructure and better-trained farm managers will see continual improvements in the cost and effectiveness of managing grain hygiene. Furthermore, new technologies such as distributed ledger technologies (Blockchain) should enable easier and more secure grain transactions directly from farms and outside of the traditional bulk handling systems.

Such a scenario raises strategic questions for the current dominant incumbents in commercial warehousing of grain. For instance, how does GrainCorp position itself to be a commercially attractive business over the next decade? How do grain traders gain visibility of grain stocks and grain quality when so much stored grain may be held in farm storage? Similarly, how do governments, farmer organisations and livestock businesses plan a response to drought if grain stock visibility is lacking?

The increase in farm storage, especially in eastern Australia, is likely to provide new business opportunities surrounding monitoring and control of insect pests in farm storage, and assessing and monitoring grain quality in those storages. Some farmers will be able to more highly segregate or identity-preserve their grain, and thereby derive price premiums or service new markets.

Freight

On average across Australia, about 50 per cent of grain transported from upcountry storage to port is moved on rail. The remaining 50 per cent is moved on road. Over the past four years, the average share of rail has remained mostly unchanged, despite closure of some rail lines.

The closure of two rail lines in SA's Mallee district saw about 180,000t of grain move from rail to road, although this was offset by operational efficiencies in other parts of the rail network, which saw a slight increase in the proportion of grain transported by rail. In effect, the overall modal share of grain transport to port in SA remains at about 50 per cent rail and 50 per cent road. The closure of Tier 3 lines in WA has seen the shift of more grain onto road transport while the upgrade of lines in NSW and Vic has seen some grain return to rail.

Rail

The rail systems linking upcountry sites to port are a combination of higher traffic, higher capacity lines (23t axle loads, longer sidings and faster train speeds) used for multiple freight tasks and lower traffic, lower capacity lines (16–19t axle loads, short sidings and slower speeds) where grain is often the only freight task. Each state of Australia has a different mix of gauges, with standard gauge being used for the interstate lines, then narrow, standard or broad gauge for grain-specific lines, depending on the state or region. This arrangement limits the ability to optimise above-rail investment, having to spread investment across narrow and standard gauge rolling stock (see NTC, 2016 and BITRI, 2017 for a description of Australia's grain freight network).

There is about 5100km of grain-only (or mainly grain) rail lines across Australia (BITRI, 2017) and as such its utilisation is relatively low, with maintenance and operation costs borne principally by grain rather than shared among a range of transported products. The long-term future of these rail networks has been called into question by the Federal Department of Infrastructure and Regional Development in their analysis of Australia's transport needs out to 2040. They state:

» *"There are significant factors threatening the ongoing viability of Australian grain freight rail networks throughout regional Australia."* (DIRD, 2016).

In general, the quality of Australia's railroad infrastructure ranks poorly compared with that of most of our major grain export competitors. Australia sits at 35th — on par with Ukraine at 37th (WEF, 2017a). It sits well behind France (5), the US (10), Canada (16) and Russia (23). The only competitor that ranks substantially lower than Australia is Argentina, positioned at 83rd, which after decades of severe underinvestment in its rail infrastructure, is now embarking on a staged renovation of its rail network, starting with a $2.8b renovation of its northern rail line. The Argentinian's government stated aim is for a complete recovery of the country's freight network by 2035, when 20,000km of track will have been renewed. Much of the investment involves private-public partnerships.

The poor quality of some Australian rail lines severly limits the carrying capacity and speed of trains.

RIGHT: The Tier 1 rail line with 23t axle loads used for transporting grain to the port of Kwinana in Western Australia.

In general, the quality of Australia's railroad infrastructure ranks poorly compared with that of most of our major grain export competitors.

Loading grain wagons in upcountry NSW ready for transport to port.

Opinions vary on the optimal mechanisms for funding maintenance and improvements of grain rail infrastructure in Australia. Government funding for grain rail has been justified because it reduces road maintenance costs caused by heavy road haulage that often falls to local governments. Others argue that grain handlers and large farm companies should be expected to invest in road and rail infrastructure because the cost-saving returns and efficiency improvements that these investments make to their business justifies the investments. The full range of views can be seen in submissions to the Inquiry into National Freight and Supply Chain Priorities (2017).

Direct comparisons with other countries, particularly in terms of cost and efficiency metrics, need to be put into context because Australian grain ports are relatively numerous and dispersed along the coast compared with many of its export grain competitors. Australia benefits from relatively short transport distances that allow the flexibility of road transport to be a competitive option to rail. However, the short transport distance also limits the opportunities to concentrate the transport task into fewer routes and hence limits the ability to create economies of scale by funnelling larger volumes through fewer assets.

Australia has 18 ports, mostly located within 400km of the production areas (although some distances are longer, particularly in NSW. See Figure 7 on page 22.) and often with just one, or sometimes two, major port terminal service providers. This configuration takes advantage of the flexibility of road transport and provides adequate capacity at port without duplicating infrastructure, yet has required regulation to ensure satisfactory access to port infrastructure. In comparison, other exporting countries have relatively fewer ports servicing their grain-growing regions, longer distances from port and multiple terminals at each port to provide sufficient export capacity. The starkest comparison is with Canada where grain is transported more than 1500km to port with 80 per cent going through just two ports with a total of 14 port terminal service providers. Transport distances for wheat exports from Russia range widely (from 100km to more than 1000km) but the grain is exported through only seven ports collectively with more than 23 port terminal service providers. Similarly, Argentina has only four grain ports and in the US about 50 per cent of all grain moves through New Orleans, about 25 per cent through the Pacific Northwest and a further 10 per cent through the Texas Gulf Coast. Ukraine is more like Australia with 14 ports and 23 terminals, but transport can be more than 800km.

Comparison of Australia's freight networks with competitor countries can prove useful. Indeed, some of the grain-only lines in Australia's grain rail networks have a closer affinity with Canadian short lines (which are also grain-only and of similar distance) rather than the Class 1 rail lines that undertake the bulk of the task of transporting Canadian commodities, including grain, over long distances using high-capacity networks.

Indeed, the debate in Australia over the viability of rail transport for grain echoes the debate around short lines in Canada. The issues in common are the disenfranchisement of communities through closure of local services; calls for upgrading and reopening of lines; the need for government support to prevent further closure; and concerns over safety and damage to local roads caused by increasing heavy haulage traffic and disagreements over who should pay.

Different geographies also need to be considered when comparing the supply chains of each state of Australia. For example, SA with its series of peninsulas and coastal cropping areas results in it having a higher number of smaller ports compared with other states, and its resulting need to balance land transport costs with the operating scale of ports. Some Thevenard growers, for example, would incur additional freight of more than $34/t if shipping only occurred through Port Lincoln.

Road

In competitiveness rankings, the quality of Australia's road infrastructure is ranked 35th in the world, similar to its ranking for rail, but this road infrastructure ranking is considerably higher than that of Argentina (96), Russia (114) and Ukraine (133), although still behind France (7), the US (10) and Canada (22) (WEF, 2017b).

The road network linking farms to upcountry receival sites and onto port is a combination of local roads, state roads and interstate highways. One of the main problems is consistency of road infrastructure and regulation to allow high-capacity vehicles to achieve end-to-end transport. A mismatch between freight vehicles allowed on one part of a freight corridor but not another requires downgrading to the lowest allowed capacity vehicle along the entire journey or the use of staging points where loads are transferred, involving extra time and cost. The first mile, or last mile, problem is one of the causes of this mismatch, where a short section of road connecting to, or leading from, a freight corridor has a lower capacity than the rest of the freight corridor. In many cases, these short sections carry limited volumes of freight, most of which is grain, so justification to fund road upgrades is often problematic. In the context of reducing the whole-of-supply-chain costs, access for larger capacity vehicles does substantially increase the efficiency of transport and also reduce the number of road trips. For example, the average truck size delivering into the Viterra network has increased by about 20 per cent from 2009–10 to 2016–17, reducing freight costs and the total number of vehicle journeys (see Figure 34).

Realising the cost savings from larger truck capacity to create more efficient transport networks also requires coordination between multiple regulatory entities. Differences of regulation between jurisdictions (so that access limits for vehicles may vary if the corridor passes across boundaries) currently limit network efficiency. These issues are likely to become more complex as truck sizes continue to increase, catchment sizes increase and growers seek to minimise supply chain costs via direct-to-port or just-in-time contracts that see the grain held on-farm until required for delivery direct to the port. Coordinated long-term planning for high-capacity freight corridors to avoid conflict with urban development will be an important ongoing requirement to continue to progress and capture the benefits of improved efficiency of grain road freight.

The advantages of enhanced coordination are:

- better freight route planning;
- maintaining freight access to ports through urbanised cities;
- improved gazetting of roads for heavy vehicles;
- better targeted complementary investments in upcountry receival facilities; and
- an overall reduction in supply chain costs to improve the international competitiveness of Australian grain.

There is an opportunity to use supply chain optimisation modelling to aid planning and investment (Higgins et al., 2017).

Improved configuration of warehouse storage sites has increased the efficiency of road transport.

Image courtesy: Ben White

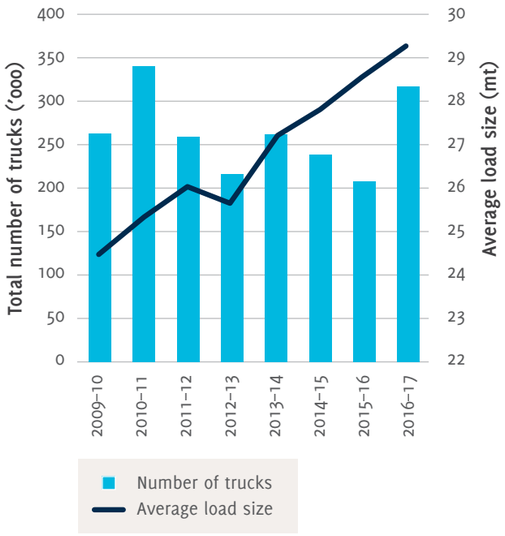


Figure 34 Number and size limits of trucks delivering into the Viterra network, 2009–10 to 2016–17

Source: Viterra

Competitiveness of rail versus road

The average distance to port from upcountry receival sites is about 250km (longer in NSW and shorter in SA. See Figure 7 on page 22). For all port zones, there is a significant catchment area where road transport costs are competitive with rail costs.

The freight charges are dynamic, with road rates showing more flexibility and variability than fixed rail rates. The catchment area can be upwards of a 200km radius from port, depending on the season and subsequent road freight rates. Road freight has advantages, including scalability, lesser regulation and ability to redeploy to or from alternate industries in very good (or very poor) seasons. For example, road transport was the dominant mode of transport for grain in Vic for the very large 2016–17 crop (BITRE, 2017), which provided the extra capacity required to get the crop to port — something unavailable to Canadian growers during their record harvest as shown by the grain transportation crisis in Canada in 2013–14 (Gray, 2014).

Over time, road transport has become more competitive with rail. BITRI (2017) list the reasons contributing to the erosion of the traditional advantage of rail over road in grain transportation as:

- variable rolling stock age and capacity on rail, which can at times be less than what the infrastructure can accommodate;
- differing degrees of grain handlers' investment in grain receival sites;
- improved roads and road transport services;
- increased containerisation of grain;
- deregulation of grain export marketing, which has seen smaller shipments being moved on diverse pathways for a broader range of grain handlers and export marketers;
- rail industry restructuring, funding and ownership changes;
- rail transport and infrastructure availability;
- increased domestic grain consumption of wheat produced in NSW, for which road transport is better suited;
- difficulty coordinating train loading times with port receival times; and
- weather events, including temperatures above 33°C, which closes tracks to rail freight operators in Vic.

The CSIRO's TraNSIT model has been used to estimate the cost of moving all grain by road rather than rail and suggests this would incur an extra $200m in costs (Higgins et al., 2017). This does not include other economic costs that such a shift would incur including increased pollution, poor road safety and greater road congestion. Harvey-Sutton (2017) argues that transport modelling could play a valuable role in facilitating investment appraisals of potential projects that address transport needs.

RIGHT: Grain sampling at receival.

Receival site efficiency

The rate at which grain is received or loaded at upcountry storage sites in Australia varies substantially within a grain storage provider's network, depending on the age and configuration of the infrastructure at any particular site. However, intake fees generally do not vary according to site loading efficiencies. Intake charges are a flat fee within a network, regardless of the loading efficiency, except in SA where Viterra makes a distinction between Tier 1 and Tier 2 sites. About 55 per cent of their receival sites are classified as Tier 1 with intake charges about 5 per cent lower than for Tier 2 sites. Most grain is received into Tier 1 sites.

Grain handlers with fixed pricing across all receival sites are engaging in average-cost pricing. Hence, growers delivering to efficient sites are making a greater contribution to the profits of the grain handler than growers delivering to less efficient sites. In some cases, the use of very inefficient sites under an average-cost pricing regime drains profits. Neil Wandel, former chair of the CBH board, called this practice "essentially unfair cross-subsidisation" (Wilson, 2015).

Service levels at less efficient sites may vary from efficient sites as an alternate mechanism to pricing differentials. In some cases, the different service levels may increase costs to growers in the form of variable waiting times when making deliveries. The difference in the efficiency of loading between sites may also be reflected in freight rates. For example, sites with longer loading times increase trains' operating costs (labour), which should increase train freight fees from that location. Neil Wandel said, "the best solution to the logistics issue was to implement differential pricing" (Wilson, 2015).

Differential site pricing, based on the efficiency of receiving and loading grain, can stimulate the rationalisation of poorly efficient receival sites. In Western Canada, for example, discounts of up to $8/t are offered by rail companies to promote movement of grain in multi-wagon blocks on efficient rail lines and these discounts have driven substantial changes to the receival system. The discounts have enabled grain companies to offer higher prices to attract grain to highly efficient sites and bypass less efficient sites. In some cases, trucking premiums were offered to compensate for the longer transport distances from farms to the efficient sites. This has caused a decline by more than 60 per cent in receival site numbers in Western Canada since 1999–2000 (Quorum, 2013). Most (91 per cent) of this decrease has come from the closure of low throughput receival sites, whereas the number of high throughput receival sites has increased by about 60 per cent.

A short-term consequence of the rationalisation of receival sites in Australia is that some farms benefit more than others, depending on their proximity to efficient transport routes and efficient receival sites. Some costs may also be pushed back onto growers through longer transport distances and requirements for more on-farm storage. In the long term, a reconfiguration of the storage, handling and transport network that reflects the efficiencies of modern transport and handling infrastructure, as well as being flexible enough to adjust to the continuing evolution of these technologies, is likely to produce overall cost savings.

An economic analysis of grain handling catchments in Australia by Kingwell (2017) found that optimum catchment size has continued to increase since the mid-1980s. This has occurred despite higher grain yields and a greater intensity of cropping that act to decrease the size of catchments because of the greater volume of grain delivered. Lower road transport costs, more on-farm storage and improved efficiency of grain receival have been the main factors leading to an expansion of catchments. These findings are consistent with the observed reduction in the number of receival sites in many grain-growing regions of Australia (see Table 4).

Trends in transport costs

Transport fees charged by the major grain handlers vary substantially. Fees in WA and SA mostly reflect the actual cost of transportation, but also reflect the level of competition on the transport route, receival site efficiency and service provider's pricing policies. In Vic, NSW and Qld, the major grain handlers do not publish freight rates, so the trends in freight costs are more difficult to determine. GTA publish location differentials that are only indicative of freight costs and do not represent true transport charges. Transport costs in these states are embedded in the price of the grain offered at each site.

South Australia

Export select rates charged by Viterra for SA indicate that transport costs have steadily declined over the past five years and there are significant differences between routes. Best-fit lines were applied to transport charges and distances to the closest port to indicate changes in the transport rates over time with a flatter line, with a lower slope and intercept, indicating rates have declined (Figure 35). This simple correlation method indicates that nominal rates have declined, averaged over all sites, every year since 2012–13, except for 2014–15 and 2017–18. The reduction in the slope of the fitted line over this period was about 7.8 per cent in nominal terms. Adjusting for inflation shows that the decrease of export select rates in real terms is close to 15 per cent. Figure 35 also shows a large scatter of points indicating considerable variation in charges, depending on the transport route and individual site. Furthermore, the volume transported is considerably larger through some sites than others, so that efficiencies of scale should allow larger declines in freight rates at these sites.

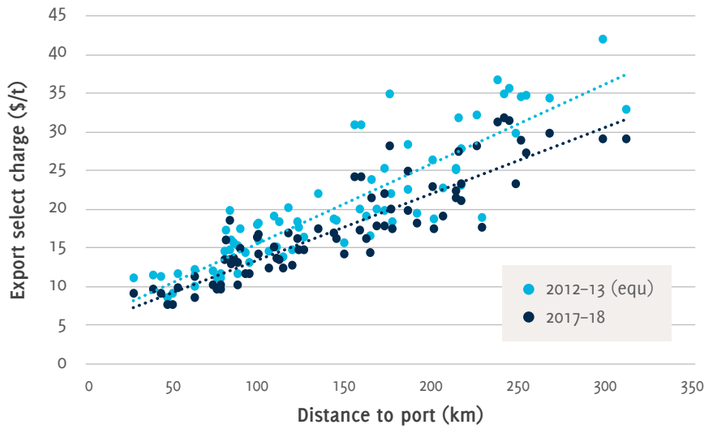


Figure 35 Relationship between export select rates and the distance to the closest port in SA for the 2012–13 and 2017–18 seasons

Source: Viterra and GTA

Freight rates from the top 22 sites responsible for outturning 80 per cent of the grain delivered to the Viterra network have declined to a greater extent (about 9.6 per cent) than the average for all sites and have decreased every year since 2012–13, except for 2014–15 and including 2017–18. Transport rates for Tier 2 sites have declined at a lesser pace than for Tier 1 sites, so the rate at which rates increase with distance in 2017–18 is more than 30 per cent greater for Tier 2 than for Tier 1 sites (Figure 36).

The differences in the transport pricing for Viterra's top 22 sites as well as their Tier 1 and Tier 2 hierarchy is consistent with an investment and pricing policy aimed at attracting grain to key sites through lower prices. This further enables logistical efficiencies that reduce operating costs at preferred sites that are subsequently reflected in lower charges.

There is also considerable variation in the competitiveness between road and rail transport in South Australia's eastern and central regions compared with the western region (Figure 37, Figure 38 and Figure 39). Road transport rates are up to 35 per cent higher in the eastern region than in the western region for an equivalent 150km road journey. The reasons for the higher road rates are complex but are likely to be related to smaller truck size, a greater demand for trucking services and the requirement to pass through the Adelaide hills on some routes. In the eastern region, the maximum truck size is mostly limited to B-doubles carrying 44t whereas in the western region triple road trains carrying 72t are approved on most routes. Victoria is an alternative market for trucking services in the eastern region creating extra demand that is not readily accessible to trucking service providers in the Eyre Peninsula.

The extent to which charges in the different regions are affected by competition between road and rail freight and the viability of each is hard to determine. There are significant differences between the capacity of the different transport systems and geography. Rail transport on the standard gauge eastern ARTC line in the eastern and central regions have 23t axle loads and faster train speeds. The narrow-gauge line in the western region has axle loads of only 16t and speed restrictions down to 20km/h in some sections. Higher road rates in the east provide weaker competition to rail freight rate compared with the west.

Figure 39 shows that road freight rates in the western region are very competitive with rail. The potential development of grain ports in Cape Hardy and Lucky Bay may further reduce the volume of grain travelling on rail to Port Lincoln, thus affecting the economic viability of the Eyre Peninsula rail network and the potential return from future infrastructure investment required to upgrade the network.

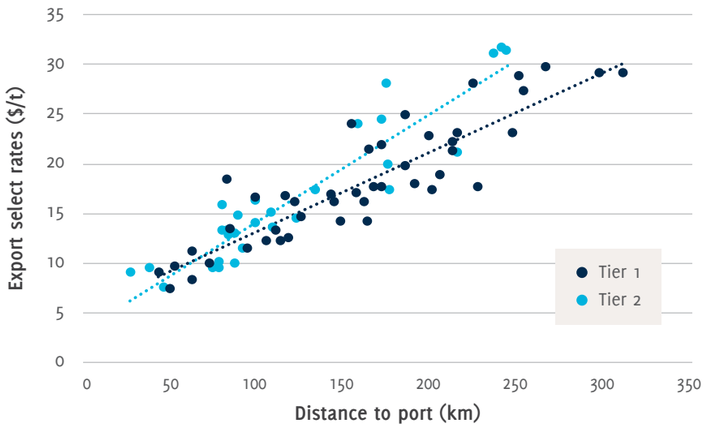


Figure 36 Relationship between export select rates and the distance to the closest port in SA for the Tier 1 and Tier 2 sites in season 2017–18

Source: Viterra and GTA

Road transport rates are up to 35 per cent higher in South Australia's eastern region than in the western region for an equivalent 150km road journey.

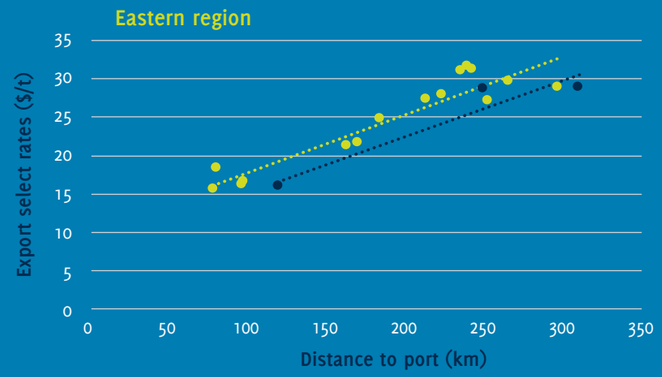


Figure 37 Relationship between export select rates and the distance to the Outer Harbor in the eastern region of SA for 2017–18

Source: Viterra and GTA

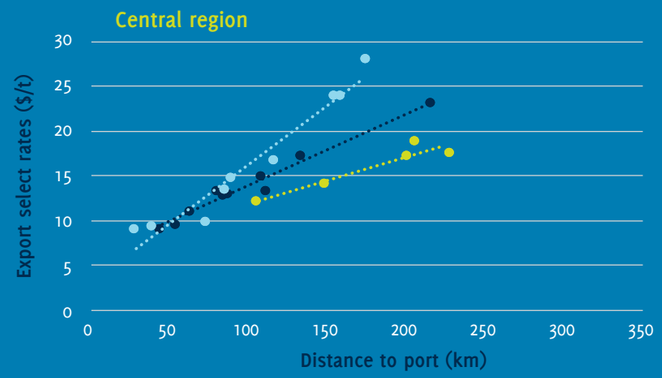


Figure 38 Relationship between export select rates and the distance to the Outer Harbor, Wallaroo or Port Giles in the central region of SA for 2017–18

Source: Viterra and GTA

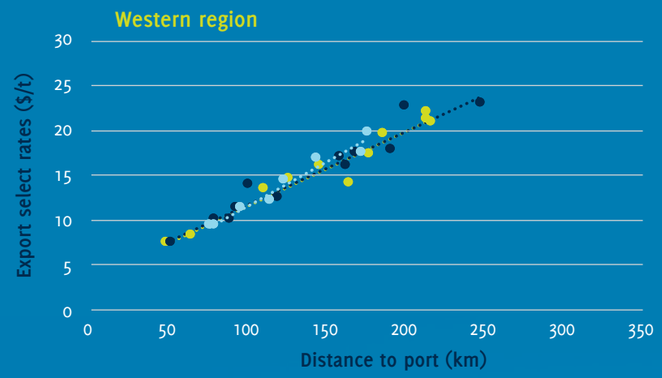


Figure 39 Relationship between export select charge and the distance to Port Lincoln or Thevenard in the western region of SA, 2017–18

Source: Viterra and GTA

Western Australia

In WA changes in freight charges over time and differences between road and rail are more moderate compared to SA. Nominal freight charges in 2017–18 published by CBH are on average about 3.5 per cent lower than in 2012–13 (Figure 40). Nonetheless, this relatively small change translates to an overall reduction of about 8 per cent in the real cost of freight when inflation is considered. Figure 40 also shows that there is considerable variation in freight rates with distance. Transport mode, site type and CBH pricing policy is likely to explain much of this variation.

Receival sites in WA are classified as primary, secondary or surge sites. The overall reduction in freight rates from primary sites has been twice as large (4.6 per cent) than for surge sites (2.3 per cent), with the reduction in freight from secondary sites being in-between (3.9 per cent). In addition, surge sites are, on average, further from port than primary sites and transport rates are about 10 per cent higher for an equivalent distance compared with primary sites.

Freight rates also vary with transport mode (rail or road), although not to the same degree as occurs in SA. CBH as a cooperative is likely to engage in a degree of cost pooling that tends to equalise the rates charged across different port zones and transport modes and hence reduces the overall freight rate variation. For example, Brookton, Canna and Mindarabin, which have different road and rail access, are all priced on their equivalent road distance (~150km) to the nearest port. This is also shown in Figure 41 that plots the freight rates with distance from primary receival sites to their nearest port – including transport by road or rail on Tier 2 rail lines (16t, 19t, 21t axle loads) and the Tier 1 rail line (23t axle loads). Freight rates are similar for similar distances regardless of port destination, except for transport on the Tier 1 rail line, which are noticeably lower, and road transport sites that were formerly located on the Tier 3 rail lines (now closed), which are noticeably higher. It is not clear why transport rates from these sites remain higher than for sites that are equivalent distances from port.

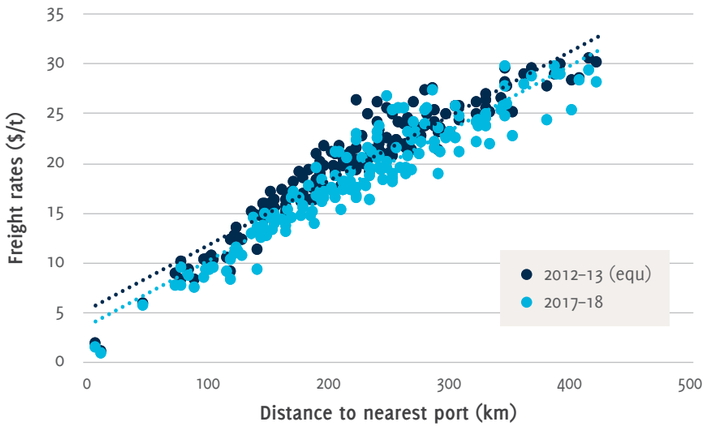


Figure 40 Relationship between CBH freight rates and the distance by road to the closest port in WA for the 2012–13 and 2017–18 seasons

Source: CBH

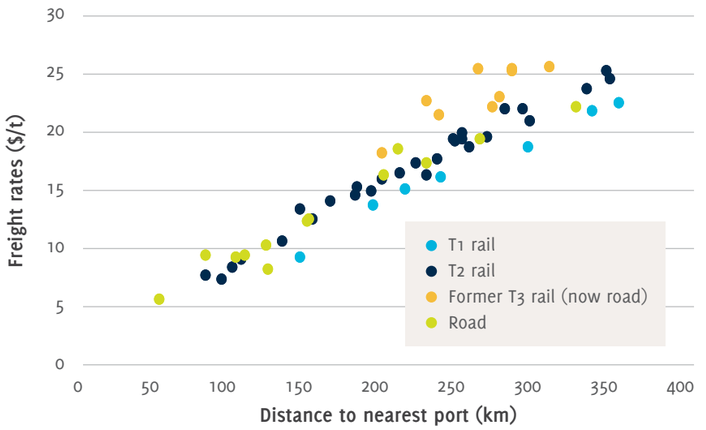


Figure 41 Relationship between CBH freight rates in 2017–18 and the distance to the closest port in WA separated into different categories of primary receival sites

Source: CBH

Higher capacity aluminium rail wagon have contributed to reducing transport costs of grain by CBH.

Victoria, New South Wales and Queensland

Limited data on the cost of transporting grain is publicly available for eastern Australia. This is partly because of the larger domestic market in these states that makes the network used for transporting grain complex and multidirectional, when compared to port based grain catchments in WA and SA. As already discussed and shown in Figure 16 on page 27, the annual variation in grain exports from NSW, Vic and Qld is substantially higher than for SA or WA. In some low production years on Australia's east coast relatively small amounts of grain will be transported to port with the majority being delivered to a variety of domestic feed and flour mills, whereas in other years more than 50% of the grain from some regions may be transported to an export port. In addition, complexity of the transport task is further complicated in states like Victoria where more than 50 percent of the grain may be exported in containers (see Figure 18 on page 29 and Figure 47 on page 69). This contrasts with the comparatively simple task in WA where every year the vast majority grain is delivered to one of five export ports in bulk regardless of the outcome of the season. Under these circumstances services providers in eastern Australia, such as GrainCorp or GrainFlow, do not publish freight rates at the beginning of the season as occurs in SA and WA.

Given the lack of publicly available information, we have used location differentials published by GTA to indicate the freight component of total supply chain costs in Vic, NSW and Qld for Figure 4 and Figure 5 on pages 18 and 19. However, GTA location differentials are not freight rates (see Box 3) and have not changed substantially over the past four years so their approximation to actual freight rates have become more tenuous and we have been advised by industry experts that actual rates may be higher or lower than the published location differential.

Data provided by GrainCorp show that execution rates offered to their pools providers have decreased for many routes over the past four years. Figure 42 shows that the overall relationship between GrainCorp execution rates and distance was similar to the GTA location differentials in 2014–15, but was more variable so, depending on the location, the rate was higher, lower or the same as the location differential. The rates quoted for 2017–18, while still more variable than the GTA location differential, were mostly lower (on average about 9 per cent), but sometimes the same as the location differential. We have only included rates for grain transport from a receival site to its natural port terminal as defined by GTA. If rates to other ports are included then the variability in the GrainCorp execution rates increases, however, the trend for a reduction in overall rates remains. Figure 43 compares the 2014–15 GrainCorp execution rates adjusted for inflation to 2017 equivalent prices and shows that on average rates have decrease by about 14 per cent in real terms over this period.

GrainCorp state that some of the reasons for the reduced rates are related to investment in rail infrastructure by the NSW and Victorian governments together with complementary investments by GrainCorp in their receival sites. These investments have increased loading rates, reduced turnaround times and provided greater utilisation of rail assets. There has also been new freight providers (e.g. Qube and Southern Shorthaul Railroad) entering the market providing greater competition, while existing freight providers have become more attuned to the commercial realities of grain transport in eastern Australia leading to an improvement in contractual arrangements.

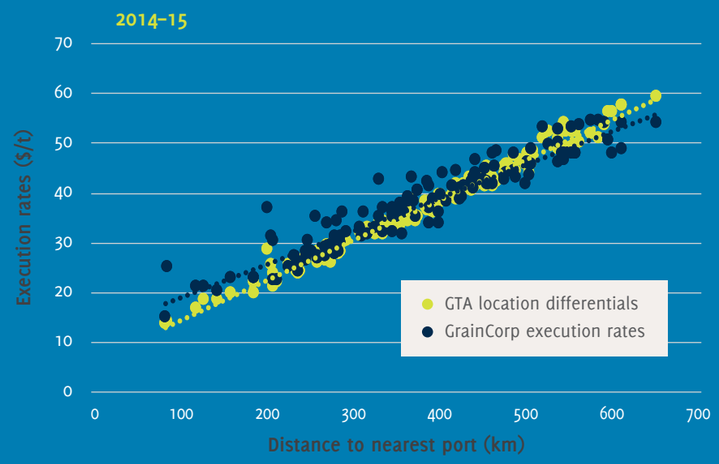


Figure 42 **The relationship between distance and GTA location differentials compared with GrainCorp execution rates offered to pool providers for 2014–15 and 2017–18. Only rates from a receival site to its natural terminal port nominated by GTA have been included**

Source: GrainCorp

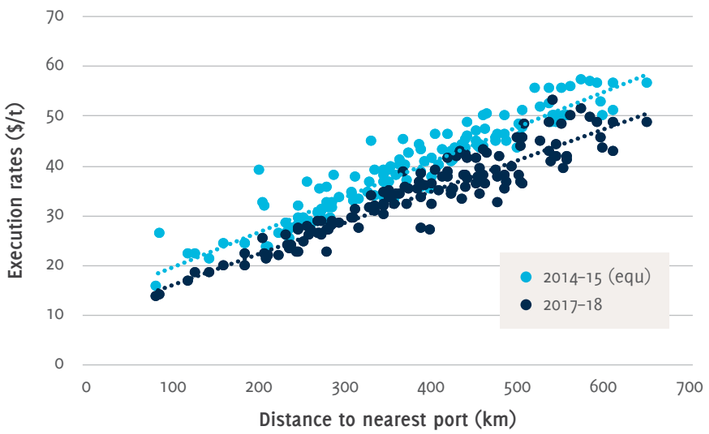


Figure 43 **Relationship between GrainCorp execution rates offered to pool providers and the distance by road to the closest port in 2014–15 and 2017–18. Only rates from a receival site to its natural terminal port nominated by GTA have been included.**

Note: The 2014–15 figures are adjusted to equivalent 2017 prices based on changes in the Australian CPI.

Source: GrainCorp

Comparison of grain freight rates between CBH and Viterra

A comparison of freight rates in SA and WA shows that, for many locations of equivalent distance from port, rates in SA are higher than in WA. Figure 44 shows the freight rates for both road and rail at the primary receival sites in WA and the top 22 sites in SA that outturn 80 per cent of grain. Freight rates from these sites are on average lower than the freight rates from other sites in the respective networks for CBH or Viterra. The fitted lines highlight that not only are rates on average higher for SA growers, but that they also increase to a greater degree with distance for SA growers than for WA growers.

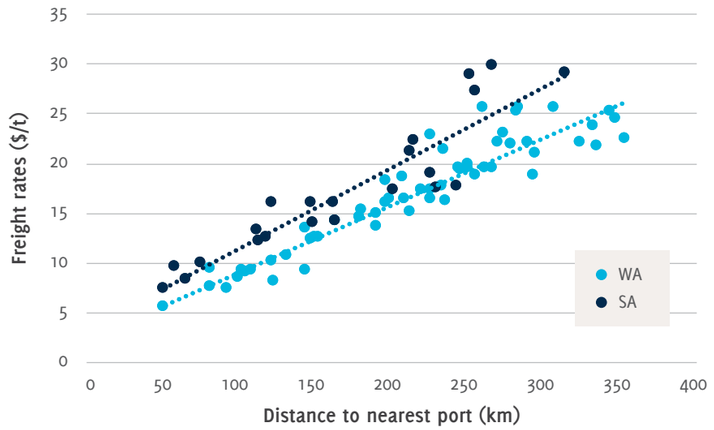


Figure 44 **Relationship between CBH freight rates at primary receival sites published by CBH in 2017–18 or export select rates published by Viterra in 2017–18 for their top 22 receival sites and the distance to the closest port in WA or SA**

Source: : CBH and Viterra

Image courtesy: CBH

BOX 3

Location differentials

Location differentials are developed and published by Grain Trade Australia (GTA). While they approximate the cost of freight for grain moved from upcountry receival sites to designated ports, GTA stress that location differentials are not freight rates and are simply designed to price grain at upcountry sites for the GTA No. 2 Contract — sometimes called a track contract. The track contract usually refers to the price of grain located at the nominated site and ready for transport.

GTA calculate the location differentials for Qld, NSW and Vic, based on a fixed-start fee added to a haulage rate multiplied by the distance to port. In WA and SA, the freight charges published by CBH or Viterra respectively are used for the freight differentials, except for deliveries to Bunge's terminal at Bunbury in WA where Bunge's own published freight rates are used. See Factsheet 005 ***Understanding Location Differentials*** published by GTA.

How are location differentials used?

Location differentials are used to adjust the track price of grain received by the seller at an upcountry site compared with the price quoted for grain delivered at port (track at port). Therefore, for example, based on the 2017 GTA location differentials, the track price at Bathurst will be $28.50 lower than the price quoted for grain delivered to Port Kembla.

Actual freight rates may be higher or lower than the quoted location differential, depending on the time of year and a range of other factors affecting transport logistics. Where site-based prices are negotiated, differences between the actual freight rates and location differentials are usually reflected in the price offered for the grain. Hence, buyers with freight costs lower than the published location differentials can offer higher prices to attract grain to their preferred sites.

Where port prices are offered and location differentials are used to adjust the price paid to sellers, the buyer of the grain may gain or lose slightly in the transaction, depending on the difference between the location differential and the actual cost of transporting the grain.

Increasingly, in eastern Australia, site-based prices are being offered to growers, in which case location differentials are not needed. In other cases, the buyer may offer a port price for grain but also specify the actual cost of freight and, therefore, not apply the location differential.

The primary users of location differentials are traders engaging in buyer-to-buyer trade of grain on the track market. Often, this trade involves forward-sold grain, so the location of the grain may not be known. The location differential allows this trade to occur using standard contracts based on the grain price without the need to negotiate a separate freight rate for each possible location. For example, a buyer may have several bids across a port zone. They can specify the grain price at different locations while simply referring to the GTA location differentials for the freight component of the contract. This simplifies and standardises the transaction.

Location differentials are also used in standard Tender Advice notices for grain futures on the Australian Stock Exchange. The increased ease of trade that location differentials provide encourages greater participation in the market, leading to increased liquidity and potentially more efficient price discovery.

The increased ease of trade that location differentials provide encourages greater participation in the market, leading to increased liquidity and potentially more efficient price discovery.

Image courtesy: GRDC

Ports and shipping

Grain port terminals

There are 25 grain port terminals in Australia, with the majority being owned by the major three providers of bulk handling services, CBH, Viterra and GrainCorp. Of these 25 port terminals (see Figure 22 on page 33), five are located in WA, eight in SA and four each in Vic, NSW and Qld. Unlike the situation in Canada or Argentina where several terminals are located at the same port (e.g. Vancouver in Canada, Rosario in Argentina) Australia's grain terminals are widely geographically distributed.

While the total capacity of the terminals is roughly 2.5 times the required capacity to ship the average volume of grain exports, that capacity is not always accessible given the geographical spread of the grain-producing area and seasonal volatility. Spatial volatility can mean that while there may be available capacity in one region or grain catchment, in another region the capacity might be more fully utilised. Given the cost of shifting grain to a different catchment, it is not always economically sensible to utilise the available spare shipping capacity. For example, if there were a poor season in NSW and a good season in SA, there may be shipping capacity in NSW but not in SA. However, the cost of moving grain from SA into a shipping position in NSW would in most cases be prohibitive.

The excess capacity provides traders with flexibility to alter their shipping programs in response to seasonal and market conditions, although it ultimately needs to be paid for by the investors or users of the port services. It means the returns on investment in these capital assets is lessened in poor or average seasons due either to their under-utilisation or the use of lower prices for the terminal services to attract grain into these facilities. Or users pay more for these services due to their greater overhead costs that arise from constructing and maintaining excess capacity.

All Australian grain ports can receive bulk vessels, with most having a berth length capable to receive Panamax-sized vessels (65,000t), although not all of these ports are able to completely fill these vessels due to draft restrictions. The loading rates of the ports range from 800 to 5000t per hour, allowing full loading over one to six days. Most ports operate 24 hours a day and seven days a week, although, depending on the port, extra charges may apply when operating outside of standard hours.

While there is demand for shipping terminals in every month, there is higher demand for terminal services between February and June. Over half of all wheat exports occur during these five months (Figure 45).

Due to the bumper harvest in 2016–17, the export capacity of many port terminals was tested in 2017, particularly during the peak export period, February to May. Many terminals exported close to or above their previous export records. In some cases, some terminal operators achieved higher volumes of exports than was suggested as being possible, according to the ACCC's assessment of their capacity (Figure 46). It should be noted that even with the bumper harvest there was still excess capacity at several port terminals in eastern Australia. By contrast, most port terminals in SA and WA were fully utilised and, in some cases, these terminal operators introduced several changes that boosted throughput and lifted capacity. For example, operating hours were extended and additional staff were employed to accommodate the export task.

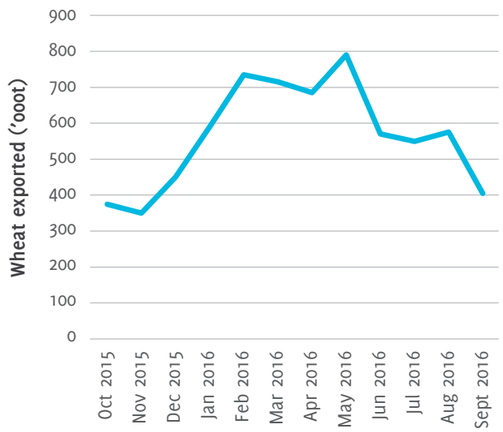


Figure 45 Average monthly exports of wheat from eastern Australia over the five years to 2015–16

Source: Based on ACCC (2016)

While there is demand for shipping terminals in every month, there is higher demand for terminal services between February and June.

Bulk loading of grain at the Port of Melbourne.

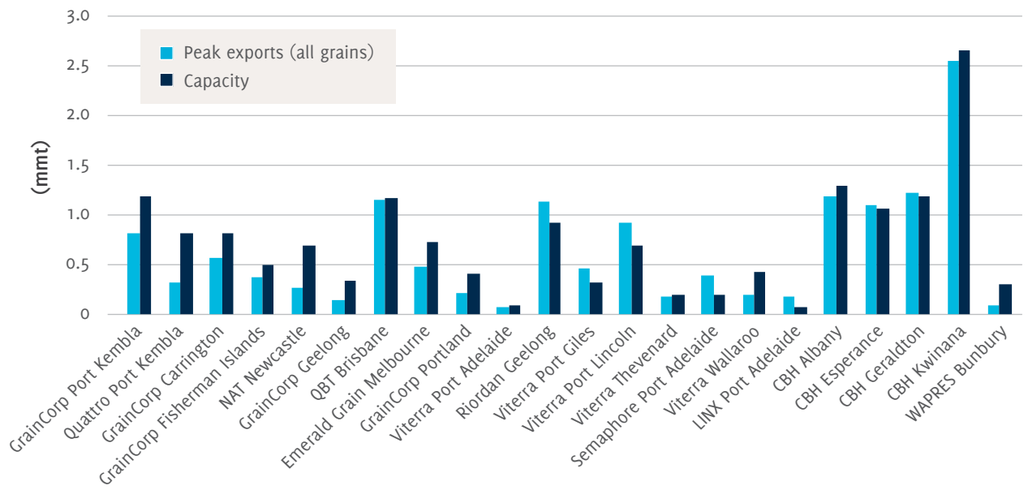


Figure 46 Grain port terminal capacity and use during peak period (February to May 2017)

Source: Compiled from data in ACCC (2017b)

Port regulation

The ACCC administers the Port Terminal Access (Bulk Wheat) Code of Conduct ('the Code'). In its 2017 monitoring report on the Code, the ACCC reported and mostly agreed with some views of stakeholders that there is greater competition between bulk wheat export port terminal operators on the east coast than in WA or SA. East coast operators face greater competition from container exports and the domestic market.

Barriers to entry in the provision of port terminal services are often very high. Typically, new entrants cannot offer the advantages that flow from using an integrated system of multiple ports, an extensive upcountry storage network and associated transport services. In the light of these findings, and after conducting independent analysis and review, the ACCC (2017b) concluded:

» *"Despite emerging competition at some ports over the last four years, the ACCC does not consider that fair and transparent access to bulk grain export services across Australia would be assured in the absence of the Code. Without fair and transparent port access, exporters may reduce their participation in export markets, reducing the marketing options for growers and ultimately the price that they can secure for grain."* (ACCC, 2017b, p.5)

In formulating its 2017 review of the Code, the 2016–17 shipping year provided the ACCC with a useful opportunity to test the efficacy of the Code and its exemptions, as the 2016 production year and resulting exports were at historic highs. Great pressures were placed on port terminal operators to receive and ship large volumes of grain following the large harvest in late 2016. These pressures facilitated the ACCC's assessment of the Code and its exemptions listed in Table 5.

In most cases, port terminal operators are exempt from the Code. No exemption applies where the port operator has not applied for exemption or their application for exemption has been rejected. Currently, only ports operated by Viterra in SA remain regulated as well as three ports operated by GrainCorp (see Figure 22 on page 33 and Table 5).

In conducting its review, the ACCC (2017b) noted how it had 'received numerous complaints over several years in relation to the difficulty exporters experience accessing bulk handling services both at port and along the related supply chain.' (p. 13). According to the ACCC, many stakeholders had expressed concern about the level of market power held by port operators that were vertically integrated across the supply chain and into end-user markets. The ACCC's response to these concerns (ACCC, 2017a), supported by its review, was to recommend that the Department of Agriculture and Water Resources extend provisions of the Code to upcountry service providers of bulk storage for export grain. The merit of such an enlargement of scrutiny by the ACCC is not without international precedent (see the Canadian example under the ***Grain monitoring*** section on page 68). Nevertheless, in its interim report of the review of Port Terminal Access regulations, the Wheat Port Review Taskforce found that:

» *"Despite the range of views, no strong evidence or arguments have been put forward indicating the need for substantive amendment of the Code, its operation or coverage."* (DAWR 2018a)

Table 5 Port terminal operators and their exposure to the Code

Sate	Port terminal operator	Exposure to the Code
WA	CBH Albany	Exempt (17 Nov, 2014)
	CBH Esperance	Exempt (17 Nov, 2014)
	CBH Geraldton	Exempt (17 Nov, 2014)
	CBH Kwinana	Exempt (17 Nov, 2014)
	WA Plantation Resources (WAPRES) Bunbury	Exempt (24 Sept, 2015)
SA	Viterra Inner Harbour	No exemption
	Viterra Outer Harbor	No exemption
	Viterra Port Giles	No exemption
	Viterra Port Lincoln	No exemption
	Viterra Thevenard	No exemption
	Viterra Wallaroo	No exemption
	LINX (previously BAPS and Patrick) Inner Harbour	Exempt (11 Oct, 2017)
	Semaphore Inner Harbour	Exempt (27 July, 2017)
East coast	GrainCorp Newcastle	Exempt (1 Oct, 2014)
	GrainCorp Geelong	Exempt (25 June, 2015)
	GrainCorp Portland	No exemption
	GrainCorp Fisherman Islands	Exempt (24 Sept, 2015)
	GrainCorp Gladstone	No exemption
	GrainCorp Mackay	No exemption
	GrainCorp Port Kembla	Exempt (1 Apr, 2016)
	Emerald Grain Melbourne	Exempt (25 June, 2015)
	Quattro Ports Port Kembla	Exempt (1 Apr, 2016)
	NAT Newcastle	Exempt (30 July, 2015)
	Queensland Bulk Terminals Brisbane	Exempt (24 Sept, 2015)
	Riordan Grain Services Geelong	Exempt (29 May, 2017)

The investigative powers of the ACCC are extensive but currently may not be sufficient to ensure accurate, comprehensive information is collected for appropriate analysis and recommended courses of action. Unlike what occurs in other industries such as aviation or stevedoring, the ACCC currently has no Ministerial direction under Part VIIA of the *Competition and Consumer Act 2010* (Cwlth) to request cost information and monitor prices or efficiency metrics for bulk wheat port terminal services. Providing the ACCC with the power to collect such information, while ensuring the ACCC has sufficient resources to undertake relevant analyses, will yield assessments and findings that inform industry debate, policy formulation and infrastructure investment decisions. In addition, unsound criticisms can be refuted, and decisions mostly based on anecdote can be avoided.

Port terminal operators not exempt from the Code face a range of additional reporting and compliance costs, including reduced flexibility. Viterra is especially constrained by the Code, having no exemptions for any of its port terminal operations. Viterra, and other non-exempt port terminal operators, are required to:

- obtain the ACCC's approval for any changes to their capacity allocation system set out in port loading protocols. To illustrate the impact of this provision, it took Viterra two-and-a-half years to gain ACCC approval for Viterra to introduce long-term agreements for the benefit of the SA grain industry;
- provide access to all exporters who meet minimum prudential requirements and enter into an access agreement;
- comply with a mandatory negotiation process in relation to any access agreement, including mediation or arbitration of those terms;
- publish standard terms of access and reference prices, and comply with mandatory procedures relating to the variation of those terms and prices;
- ensure that it does not discriminate in favour of its own trading operations;
- publish information about expected port capacity, performance indicators and stocks; and
- retain records relating to access agreements, disputes and shipments by exporters.

As can be inferred from the above list of regulatory provisions, meeting these requirements of the Code does impose a range of reporting and operational costs on a port terminal operator, at a time in Australia's history when its grain exports face fierce competition from low-cost exporters in the Black Sea region and Argentina (Kingwell et al., 2016a, b). Designing regulations that are cost-effective in promoting competition is no simple feat. The decision by the federal government to move from access undertakings to a mandatory code may have greatly lessened the business

costs for port terminal operators exempt from the Code, but it has constrained and affected the costliness of operations of those port terminal operators still subject to the Code. Ultimately, regulatory costs must be paid for by the users or investors in the port terminal infrastructure subject to the Code.

The cost of regulation must be balanced against its benefits. Given the dominant market positions held by CBH, Viterra and GrainCorp in different regions and port locations of Australia, it is important that reputable regulatory bodies like the ACCC have the power of scrutiny to regularly report on the actions of these dominant players to create advantages for the entire grain industry and the wider Australian economy.

The ACCC (2017b), after reviewing the Code's impact found:

- ongoing concerns surrounding some market structures in grain supply chains and therefore the need to consider behaviour and impacts from a whole-of-supply-chain perspective;
- retention of the port Code is essential, and it should be improved and strengthened;
- no clear changes in exporter market shares held by owners of port infrastructure following Code exemption decisions;
- a greater range of services were now being offered by port terminal operators; and
- new entrants to port terminal service provision in a few port zones. A similar finding noted earlier by Kingwell et al. (2014).

The fact that the ACCC recommends an extension to its review services suggests that the nature and ownership structures within grain supply chains, according to the ACCC, are such that efficiency and competition assessments require whole of supply chains review, not just the scrutiny of port services.

Another important aspect of regulation that potentially affects all port terminals is their freedom to operate and their ability to access least-cost grain pathways. Explaining further, Australia's population is expanding and becoming increasingly urbanised. Against the backdrop of those demographic trends is the challenge for grain port terminals to ensure their access to freight services is unimpeded, along with their ability to retain operational flexibility. If their access to least-cost grain paths and operational efficiencies becomes constrained by urban development, poor planning decisions and local populist politics, then their profitability will suffer, but more importantly the international competitiveness of Australia's export grain supply chains will suffer. Hence, it is imperative that planning, zoning, regulation and development decisions that affect freight corridors, ports and grain terminals are based on careful strategic considerations and thorough analyses. Failure by all tiers of government to maintain well-resourced, sound processes of review, planning and regulation could unleash significant economic damage.

Grain monitoring

It is interesting to compare regulation of the Canadian export grain supply chain to the Australian supply chain. White et al. (2015) reported on the advantages of the Canadian government's grain monitoring program for Western Canada. This program monitors all aspects of the movement of grain from the farm gate through to vessel loading and departure. This monitoring provides the Canadian government and the Canadian grain industry with annual (and quarterly) comprehensive and objective performance metrics that facilitate informed debate, policy formulation and investment planning by all stakeholders. By contrast, the Australian grain industry is mostly subject to piecemeal, ad hoc scrutiny by a range of government, parliamentary and industry organisations. By their nature, urgency and frequency, the plethora of such inquiries imposes significant reporting costs on key stakeholders in grain supply chains. Fewer, regular inquiries with consistency of information requests may lessen the reporting burden for these stakeholders.

Canada's grain monitoring program has a legislative underpinning and has existed since 1999–2000. Quorum Corporation, a private transportation and logistics consulting firm, through tender processes, has regularly provided this monitoring service. The program costs about $1.3m per annum and consists of three analysts, back-office and database support, plus operating and corporate overheads.

In the absence of transparent monitoring of the performance and costliness of the Australian supply chains, users of those services may question the fairness or value of the services provided. This leads to frequent calls for inquiries and greater regulation by parliamentary committees or government agencies. Establishment of the current port access regulation is a case in point. Despite the recommendations from the Productivity Commission to reduce regulation and move to a voluntary code of conduct being accepted in-principle by the government in 2010, there was insufficient support from sections within the industry that insisted industry-specific access regulation was still needed (DAWR, 2018). These tensions remain strong as shown by the inquiry into the South Australian bulk grain export supply chain costs, currently due for completion in 2018 and the response by the ACCC to the 2018 interim report on the review of the wheat port code (ACCC, 2018).

AEGIC's view is that supply chain owners should consider making their component costs, charges and performance metrics visible across the supply chain to improve customer satisfaction and perceptions of fairness. This information can, as in the Canadian system, be provided to an independent third party to maintain commercial sensitivity. Greater transparency could become a point of competitive advantage for the industry and a pathway to lower regulation.

Port containerisation facilities

Container export facilities are used much more in eastern Australia than in WA and SA (Figure 47). The ACCC (2017b) indicates that in 2015–16 of the wheat tonnes exported from Qld, Vic and NSW, 62 per cent, 61 per cent and 18 per cent respectively were exported in containers. The equivalent percentages in 2016–17 were 34 per cent, 38 per cent and 19 per cent. Interestingly, in an opinion piece in the Australian Farm Institute's newsletter (AFI, 2017), Don McGauchie, a non-executive director of GrainCorp, commented that GrainCorp is preparing for a market shift towards highly specialised, high-value, small-batch grain development that involves investment in container facilities and a greater commitment to customer intelligence. He considered that:

> *"In 20 years, GrainCorp, which is currently a commodity business, may well generate the majority of its returns from specialised small-batch product."* (p. 4)

The growth of the container export service over the past decade has provided smaller exporters with the opportunity to scale up, where they may not have resources to commit to a bulk vessel. In this manner, the container export industry helps introduce competition into the bulk market. As examples, Semaphore Container Services and Arrow Commodities now export in bulk out of Port Adelaide and from the NAT in Newcastle.

In the export-oriented states of SA and WA, container markets remain very small and supply chains are focused on efficient bulk transport of grain to large bulk export terminals. The larger populations in NSW, Vic and Qld create a large in-flow of suitable containers and sustain domestic markets that facilitate container-based, small-batch trading of grain; and so, understandably, supply chains develop to serve those internal markets with spillovers, negative and positive, to export market supply chains.

Although containerised trade is relatively more important in eastern Australia, containerised grain exports from Australia overall accounted for only 11 per cent of total exports of grain in 2016–17. For much of the past decade, exports of containerised grain from Australia have remained mostly stable, ranging from 2 to 2.6mmt per annum and several stakeholders see the prospect of only modest growth in the container trade for major a grain like wheat.

Record grain production in 2016–17 increased the demand for containers, resulting in a shortage of suitable 20-foot, food-grade containers. Most containers arriving in Australia are 40-foot containers, too large to fill with heavy grain cargoes and often too large to be received by the overseas buyer.

In the export-oriented states of SA and WA, container markets remain very small and supply chains are focused on efficient bulk transport of grain to large bulk export terminals.

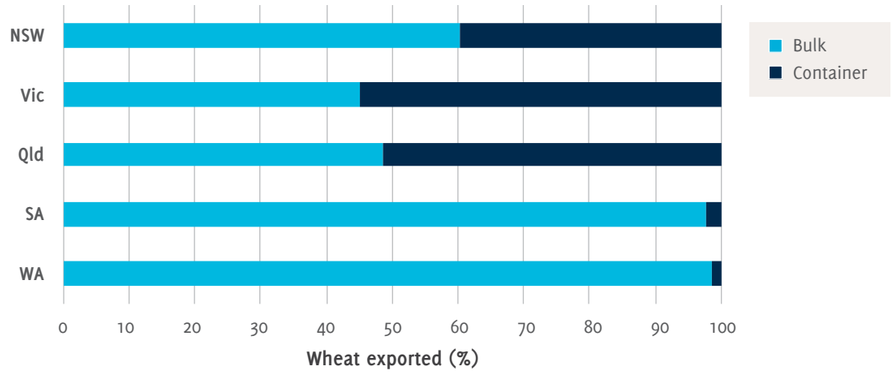


Figure 47 Percentage of wheat exported in bulk and containers by state, five-year average: 2012–16

Source: ABS

Trends in port terminal operations

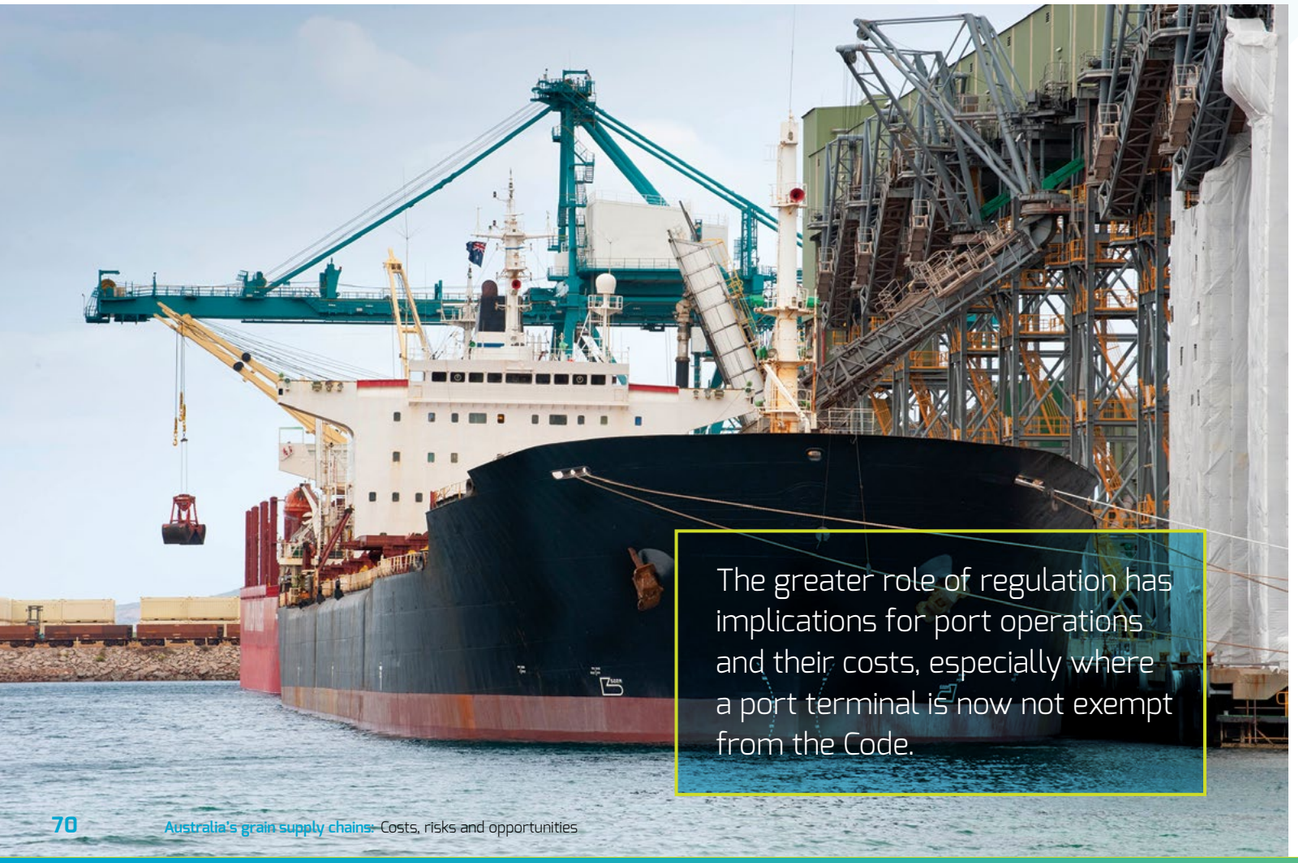
One trend affecting Australian port terminal operations that has emerged since the grain market was deregulated is a regulatory shift away from access undertakings to a mandatory code and an appetite to consider further improvements to that code to increase its effectiveness. The greater role of regulation has implications for port operations and their costs, especially where a port terminal is now not exempt from the Code.

A second trend is the increased investment over the past decade in new and upgraded grain port terminals (e.g. WAPRES at Bunbury, Quattro Ports at Port Kembla and NAT at Newcastle). The increased competition generated by this investment is evident by exemptions granted to the Code at these ports. These investments have increased Australia's capacity to load grain vessels, but in the absence of more frequent large harvests, may represent an inefficient duplication of services that generate lower returns to these and existing investments in grain port terminals.

A third trend noted by the ACCC's monitoring is that third-party storage differential charges are reducing. These charges may be appropriate where increased costs and risks associated with receivals from third-party storage are incurred by the port terminal operator. Alternatively, as noted by the ACCC (2017b), these charges may reflect a port terminal operator using their market power to advantage its own upcountry storage and handling facilities and transport services. Perhaps in response to the persistent scrutiny by the ACCC, or perhaps due to the port terminals' learning by experience that the cost of receiving grain from third-party storage is less than initially envisaged, third-party storage differential charges have diminished.

A fourth trend, especially observed in WA amid large harvests, is to more rapidly bring grain to port early in the harvest period. As outlined by Kingwell (2017), modern grain varieties and grain harvesting equipment cause large volumes of grain to flow from farms during favourable production years. To facilitate upcountry storage operations and expedite shipping, grain is being more rapidly moved into port or nearby storage, especially at CBH's Kwinana port terminal with its throughput capacity of up to 8mmt in the 2017-18 harvest and more than 1mmt of port storage capacity. Use of shuttle trains delivers grain accumulated at nearby upcountry storage for either just-in-time port delivery or into port storage.

A fifth trend is a greater use of low-cost mobile ship loaders. These services provide flexibility to small operators to bypass long-term ownership and use of costly port infrastructure. These operations are more exposed to grain hygiene risk and delays associated with out-of-specification truckloads. The logistics associated with these just-in-time deliveries are also more exposed to quality fluctuations between loads, where there is insufficient flexibility to blend.



The greater role of regulation has implications for port operations and their costs, especially where a port terminal is now not exempt from the Code.

Port terminal operational charges

The ACCC (2017b) argues that the Code provides port terminal operators with greater flexibility, irrespective of whether they are exempt from the Code. A ramification of this flexibility is that each port terminal operator has freedom to determine the structure and level of charges for their port terminal services. This allowable variation in cost or fee components is illustrated in Table 6.

Table 6 shows that the base cost for port fees in 2017–18 ranges from $15 to $28/t, with a wide range in fees associated with various service components. Table 3 in ACCC (2017b) also lists similar wide variation in the service cost components of operators of several port terminals in Australia in 2016–17. Stretch et al. (2014) have questioned the justification for the wide variation in fees for some services, such as shrinkage and dust. For example, there is unlikely to be a marked variation in the dust burden of wheat received at different port terminals in the same production year, yet for a $250/t FIS wheat price, the port dust charge could range from zero to $1/t. For a farmer delivering 10,000t of wheat, the latter charge is a $10,000 reduction in their income. Similarly, a $2/t difference in port fees would mean a $20,000 reduction in the farmer's income.

To illustrate how port fees have changed through time, Figure 48 considers the fees of four main port terminals with all fees expressed in constant 2017–18 dollar terms. Two seasons are compared: 2013–14 and 2017–18. The cost components in Figure 48 include the basic intake receival fee (rail only), vessel nomination, vessel loading, government fees (AQIS, etc.), miscellaneous port/wharf fees and stevedoring. We have not included dust or port storage (dust charges are ignored because the shrinkage rate has remained unchanged, but the charge has varied simply because the grain price has changed) or discretionary and optional services. It should be noted that some services are included within the standard fee for some providers but are optional for others. For example, blending is included within the ship loading fee charged by Emerald Grain but is charged at $2.50 by GrainCorp. Furthermore, standard services offered in 2013–14 may be different to those offered in 2017–18.

Table 6 **Fee[1] components in port charges at six major grain port terminals in 2017–18 ($/t)**

	CBH Kwinana	GrainCorp Port Kembla	Viterra Adelaide – Outer	Emerald Grain Melbourne	Quattro Port Kembla	NAT Newcastle
Intake fee	–	0.00-2.04[h]	3.40-4.70[h]	6.00-8.00[h]	4.00	5.00-7.00[h]
Vessel nomination	–	8.00	5.50	8.00	8.00	8.00
Vessel loading or terminal shipping	12.20	11.39	12.07-14.65[a]	7.50	7.60	5.00
Storage	–	–	–	–	–	1.00
Inspection	0.31	0.31	0.26	0.25	0.25	0.50
Storage	–	–	–	–	–	1.00
Miscellaneous port/wharf fees	2.40[b]	2.66[c]	2.62[d]	2.40[e]	2.35[f]	1.45[g]
Dust and/or shrinkage factor	0.20%	0.30%	0.15%	0.00%	0.40%	0.20%
Dust charge[i]	0.50	0.75	0.38	0.00	1.00	0.50
Base cost	**15.41**	**23.11–25.15**	**24.23–$28.11**	**24.15–$26.15**	**23.20**	**21.45–23.45**

[1] Fees are listed for standard services by each service provider. Specified standard services will vary with each provider and extra charges may apply. The names and purpose of the fee varies between service providers. The names we have used to identify the fees here may be different from the name used by the service provider. For example, the vessel loading fee is used in this table to indicate the port handling and shipping fee for Viterra.

[a] Viterra's charges vary throughout the year.

[b] Stevedoring charge (0.50) plus wharfage fee for maintenance of the Kwinana jetty listed in the CBH port terminal service agreement (1.90).

[c] Stevedoring charge (0.40) plus the Port Kembla wharfage charge listed by the NSW Ports schedule of charges for Port Kembla (2.26).

[d] Bulk cargo service charge (2.15) plus grain channel levy (0.47) listed by Flinders Ports. Stevedore charge is incorporated in Viterra's loading fee.

[e] Wharfage fee as listed by Victorian Ports Melbourne. Stevedore charge is incorporated in Emerald Grain's loading fee.

[f] Bulk cargo facility access charge (1.10) listed in Australian Amalgamated Terminals Port Kembla Tariff Schedule, plus stevedoring charge (0.4) and berth hire (0.85) listed in Quattro Ports scheduled charges.

[g] Stevedore charge (0.5) listed in NAT schedule of charges plus wharfage charge (0.95) listed by Port of Newcastle for Dyke 2.

[h] Intake fee varies between rail (lower figure) and road (higher figure).

[i] Based on a grain price of $250/t.

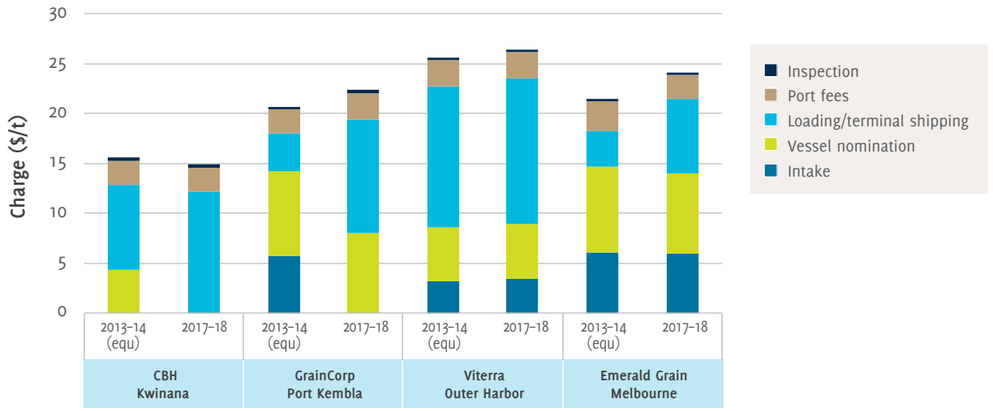


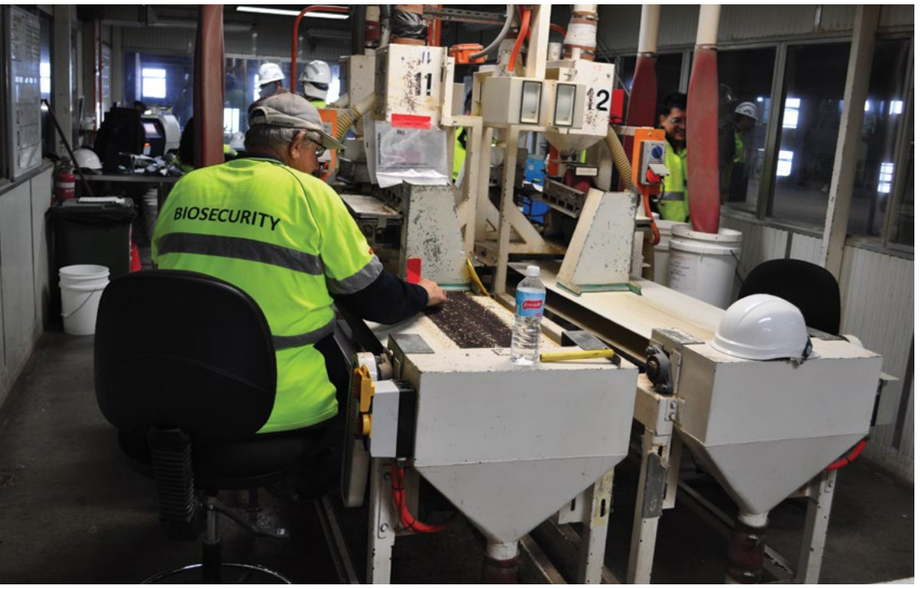
Figure 48 Port charges in 2013 (adjusted to 2017 equivalent prices based on changes in the Australian CPI) and in 2017–18 for major port service providers in Kwinana, Port Adelaide, Port Kembla and Port Melbourne

Note: For CBH, the loading/terminal shipping fee is derived from the proportion of the export shipping fee that was allocated to the terminal shipping fee when this charge was created in 2017. Inspection fees were not charged directly by CBH and Viterra in 2013 and therefore we have used the rates charged by GrainCorp and Emerald Grain ($0.25/t) in 2013 as an estimate. Port charges for Viterra vary throughout the year. We have applied charges for export at February 2018.

Total fees for exporting grain charged by all major port terminal service providers have increased in nominal terms since 2013. Increases ranged from about 3 per cent to nearly 21 per cent over this period. In real terms, after accounting for inflation, charges have decreased for export through Kwinana by about 4.2 per cent but have increased for all other ports. With a real increase of just over 12 per cent, the charges for export through Port Melbourne have been the highest over this period. Of the ports listed in Figure 48, only Viterra's Outer Harbor operation is fully regulated under the port access code.

From this data, it is not clear if there is a relationship between port regulation, total charges or the increase in port charges.

A separate investigation by the ACCC (2017b) generated a similar conclusion, although the ACCC analysis included a combination of charges that, as they acknowledged, may not necessarily reflect how each port terminal might be used by a majority of exporters. In addition, the ACCC analysis ignored costs of shrinkage and dust, and inspection and other port-specific wharf or shunting fees. Also, their analysis excluded costs charged for season 2017–18. Both analyses excluded rebates provided by CBH.



LEFT: Biosecurity inspection of grain during loading of a bulk vessel.

CBH rebates

It can be argued that the effective cost to growers of CBH services (grain receival, storage and handling, freight and port services) is lower because of the rebates it provides. Due to the magnitude of rebates in 2017 and 2018 (see Table 7), the real cost of CBH services, including port services borne by growers, has diminished substantially and in that sense the CBH port terminal service fee history differs even more from their interstate counterparts than indicated in Figure 48.

CBH uses the operations rebates to manage the uncertainty associated with forecasting harvest size, so that a rebate is paid after a surplus is created when the amount of grain handled and shipped is greater than average.

The rebates, irrespective of the source (CBH Operations, Marketing and Trading, or Investments), are store credits that can only be redeemed through future use of CBH services. Rebates vary each year, depending on the performance of the different divisions within the business and are provided to all growers that use the CBH system, not just CBH members.

Table 7 CBH rebates[1] since 2013

Year	Rebate ($m)	Rebate ($/t)
2013	4.8	0.53
2014	53.6	4.55
2015	16.9	1.05
2016	62.7	4.20
2017	156.3	12.75
2018	94.5	10.50

[1] Rebates are based on the amount of grain delivered and sold to CBH in the previous financial year and have varying components. In 2017 the $12.75 rebate comprised $6.25/t from CBH's Marketing and Trading Division, $6/t from Operations and a $0.50/t Investments rebate.

Rebates are not unilaterally supported within the industry: they have their critics and supporters. Some users of the CBH system have expressed a private view claiming that the rebates reduce effective competition for exports out of WA. Rather than rebates, these users argue that competition would be better served by lower upfront fees charged for the services provided. These claims could be tested under competition law.

CBH uses the operations rebates to manage the uncertainty associated with forecasting harvest size.

Loading grain onto a ship at CBH's port terminal in Kwinana.

Sea freight

Australia is geographically close to its primary markets for wheat and this delivers a benefit to the industry through reducing the cost of delivering grain to those markets (Figure 49).

Noting that Indonesia is the major destination of wheat exported from WA, the freight advantage for WA-origin wheat sent to Indonesia is around $10-$12/t compared with wheat from Canada's port of Vancouver or Ukraine's port of Odessa. By contrast, North Asian destinations convey only a small freight advantage for Australian wheat exports against exports from Vancouver or the US port of Portland, although the freight advantage for Australian wheat against wheat from the Odessa remains around $10/t. The freight advantage for Australia's western ports (i.e. Kwinana) has been eroded over the past several years, especially when shipping to Indonesian ports like Jakarta, as shown in Figure 50. While Australian rates have remained flat, there has been a marked decline in the sea freight rate from the Black Sea, thereby lessening the impact of sea freight on the landed cost of grain from the Black Sea.

While the freight advantage for Australia has declined in real terms since 2010, shipping rates are volatile and have increased since early 2016 (Figure 50). This recent upward trajectory of sea freight rates, combined with the decline in real prices of grain, has meant that the sea freight as a share of calculated CIF values has risen. If shipping rates climb further in 2018, then the advantages of geographical proximity to major wheat customers become more forceful. This would bestow further advantages to EU and Black Sea wheat being exported to northern African markets. However, South-East Asian markets would be more easily served by Australian suppliers and North Asian markets would become more attractive to Canadian and Pacific north-west US wheat marketers.

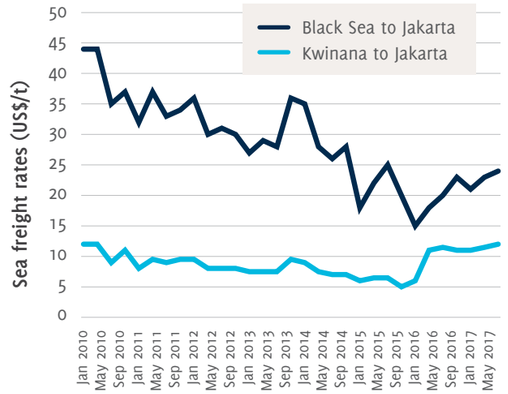


Figure 50 Sea freight rates from the Black Sea to Jakarta and from Kwinana to Jakarta, 2010–17

Source: Kalisch Gordon (2018)

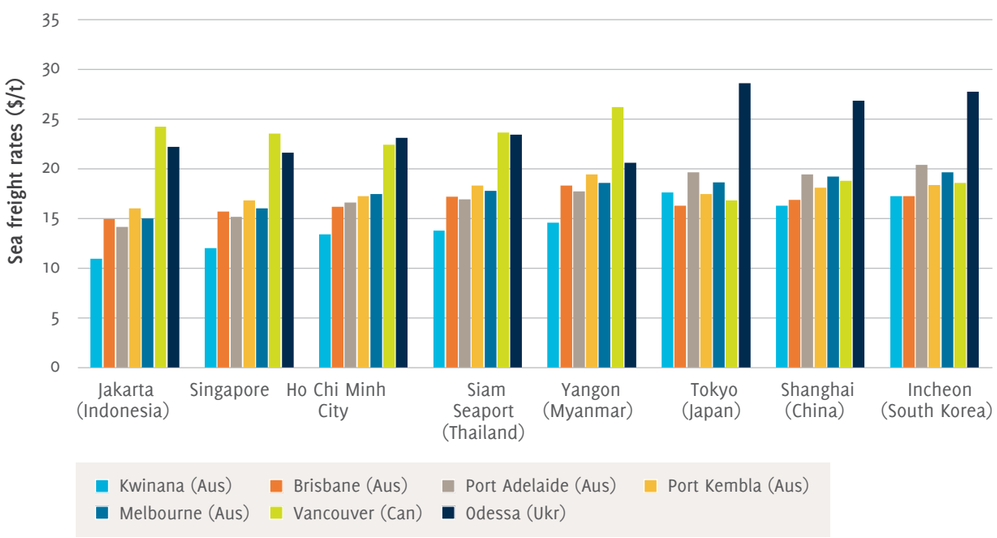


Figure 49 Estimated sea freight rates to major Asian ports in 2017–18

Source: Rabobank, Searates.com

Table 8 Shipping journey durations (days) for 40,000t wheat shipments (as at 24/11/2017)

	Argentina (Rosario)	Australia (Kwinana)	Canada (Vancouver)
Indonesia (Jakarta)	35	10	30
China (Shanghai)	35	20	23
Vietnam (Vung tau)	38	14	27

Although they are inherently volatile, the likelihood of a continued strong uplift in sea freight rates, is low – at least in the foreseeable future. Idle fleets (ships not being used commercially) remain a feature of the shipping industry. The current overcapacity, exacerbated by ship orders still yet to be filled, suggests it could be some years before overcapacity lessens to drive up freight rates. Nonetheless, Kalisch Gordon (2018) suggests that some increases in sea freight costs in the midterm will lift landed prices into South-East Asia that favour Australian wheat over US wheat but Black Sea wheat will remain price-preferred.

Table 8 illustrates shipping journey durations for wheat from Argentina, Australia and Canada travelling to Asian ports. When wheat prices are low, the cost of shipping becomes a more important consideration when choosing the source of wheat to import.

Innovation in shipping and associated support services is also likely to place downward pressure on sea freight rates. Improvements to engines, better propeller performance and high-tech coatings, friction-reducing air cushions and even skysails are reducing fuel needs of ships.

Blockchain technology, admittedly in its infancy when applied to shipping, offers the promise of reduced transaction costs, replacing costly legacy systems based on logs, spreadsheets, data and service intermediaries. Blockchain technology offers three key roles — recording transactions, establishing identity and establishing contracts. For example, the company, Blockfreight, has built an end-to-end blockchain solution for 'bill of lading' access by all entities in the supply chain — from freight forwarders and shipping carriers to port operators and regulators.

Examples of other innovations in their infancy are: first, the web-based service OpenSea Pro that hosts an online marketplace for shipowners, charterers, and brokers, and second: Xeneta, which maintains the world's largest database for ocean freight rates and can provide real-time rates for over 160,000 global trade routes.

These sorts of innovations will help constrain the cost of sea freight. An implication of continued downward pressure on the cost of sea freight is an increase in the competitiveness of non-traditional origins such as the Black Sea region and Argentina. The low cost of freight will provide them with extended market reach, making the grain from these origins more competitive in traditional Australian markets. Conversely, the low cost of sea freight will also make Australian grain more competitive in markets where other origins have traditionally dominated.

BELOW: The port of Makassar, South Sulawesi, Indonesia an important destination for Australian grain.

Other costs

Other costs incurred within the supply chain include the regime of federal and state-based levies and the 'end point royalty' collected by plant breeders for use of IP-protected varieties. The federal levies are mandatory and, while the state levies are also mandatory, there is an option for growers to opt out (GTA, 2018).

The levies are used to fund a range of organisations with either a national or state-level presence, where their service offering is the contribution of an industry-good function. The return from these services is valuable and the funded activities contribute strongly to the productivity growth and security of the Australian crop.

Mandatory federal levies

The levies collected to fund organisations with a national mandate, are collected from the grower at the rate of 1.02 per cent of an estimated sale value of the crop for most types grain exported (Table 9). The national organisations provide biosecurity, research and residue testing. In each case, the levy is matched by a federal government contribution. As these levies are pegged to both price and yield, the revenue collected is exposed to some price and production risk.

The four activities listed in Table 9 offer the services outlined in Box 4 (page 78). The groups referred to have a national mandate to provide a set of services.

A range of levies support grains research throughout Australia.

Table 9 National levies on grain production as a percentage of farmgate sale value of the grain

Crop type	Emergency plant pest response	National residue testing	Plant Health Australia	R&D	Total
Barley, chickpea, common vetch, faba bean, field pea, grain sorghum, lentil, linseed, lupins, maize, millet, mung bean, navy bean, oats, pigeon pea, rape seed, safflower, soybean, sunflower, triticale, wheat, Wild cow pea	0.005%	0.015%	0.010%	0.990%	1.020%
Peanuts, black gram, canary seed, cereal rye	0.005%	–	0.010%	0.990%	1.005%
Maize	0.005%	0.015%	0.007%	0.693%	0.720%

Source: DAWR, 2018

As these levies are pegged to both price and yield, the revenue collected is exposed to some price and production risk.

Image courtesy: GRDC

BOX 4

Services associated with national levies on grain production

Emergency plant pest response

» *"The Emergency Plant Pest Response Deed (EPPRD) is a formal, legally binding agreement between Plant Health Australia (PHA), the Australian Government, all state and territory governments and plant industry signatories, covering the management and funding of responses to emergency plant pest (EPP) incidents.*

» *It covers the management and funding of responses to EPP incidents, including the potential for owner reimbursement costs for growers. It also formalises the role of plant industries' participation in decision making, as well as their contribution towards the costs related to approved responses.*

» *The ratification of the EPPRD in 2005 significantly increased Australia's capacity to respond to emergency plant pest incursions."* (PHA, 2018).

National residue testing

» *"The National Residue Survey (NRS) is a part of the Australian system for managing the risk of chemical residues and environmental contaminants in Australian animal and plant products. The core work of the NRS is to facilitate the testing of animal and plant products for pesticide and veterinary medicine residues, and environmental contaminants.*

» *"NRS programs encourage good agricultural practices, help to identify potential problems and indicate where follow-up action is needed. The NRS became an industry-funded activity in 1992."* (DAWR, 2018b).

Plant Health Australia

» *"Plant Health Australia is the national coordinator of the government-industry partnership for plant biosecurity in Australia. The purpose of PHA is for government and industry to have a strong biosecurity partnership that minimises pest impacts on Australia, enhances market access and contributes to industry and community sustainability."* (PHA, 2018).

Research and development (GRDC)

» *"The Grains Research and Development Corporation (GRDC) is … responsible for planning, investing in and overseeing RD&E to deliver improvements in production, sustainability and profitability across the Australian grains industry.*

» *"The GRDC's primary objective is to drive the discovery, development and delivery of world-class innovation to enhance the productivity, profitability and sustainability of Australian grain growers and benefit the industry and the wider community.*

» *"The GRDC is a statutory corporation, founded in 1990, under the* Primary Industries Research and Development Act 1989 *(PIRD Act), it is subject to accountability and reporting obligations set out in the* Public Governance, Performance and Accountability Act 2013 (PGPA Act). *The GRDC's portfolio department is the Australian Government Department of Agriculture.*

» *"The functions of the GRDC under the Act include coordinating or investing in R&D activities; monitoring, evaluating and reporting on the impact of R&D activities on the grains industry and the wider community; and facilitating the dissemination, adoption and commercialisation of the results of R&D."* (GRDC 2018).

Mandatory state levies

Western Australia — biosecurity and agricultural management scheme

In WA, funding arrangements authorised under the *Biosecurity and Agriculture Management Act 2007* (BAM Act) permit the collection of a $0.25/t contribution on the first sale of every tonne of grain and seed produced within the South West Land Division (DPRID, 2017). This has been reduced from the $0.30/t charge levied before 2017. The contributions fund programs to manage declared weeds, although they can be used to raise funds for other programs to tackle additional pests.

Every individual/entity purchasing or receiving 500t or more of grain/seed/hay (in combination) in a given financial year is required to register with the Industry Funding Scheme. These 'registered receivers' are responsible for deducting and forwarding contributions at the determined rate. There is an option to opt out of the scheme, where producers who wish to opt out must do so in June of the relevant year (DPIRD, 2018)

These levies are a fixed cost per tonne of grain. As such the real cost of the levy on a per tonne basis will reduce over time. The total revenue collected in nominal terms through the levy is likely to increase at the rate of yield improvement.

South Australia — Grain Industry Fund levy

The Grain Industry Fund was established under regulations of the *Primary Industry Funding Schemes Act 1998* to collect contributions from SA grain growers to support grain industry activities.

SA grain growers contribute $0.20/t to the fund, although there is an opt-out option. The levy provides funds for a range of purposes including payments to an organisation for representing grain growers.

As in WA, these levies are a fixed cost per tonne of grain and as such the real cost of the levy on a per tonne basis has reduced. The revenue collected through the levy is only increasing at the rate of yield improvement.

End point royalties

End point royalties (EPRs) are currently collected at the point of transaction between the farmer and the first purchaser. The first transaction is in many cases with the trader purchasing that grain or the domestic user of that grain. This is not the only point at which the EPR could be collected, as the legislation allows collection of the royalty at any point of the supply chain. This includes offshore users of the grain.

Currently, EPRs are viewed as part of a farmer's costs of production rather than part of the post farm gate supply chain; even though businesses within the supply chain facilitate EPR revenue collection. EPRs are the payments farmers make to wheat breeders for the right to use the superior varieties developed by the wheat breeders.

In the first decade after their introduction, EPR rates for wheat varieties rapidly increased in real and nominal terms (Figure 51). After 2011, EPR rates have plateaued and little change is observed in real or nominal rates, with most EPRs now being set around $3.50/t. At a farm-gate price of wheat of $200/t, most EPRs would equate to 1.75 per cent of such a farm-gate value of wheat.

As EPRs are fixed rather than ad valorem royalties, farmers particularly benefit in any high-priced years, yet conversely contribute a higher proportion of their wheat price in low-priced years. Breeding companies, like farmers, are exposed to the revenue vagaries of climate variability yet they also experience the force of competition from rival breeding companies, just as Australian farmers experience competition from other wheat exporters.

Farmers with large cropping programs have large fixed costs. Similarly, there are potentially large fixed costs associated with establishing a wheat breeding program, so wheat breeding companies tend to concentrate on breeding wheat varieties likely to be widely grown, such as AH varieties (Figure 52).

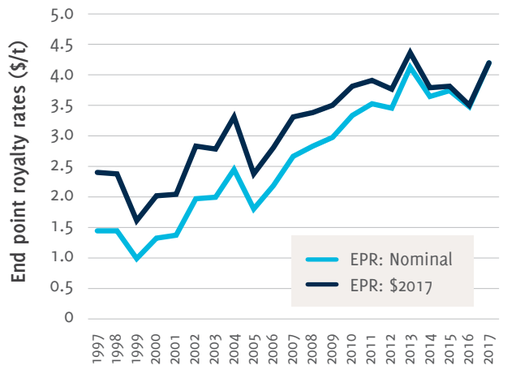


Figure 51 Average end point royalty rates since 1997 in nominal and real terms

Source: Variety Central and Wheat Quality Australia

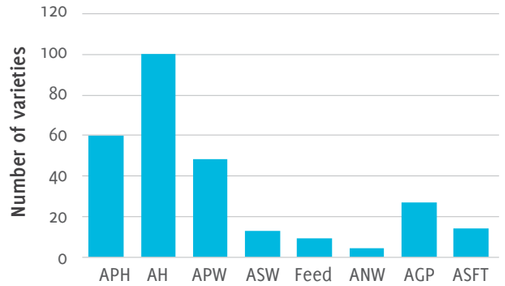


Figure 52 Number of registered wheat varieties in different wheat classes since 1997

Source: Variety Central and Wheat Quality Australia

Although Australia has several different wheat classes (Figure 52) and has the apparent ability to supply different classes of wheat to local and overseas customers, the reality is that there is not equal investment in breeding for each of those classes. Hence, there is a risk that yield relativities between classes could widen over time due to these different levels of breeding investment. A ramification of widening yield trends between wheat classes is that the price premiums that a farmer would need to receive to continue growing a less popular class of wheat will increase. Moreover, if such yield trend divergence occurs, then wheat supply chains will likely experience a reduced incentive or need for segregation by wheat class, as farmers increasingly will grow more of the wheat class that offers the highest margin. Such a commodification of wheat supply chains would reduce the unit costs of storage, handling and transport. It would mean less diversification in the types of wheat grown by farmers and offered to the market, and an increasing concentration risk. Ultimately, it could mean less diverse export market exposure for Australian wheat exporters and farmers.

Organisational costs

In preparing this report, we held discussions with several stakeholders in Australia's export grain supply chains. A consensus of those discussions, somewhat tangential to supply chain analysis, was the perceived need for organisational innovation involving the funding, structure and performance of industry-good organisations. Some of those organisations indirectly or potentially affect grain supply chains. The grain industry is littered with organisational acronyms (e.g. GTA, PA, AOF, BA, AEGIC, GGL, GPA, GIMAF, WQA, GIWA), each with organisational overheads and some with insecure funding. Rationalising the number and function of these industry-good organisations, while ensuring their performance is not jeopardised by insecurity of funding, may deliver a more efficient use of government and industry funds and resources.

After 2011, EPR rates have plateaued and little change is observed in real or nominal rates, with most EPRs now being set around $3.50/t.

Image courtesy: GRDC

Emerging innovations and technologies within supply chains

Often innovations and new technologies arise from responding to a new need or perceiving an opportunity to do a common task differently, more efficiently or more cheaply.

For example, there is an increasing need for the grain supply chain to be capable of identity preservation and/or segregation of different types and qualities of grain. This need arises especially where quality differentiated grain markets are targeted, rather than bulk undifferentiated markets.

Commodity or bulk markets are characterised by minimum common standards, many buyers and sellers and a focus on cost minimisation. By contrast, differentiated grain markets have fewer buyers and sellers, higher costs for segregation or identity preservation, more specific quality requirements and the lure of higher price premiums, yet often higher risks in production and marketing. Providing flexibility and innovation within a supply chain that can accommodate both markets (bulk and differentiated) while securing business profits is no easy task for the owners and providers of grain supply chain assets and services. The Viterra Verrified quality management system is an example of a recent innovation aimed at increasing grain value by establishing confidence in the quality of the product through specified control arrangements. Development of the container trade, similary provide opportunities for innovative product differentiation.

Traditional innovations such as more fuel-efficient, safer trucks and locomotives will continue to underpin the cost efficiency of supply chains. Also, with the increased emphasis on on-farm storage, lower cost methods of storage are likely to emerge.

The main operating cost items of businesses that provide storage and handling, transport and port terminal services are labour, safety and energy costs. Accordingly, any innovation that reliably and cost-effectively reduces these key costs is likely to be embraced by these service providers. So, for example, greater use of automation is likely due to the cost and reliability of automation diminishing relative to the cost of labour and its occupational health and safety requirements.

Illustrations of automation likely to be more fully embraced within grain supply chains include:

- driverless chaser bins that deliver grain from farmers' fields to on-farm storage or grain trucks;
- autonomous cartage of grain from upcountry bunkers to adjacent rail loading facilities;
- grain rail wagons that automatically load and unload;
- driverless shuttle trains;
- greater automation of grain receival and grain quality assessment; and
- more automated grain container port operations.

To illustrate some of the emerging applications of automation, already in 2018 CBH is trialling automation of basic repetitive tasks at eight receival sites around Geraldton in WA's northern grain belt. If the trial is successful, the intention is to introduce the automation at up to 100 key sites potentially halving the number of casual labour jobs at these sites.

Replacement of basic repetitive tasks with automation offers the potential to reduce labour costs and to reduce occupational health and safety costs. However, grain handlers are often a main source of employment in some small country towns, so labour-saving automation is not without social consequences.

Accompanying greater use of automation is likely to be a range of information-based innovations that lower the cost of transactions and service provision in different parts of grain supply chains. An example similar to the OpenSea online marketplace for shipping (referred to above) is Cargo42, a phone and PC app that acts like Uber for grain trucks. Underused local trucks can increase their revenues through transport of grain to port at competitive rates. Internationally, over 85 shipping companies and 380 carriers already are using the Cargo42 platform. These web-based, cloud-based apps that facilitate exchanges and movement of grain along the supply chain will continue to emerge, leading to some job losses and lower business overhead costs. Operating costs will be reduced through greater use of transport assets, with reduced queuing, better scheduling and less downtime.

Another possible source of innovation is organisational innovation. For example, following deregulation of grain marketing in Australia, some traders have entered the Australian market and invested in additional upcountry storage and port terminal capacity. The result, especially in eastern Australia, appears to be the creation of overcapacity in Australia's grain port and storage network and initially expensive payments for access to shipping slots. As a result, the margins associated with grain trading have been thin. Rather than continue to rely solely on competition, it is possible that organisational innovation may mitigate overcapacity in asset duplication. This would avoid a commercial 'war of attrition' where incumbents act to stifle infrastructure investment by competitors, even if it means retaining uneconomic receival sites or port terminals. These competitive strategies can deliver a more expensive supply chain than might otherwise arise through organisational innovation such as 'coopetition'.

Coopetition occurs when companies interact for mutual benefit where there is a partial congruence of interests. Coopetition involves cooperation to achieve an outcome more valuable to the individual companies than would otherwise occur if they only competed. Often, coopetition occurs when companies jointly invest in targeted infrastructure or jointly demand regulatory review for their mutual benefit or co-invest in research and innovation while competing still more widely for market share. The advantages of coopetition can be cost reductions, resource complementarities and greater innovation. However, difficulties also exist, such as avoiding uncompetitive collusion, ensuring equity in control, ensuring equity in risk and maintaining trust. More transparent metrics around Australian supply chains may facilitate the development of coopetition.

An example of possible coopetition would be the incorporation of on-farm storage within the network strategy of supply chain owners. Just as farmers outsource their grain marketing or agronomic advice to consultants, so too could farmers with large investments in grain storage outsource the maintenance of their grain quality testing or grain-drying equipment, grain insect control and grain quality monitoring to a centralised grain handler. The centralised grain handler, in some circumstances, could also co-invest with farmers in permanent or temporary storage to their mutual benefit.

A fundamental issue affecting the development of innovations and technologies applicable to grain supply chains is whether existing providers of supply chain services have sufficient incentives to commit funds to R&D that may yield valuable outcomes. This important issue deserves a separate review. Australia, by international comparison, already has relatively expensive supply chains (see White et al., 2015, Kingwell et al., 2016a, Kingwell 2016b). Developing and applying innovations and technologies is one way of reducing the expense of supply chains. A corollary is the need to ask the question: Are there sufficient incentives for R&D investment to improve the cost-efficiency of supply chains? Hence, in this report, we recommend that this question be answered. If there are impediments to R&D investment in supply chains, then policy or institutional changes need to occur to address any such impediments.

Competitiveness of Australian supply chains

Most of the wheat revenue received by Australian grain farmers comes from sales of wheat in international markets.

To sustain those revenues requires Australian wheat to remain attractive to international buyers. Hence, Australian wheat needs first to remain affordable and second fit-for-purpose; that is, having characteristics required or desired by end users. Affordability is affected by many factors, not all of which are under the control of the Australian wheat industry. These factors include:

- the Australian dollar's exchange against the US dollar and the currencies of other wheat exporters, noting that wheat is internationally traded in US dollars;
- the costs of sea freight from wheat production regions to export destinations;
- the relative costs of wheat production in countries that export wheat;
- the relative costs of wheat supply chains in each country that exports wheat;
- the types of wheat exported by each country;
- the relative profitability of wheat production versus other possible uses of wheat lands (e.g. oilseed or livestock production) in each country that usually exports wheat; and
- the type and magnitude of assistance provided by government to wheat producers and participants in the export supply chain.

Costs of wheat production in Australia

The costs of producing wheat differ depending on the state, the region, the season, the grower, the paddock, the adopted technologies, the inputs applied and the overall size of the wheat program. Hence, in practice there is no one uniform cost of wheat production. Rather, there is a distribution of wheat costs of production, even within a farm due to soil type, weed burden and rotational differences. It is not possible due to data and time limitations to capture all these important features of costs of wheat production. So, for this section, we generated typical or illustrative costs of wheat production for each region, such that these costs are a reasonable general representation of each region's cost of wheat production.

At an aggregate level, there has been a structural shift towards more efficient, less costly production, mostly triggered by droughts in the 2000s (Figure 53). The real cost of grain production over the past decade has been roughly $100/ha cheaper than in the 1990s (ABARES 2018). Drought curtailed input use and encouraged farm rationalisation, forcing out some inefficient or debt-laden operators. The learnings from these drought years, and the shift in industry efficiency, have persisted during better seasons enabling the cost of grain production on a per hectare basis to remain low.

Farm amalgamation has led to larger farms, enabling these businesses to benefit from size technologies and economies of scale, leading to lower unit costs of production in real terms (Figure 54).

The costs of production by location are presented in Table 10. While the costs are presented as single fixed estimates, in practice they are highly variable from year to year. The cost per tonne is affected by seasonal conditions and management responses to those conditions, as shown by unit costs at different yield deciles. The expected total cost in Table 10 is representative of a production season with median yield and associated agronomic practices. While costs of production are often presented in terms of cost per hectare, instead we refer to the cost of producing a tonne of wheat. This provides consistency with supply chain costs that are described in terms of costs per tonne.

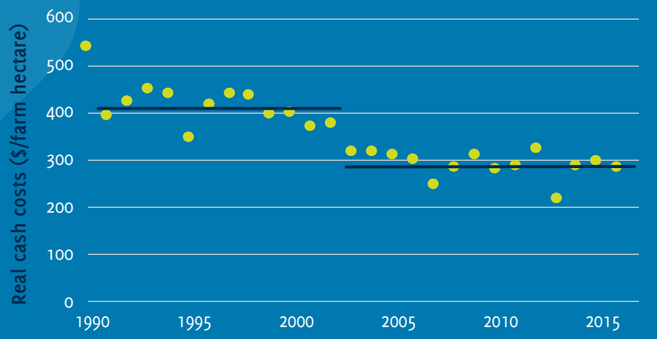


Figure 53 Australian grain farm cash costs, 1990–2016 (constant 2016 dollars)

Source: ABARES (2018)

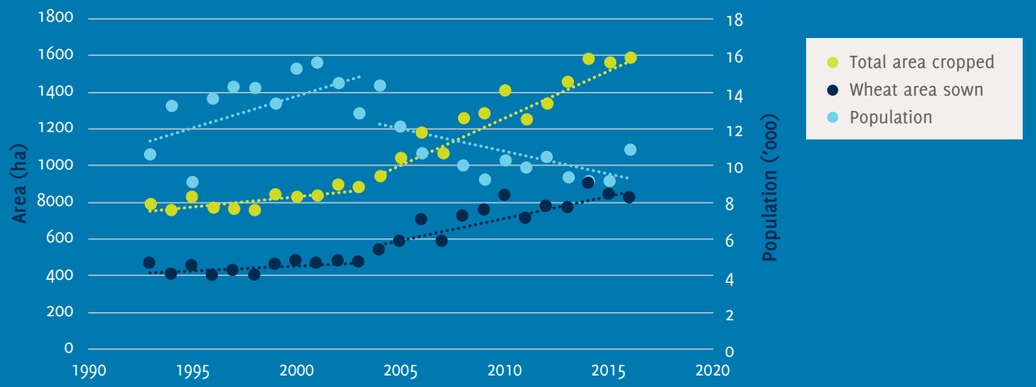


Figure 54 Number of farmers in the wheat and other crops industry, and average crop area and wheat area per farm in that industry in Australia, 1993–2016

Source: ABARES (2017)

Image courtesy: Ben White

Table 10 **Expected costs of production by location**

State	WA			SA			Vic		NSW			Qld		
Location	Medium	Low	High	Medium	Low	High	Wimmera	Mallee	Central west	Riverina	Northwest Slopes	Roma	Emerald	Dalby
Expected total cost ($/t)	162	211	191	178	205	144	145	123	167	226	302	127	193	187
Costs ($/t) @ yield decile														
Decile 2	242	339	310	314	300	282	308	219	344	496	450	266	348	379
Decile 5	162	211	191	178	205	144	145	123	167	226	302	127	193	187
Decile 8	108	132	118	101	141	73	69	69	81	103	203	61	107	92
Yield (t/ha)														
Median	2.4	1.9	2.3	2.7	1.5	4.0	2.5	1.9	2.5	2.7	1.5	3.5	2.0	2.1
Coefficient of variation	0.2	0.3	0.3	0.3	0.3	0.2	0.4	0.4	0.3	0.4	0.3	0.3	0.4	0.4
Variable costs ($/ha)	**336**	**340**	**339**	**380**	**263**	**475**	**266**	**182**	**358**	**500**	**388**	**341**	**335**	**337**
Fallow management	25	25	25	20	25	25	25	25	25	25	25	23	23	23
Planting	49.9	50.5	50.3	78.0	71.0	85.0	26.0	15.2	32.2	48.9	40.1	57.0	57.0	57.0
Nutrition	98.2	99.4	99.1	89.3	27.2	151.4	56.3	32.3	80.7	117.6	58.2	175.0	175.0	176.0
Crop protection	80.3	81.2	81.0	136.9	86.9	155.2	71.4	49.5	77.0	118.4	105.5	39.0	39.0	39.0
Harvesting	50.1	50.7	50.6	50.0	50.0	50.0	50.9	36.8	75.7	102.8	77.2	23.0	23.0	23.0
Other	32.2	32.6	32.5	5.6	3.1	8.3	35.9	23.4	67.7	87.7	81.8	23.0	17.0	18.0
Fixed costs ($/ha)	**51**	**55**	**100**	**100**	**45**	**100**	**100**	**55**	**60**	**100**	**55**	**105**	**51**	**55**
Total costs ($/ha)	**387**	**395**	**439**	**480**	**308**	**575**	**366**	**237**	**418**	**600**	**443**	**445**	**385**	**391**
	Planfarm Bankwest Benchmarks	Planfarm Bankwest Benchmarks	Planfarm Bankwest Benchmarks	GRDC/PIRSA[a]	GRDC/PIRSA	GRDC/PIRSA	ABARES: AgSurf	ABARES: AgSurf	ABARES: AgSurf	ABARES: AgSurf	ABARES: AgSurf	Qld DAF[b]	Qld DAF	Qld DAF
				Med	**Low**	**High**	**Wimmera**	**Mallee**	**Central west**	**Riverina**	**Northwest Slopes**	**Darling Downs**	**Central Highlands**	**Maranoa**

[a] PIRSA – Primary Industries and Regions South Australia
[b] Qld DAF – Queensland Government Department of Agriculture and Fisheries

Source: ABARES, 2018; QDAF, 2017; PIRSA, 2017; Planfarm, 2017

Table 11 lists the costs of wheat production and associated supply chain costs for Australia and some of its main competitors in the South-East Asian markets that are the principal destinations for Australian wheat exports. The cost estimates in Table 11 are based on AEGIC and GRDC research from 2013 to 2017 and represent a snapshot for the circumstances occurring at each point in time. Total costs and cost components vary due to a range of factors such as exchange rates, yields and the volumes of grain exported each year. Despite this variation, supply chain costs are consistently about 30–35 per cent of the total costs for all countries and all years, except for Canada. In Canada, supply chain costs are especially high due to the long rail journey required to move grain from the Canadian prairies to the Port of Vancouver.

Australian supply chain costs are higher than most of its competitors, except for Canada, yet some components of Australian supply chains compare favourably with competitors. Transport from upcountry receival sites to port and port charges are the highest components of supply chain costs in all countries and represent 55–70 per cent of total supply chain costs. These are the components of the supply chain that growers have least control over yet they can be greatly affected by government policy, labour costs, regulation and investments by private firms and governments.

Table 11 **Estimated supply chain costs in Australia and other wheat export competitors, 2013–17**

	2013	2014		2015–16	2016		2017	
Costs ($/t)	**Australia**	**Canada**	**Australia**	**Ukraine**	**Russia**	**Australia**	**Argentina**	**Australia**
Cartage farm-site	8.9 (12%)[a]	10.7 (10%)	8.9 (11%)	4.3 (8%)	3.5 (6%)	7.8 (9%)	2.9 (5%)	7.8 (11%)
Upcountry handling	11.9 (16%)	15.2 (14%)	14.4 (17%)	7.7 (14%)	9.2 (16%)	18.4 (22%)	13.2 (21%)	10.4 (15%)
Storage	6.8 (9%)	17.7 (16%)	8.9 (11%)	2.9 (5%)	5.1 (9%)	9.0 (11%)	1.4 (2%)	5.0 (7%)
Transport upcountry to port	21.6 (29%)	46.8 (44%)	27.8 (33%)	13.3 (23%)	15.5 (28%)	26.7 (32%)	29.5 (47%)	23.6 (33%)
Port charges	21.2 (29%)	13.9 (13%)	21 (25%)	23.8 (42%)	22.4 (40%)	19.9 (24%)	15.5 (25%)	21.7 (30%)
Levies and check-offs	2.9 (4%)	3.0 (3%)	2.8 (3%)	4.9 (9%)	0.10 (<1%)	2.8 (3%)	nd[b]	2.8 (4%)
Total supply chain cost	**73.3**	**107.3**	**83.8**	**56.9**	**55.8**	**84.6**	**62.5**	**71.3**
Production cost	**nd**	**139.1**	**157.1**	**133.0**	**121.1**	**148.3**	**140.0**	**148.8**
Supply chain proportion	**nd**	**0.44**	**0.35**	**0.30**	**0.32**	**0.36**	**0.31**	**0.32**

[a] Percentages in brackets are the cost item as a proportion of the total supply chain cost.
[b] nd — no data

Source: AEGIC and GRDC

In absolute terms, the international competitiveness of Australian wheat currently suffers from relatively higher costs of production at the farm level. And its supply chains are also relatively more expensive compared to those in the Black Sea region and in Argentina. Herbert (2017) provides a further illustration of Australia's higher farm costs of wheat production (Table 12). Of the wheat exporting countries listed in Table 12, Australia has the highest farm costs of production, in US dollar terms, over the study period (2011–15). Hence, it is no surprise that countries in eastern Europe, the Black Sea region and Argentina play increasing roles as sources of wheat exports.

Moreover, of further concern to the Australian grain industry is the magnitude of new investment underway in several of these countries, and in well-established competitor nations like Canada especially. These investments are increasing these countries' grain export capacity relative to Australia and are reducing the costliness of their supply chains.

By illustration, since AEGIC's last report on the Canadian export grain system (White et al., 2015), substantial investments have occurred at the Port of Vancouver and in Canada's rail system. The stimulus to additional port terminal investment can be gauged by noting that the average terminal capacity turnover ratio at the Port of Vancouver was 16.8 over the period from 2011 to 2013, yet from 2014 to 2016 this ratio jumped to 30.9, signalling the need for additional investment. Accordingly, as shown in Table 13, additional port storage and new grain terminals are under construction at the Port of Vancouver, boosting export capacity by 12mmt.

In Canada's rail system, newly designed rail wagons are enabling unit trains of up to 144 wagons to convey up to 14,400t per train rather than the previous norm of around 10,000t. Institutional arrangements regarding maintenance of the air-brake systems in unit trains at upcountry elevators has greatly improved the speed of coupling and departure efficiency and facilitated train crew management. Rail loops are being constructed at some upcountry terminals and at the new G3 terminal at the Port of Vancouver (see photograph on page 88), further facilitating grain transport and handling. The G3 terminal will include a rail loop track capable of holding three 134 wagon-unit trains and the terminal will be operational in 2019.

Table 12 **Farm costs of wheat production in various wheat exporting countries or regions, 2011–15**

Country or Region	Cost per tonne of wheat produced (US$/t)					
	Seed	**Fertilisers**	**Pesticides**	**Labour**	**Machinery**	**Total**
Australia	**10**	**43**	**29**	**28**	**57**	**169**
East Europe	11	26	10	17	56	120
EU	13	36	22	33	53	160
North America	16	46	21	13	49	154
Argentina	13	41	17	4	34	109
Uruguay	28	46	24	4	62	165

Source: AEGIC and GRDC

Table 13 New investment in export port terminal capacity at the Port of Vancouver, Canada

Company	Port storage expansion ('000t)	Export increase (mmt)
Richardson Pioneer	80	2
Global Grain Group (G3)	180	6
Parrish and Heimbecker and Paterson Global Foods	75	4

Source: Richard Gray (personal communication)

The cost of rail transport of grain in Canada has fallen in real terms by 7 per cent over the past five years, with the prospect of falling further. Canada's rail system is well-maintained and it triggers complementary investments such as illustrated by the rail loops for the new G3 port terminal. By contrast, much of the grain rail network in Australia has been inadequately maintained, as evidenced by line closures and some safety-based rail-use decisions.

Infrastructure investments in competitor countries ensure that cost-efficiency in Australia's export grain supply chains needs to remain a priority for the Australian grain industry. Without least-cost pathways to port, the competitive strength of Australia's export grain industry will be subject to further erosion.

Harvey-Sutton (2017) argues that Australian investment in infrastructure, especially roads, has often been more linked to political rather than economic imperatives. Consequently, often these investments lack coordination and strategic prioritisation, being purposed mostly to deliver political outcomes. The Australian export grain sector is not well served by such myopia in infrastructure provision. Indeed, if major investments in supply chain infrastructure are not well-coordinated and appropriately prioritised, then the required efficiency or productivity gains will not be achieved, and the Australian grain sector will be poorly served.

Technical illustration of the G3 terminal under construction at the Port of Vancouver.

Source: : http://g3terminalvancouver.ca/survey-1/

RIGHT: New grain storage and processing facilities under construction in Ukraine.

Concluding remarks

Since 2014, key stakeholders (including grain handling and marketing companies, farmers and road and rail infrastructure providers) have undertaken major investments in Australia's grain supply chains. However, this report finds that the real costs of many export grain supply chains in Australia have only slightly decreased or remained stable.

Of importance, we note there are differences between states in the effective cost to grain producers of supply chain services, with WA grain growers particularly benefiting from CBH's rebate policy in the past two years.

What should concern the Australian export grain sector are the high costs of its supply chains (in spite of large investments by many parties) and its high costs of grain production relative to those of emerging competitors. These features limit the geographical reach of Australia's grain exports and increasingly mean that the Australian industry must concentrate on premium-paying nearby markets and delivering wheat with characteristics not easily or cheaply replicated by competitors.

The challenge from overseas competitors is unlikely to dissipate. Significant investments are underway in their supply chains that will further challenge the competitiveness of the Australian industry. Actions the Australian industry can undertake in response to this challenge are mentioned within this report and in previous AEGIC reports, with some of these actions listed as recommendations in this report.

The challenge from overseas competitors is unlikely to dissipate. Significant investments are underway in their supply chains that will further challenge the competitiveness of the Australian industry.

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