
Australasian Agribusiness Review

2022, Volume 30, Paper 3

ISSN: 1883-5675

Wheat Quality Management in a Post Single-Desk Era: What Canada Could Learn from the Australian Case?¹

Monika Çule^a, Richard Gray^b and Viktoriya Galushko^c

^a Department of Economics, University of Regina, Saskatchewan, Canada.

^b Department of Agricultural and Resource Economics, University of Saskatchewan, Saskatchewan, Canada.

^c Department of Economics, University of Regina, Saskatchewan, Canada.

Abstract

Until 2006, the Australian Wheat Board played a central role in providing numerous industry goods, including a comprehensive system of quality assurance. We examine the evolution of the wheat quality management system in Australia in the post single-desk era to gauge what lessons might apply to Canada that is reviewing its current wheat industry regulations. While industry collective actions in Australia were successful in maintaining its wheat classification and grading standards, the provision of other industry goods related to wheat quality management, market intelligence and market engagement developed more slowly. The most recent consolidation of many of these industry functions under Grains Australia Limited signifies the need for coordination and joint provision of complementary industry goods, achieved more effectively in a centralized structure. Furthermore, the levy-funded Grains R&D Corporation has played a critical role in the funding of grains industry goods in Australia. Perhaps the greatest lesson to be learned from Australia, as Canada contemplates regulatory changes to the Canada Grain Act, is that while the grains industry in Australia explored many options, it eventually redeveloped a well-funded, effective wheat quality management system that provides many of the same functions we currently see in Canada.

Key words: Wheat quality, complementary industry goods, marketing deregulation, AWB.

Introduction

To modernise the regulatory framework of the Canadian grain industry, the Canada Grain Act of 1985 is currently being reviewed (AAFC, 2021). Since 1985, Canada's grain industry and marketing channels have undergone significant changes including the removal of the single-desk marketing powers of the Canadian Wheat Board (CWB) and the implementation of Plant Breeders Rights. In the face of these structural changes and amid heightened competition from emergent grain suppliers from the Black Sea region, Canadian stakeholders must decide how best to amend its legislative regulations to effectively and efficiently serve the current and likely future needs of Canada's grain industry.

¹ We would like to acknowledge the research funding by Genome Prairie and Genome Canada to support this work under Activity 5.4 of the CTAG2 research project. We also thank the anonymous reviewers for their useful comments and suggestions.

One critical consideration of the review is the effect of regulation on the perceived quality of Canadian grains. As mandated by legislation, the Canadian Grain Commission (CGC) has played a very important role in the management of Canada's grain quality not only through its direct role in variety registration and management of grades, but also through its interactions with other organizations and industry stakeholders that impact grain quality. In the case of wheat, a main grain grown in Canada, the CWB played a central role in wheat quality management until 2012 both through direct activities in marketing, logistics and customer service and through its support for the Western Grains Research Foundation and for the Canadian International Grains Institute (CIGI). With the elimination of the CWB, many of these activities have been shifted to other industry players including the private grain trade, the newly established provincial wheat commissions, and the CIGI through its new funding model. The current review of regulation is taking place in the context of an increasingly competitive international market, changes to the broader quality management system, and the changing roles and incentives within the grain marketing value chains.

In this paper, we draw some lessons from Australia after the dissolution of the Australian Wheat Board (AWB), which played a central role in wheat quality assurance and the provision of numerous industry goods.² More specifically, we look into the evolution of Australia's Wheat Quality Management System (WQMS), which was applied across the Australian wheat supply chain following wheat marketing deregulation in 2008 and the development of private breeding companies. We undertake a case study employing qualitative data collected through expert interviews with key organizations. Based on publicly available sources, we conducted additional analysis on various developments in the industry that occurred beyond the interview time.

Our research concludes that the removal of the AWB widely impacted the quality assurance system. Activities deemed valuable by all industry players, such as wheat classification and managing the wheat trading standards, continued to be provided although through different organizational arrangements. However, with respect to activities for industry goods more prone to free-riding, such as market intelligence, generic promotion, and technical training in using Australian wheat, adequate provision was less keenly supported. The Grains Research and Development Corporation (GRDC) has played a leading role in funding³ and facilitating the work of organizations that provide these industry goods.

The remainder of the paper is organised as follows. The next section outlines the research design and theoretical framework for understanding deregulation and the evolution that followed. The third section outlines the structure of WQMS in Australia and identifies important aspects of the new system. The fourth section outlines several emerging issues in the deregulated environment that have important implications for wheat quality. Lastly, we make a few concluding remarks and offer some general lessons for the Canadian context.

² Industry goods share public goods attributes since they have some degree of non-rivalry and non-excludability. More specifically, these impure public goods can be considered as club goods. Griffith et al. (2014) argue that value chains are conceptually like clubs. Matters of value chain failures, goods, and externalities are relevant in a number of agricultural contexts. For instance, Mounter et al. (2019) explore how to fund value chain RD&E in the red meat industry, while Rohr et al. (2020) argue how to deal with/internalize value chain externalities into agricultural industry models.

³ The residual of the Wheat Industry Special Account (WISA) has been one of the funding sources, as was the case for GAL (GRDC, 2020a). WISA was established by the Commonwealth government in 1989, when the domestic wheat market was deregulated. The funds were raised through a mandatory levy on wheat sales intended to create the capital base for privatization of AWB (ABS, 2006). The remaining funds are currently managed by GRDC on behalf of the Commonwealth government.

Theoretical Framework for Deregulation, Study Design, and Data Collection

In this case study we employed qualitative data collected through expert interviews with representative organizations across the supply chain from the pre-production stage to end-use customers, including wheat breeding companies, producer organizations, representative marketing organizations, and handling and export companies. In addition, we ensured participation of crucial organizations such as Wheat Quality Australia that manages the wheat classification process, Grain Trade Australia that administers the trading standards, and the Australian Grain Export Innovation Centre that provides other quality-related industry services. Participants were identified by utilizing public information available on organizations' websites as well as following leads from academics, public servants in agriculture, and senior managers/executives in the wheat industry. In addition, we used the snowball sampling technique by which a few initial participants suggest additional ones.

To avoid bias, the primary aim of the interview questions was to obtain factual information regarding the inner workings of the Australian system rather than experts' opinions on the issues examined. As reasonably expected, many participants, particularly those in leadership positions, had agency (choice and deliberate intent) in their organizations which meant that their position on various issues could potentially influence the functions of their organizations and the level and quality of coordination among other parts of the system. These interviews took place in various locations in Australia (Canberra, Melbourne, Adelaide, Sydney, and Perth) in 2016 and 2017. In compliance with research ethics requirements, we maintain the strict anonymity of our participants when referring to them in our analysis. Additional analysis on industry developments which occurred beyond the interview time was conducted based on publicly available sources.

An institutional and organizational economics framework guided the design of the interview questions and our approach to analysing the information obtained. Our reference to institutions and organizations follows the definition by North (1990).⁴ In addition, to fully appreciate the nature of changes and the various challenges arising from deregulation of export wheat marketing in 2008, we considered deregulation as an institutional change in the form of displacement,⁵ which according to Mahoney and Thelen (2009) can be radical (due to an external shock) or more gradual.

In the Australian context, one could argue that this displacement was a combination of both gradual and abrupt changes. Various study participants noted that the grain handling industry actively lobbied for marketing deregulation, while pressures to maintain the single-desk came primarily from grower communities,⁶ hence the continuously shifting public attitudes on the issue. However, the Cole Inquiry findings on the Oil for Food program of AWB served as a strong catalyst in abruptly removing the single-desk marketing function in 2006 (Honey, 2012).⁷

⁴ Institutions are defined as the humanly devised "rules of the game" that govern and constrain human interactions; and organizations are defined as the deliberate (political, economic, social, educational etc.) bodies or group of individuals that pursue a common objective. Inevitably these two come together in a symbiotic relationship since institutions determine the set of opportunities that an organization could pursue, and feedback effects ensure that evolving organizations initiate institutional changes to further their interests (North, 1990).

⁵ Mahoney and Thelen (2009, p. 15) define displacement as "the removal of existing rules and introduction of new ones." Displacement takes place in a political context of weak veto possibilities interfacing with low level of discretion in interpretation/enforcement of the institution. Under such conditions, insurrectionary agents who actively and openly aim for displacement are likely to be better positioned to overwhelm efforts of those that want the status quo.

⁶ Another grower representative organisation, Grain Growers (GGL) which had a considerable ownership share in Grain Corp did not favour the single-desk model.

⁷ The AWB single-desk marketing powers were removed in December 2006. During the interim period toward the deregulated marketing regime, these powers rested with the Minister of Agriculture until the Wheat Export Marketing Bill, which gave growers the right to market their wheat with any accredited exporter of their choice, became effective on July 1, 2008 (Honey, 2012).

Grain handling companies that were advocating for wheat marketing deregulation and that were already engaged in marketing and trading other grains were prepared to take advantage of new economic and marketing opportunities for wheat. While the marketing function was the chief purpose of this institutional change, the provision of other industry functions that were normally undertaken by AWB did not carry much weight in the decision to deregulate or in the transition plans. As one participant noted, the insufficient attention to address the industry good provision within the marketing freedom legislation was not for lack of acknowledging their benefits in public consultations; rather, it was mostly due to the difficulty in quantifying them in monetary terms. Nevertheless, their value became increasingly apparent at the start of the deregulation period when their provision was often fragmented, inadequate and uncoordinated.

Brynjolfsson and Milgrom (2013) show the importance of complementarity of functions in enhancing the economic performance of an organization. Additional functions to the core function are provided jointly within an organization and are encompassed within a “matrix.” Organizational performance is enhanced when these functions are complementary in nature, so that the joint provision creates positive synergies. In such complex interdependent structures, changes that affect one part of this “matrix” can adversely affect the entire system since the capacity to enhance the overall performance is curtailed.

As Fulton (2011) showed, under a single-desk regime, the administrative fiat played an important role in the accumulation and delivery of grain. Export wheat marketing was AWB’s core function. In addition to this core function, AWB’s functional “matrix” included (i) variety registration and classification, (ii) quality management to ensure a quality product, (iii) market intelligence that directed sales to the highest value market, (iv) generic promotion of Australian wheat, and (v) end-user technical training for using Australian wheat. In concert, these activities ensured continuity and stability in meeting future commitments and customers’ expectations in buying a trusted product.

AWB services had the characteristics of public goods with some degree of non-rivalry and non-excludability. In the presence of positive externalities and free-riding, a single-desk organization like AWB was well positioned to provide them at an adequate level. Provision of these industry goods required obtaining relevant information and developing mechanisms to effectively disseminate the information across various structures of the system. As the sole seller, AWB had developed long standing relationships with the final or end-use customers, and therefore, was well positioned to receive relevant and timely feedback from them with relative ease. Additionally, internal coordination for transmitting the relevant information across the various structures of the organization was achieved more effectively and at a lower cost since all these functions were embedded within the same (fairly centralized) organization.

After deregulation, under a competitive marketing regime with multiple players providing the core function of grain trading and marketing, price signals mostly drove market transactions and exchanges of market participants. Grain trading is more transactional in nature whereby pricing signals drive grain accumulation and sales in any given crop year (Fulton, 2011). Although the effective transmission of market signals across the supply chain becomes more difficult to obtain, it is critically important to achieve coordination and efficiency.

With free-riding, complementary functions previously performed alongside the core function become too costly for a single player to provide for the entire industry. Any player that undertakes generic promotion or provides technical training for using Australian wheat will not be able to benefit solely or sufficiently from such costly activity. Similarly, gathering market intelligence creates an advantage which can only be maintained if not shared with others. As a result, from the onset of deregulation

there was a need for collective industry actions to provide the industry goods that were traditionally AWB activities.

The key activity of managing wheat quality throughout the supply chain, including administering wheat classification, can add value to all industry participants. A market-based classification system requires that information pertaining to quality flows effectively across all relevant supply chain participants. Information channels pertaining to wheat quality between breeders and growers, growers and marketing/traders, marketers and end-users, and end-users and breeders are all important in ensuring that supply chain participants are responsive to market changes/challenges and the supply chain is efficient and effective in creating value. The effectiveness of such information flow in both directions partially depends on the willingness of key industry players to participate and cooperate in building and maintaining well-defined information feedback processes.

When the interests of players across the supply chain are well aligned towards increasing value for all, and individual benefits are captured accordingly, such feedback processes can be established. However, since these processes have public goods features, incentives for free-riding can potentially diminish their provision and result in a breakdown of information flow. While players may acknowledge the need for collective action to further the common interest, financing the provision of the industry goods and establishing cost-sharing mechanisms can often be problematic in practice (Sandler, 1992). The data collected through interviews support these notions, and the following analysis outlines the concrete challenges and their resolution.

The Wheat Quality Management System in Australia

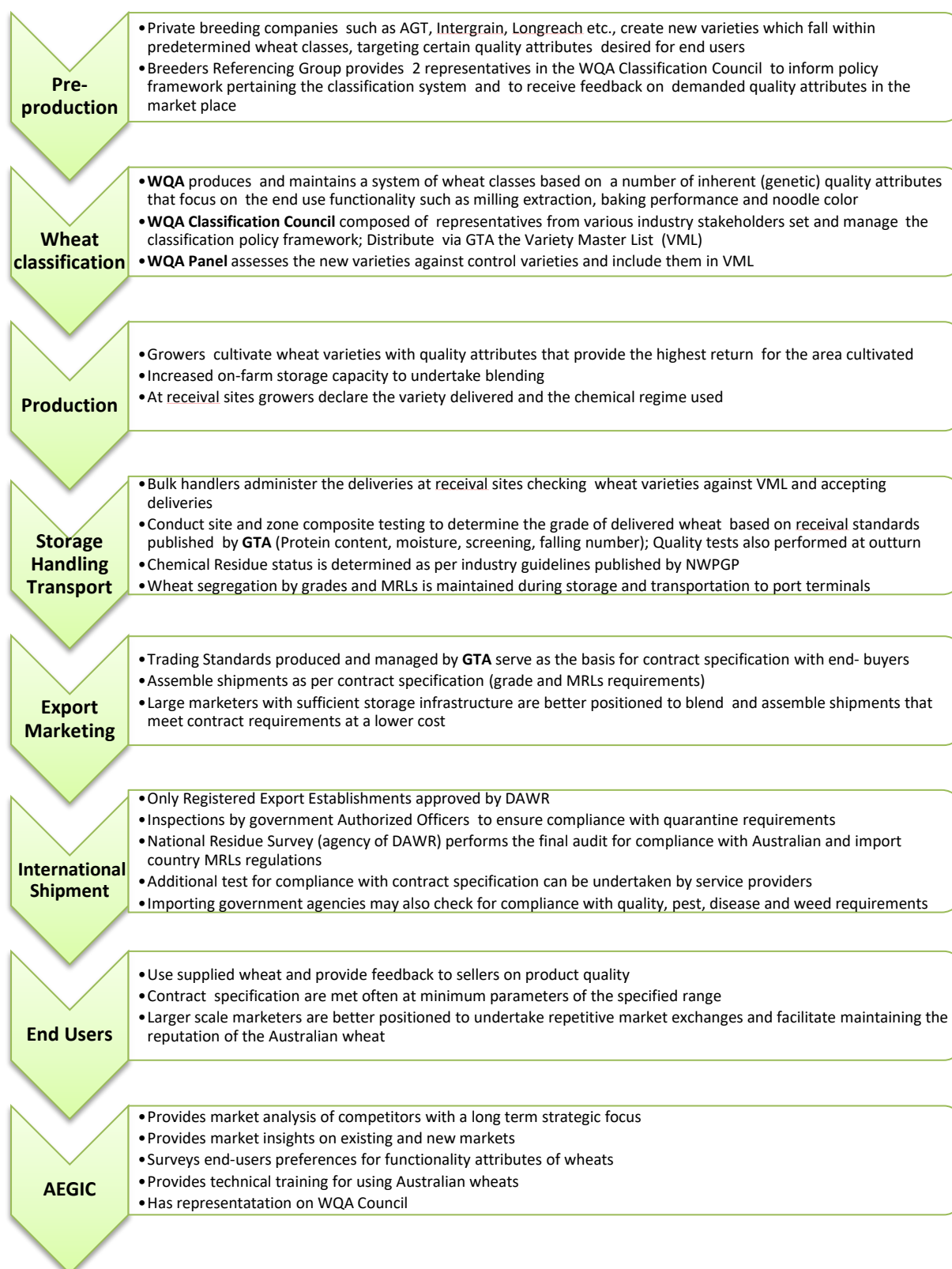
This section outlines the management of Australia's wheat quality⁸ system (WQMS) across the supply chain. We pay special attention to wheat classification since it provides critical links between the pre-production (breeding) and production stages of the supply chain on one side, and the breeders and quality attributes valued by end-users on the other. We also identify other industry goods that facilitate various feedback information channels needed in an integrated and well-functioning system.

Figure 1 depicts the WQMS across the supply chain and provides a summary of its functions. Subsections that follow profile key organizations in the system with the interview data serving as a major source of information. To identify the organizational evolution of this system, whenever appropriate, we compare and contrast its various aspects with the single-desk regime, in which AWB played a central role. Given its critical role, we start our discussion with Wheat Quality Australia (WQA) and its focus on wheat classification.

Australia's wheat classification system

Australia's wheat classification system plays a central role in managing wheat quality. First, the wheat classification system provides clear guidelines to breeding programs on targeting varieties that can be grown in Australia and have quality attributes that are desired by end-users both domestically and internationally. Second, it ensures that growers cultivate wheat varieties demanded in the marketplace to maximize their returns in terms of combined yield and quality. Well-defined wheat classes with certain expected quality attributes provide assurance to international and domestic end-users that they are purchasing a product which will perform in a predictable manner within a narrow range of functional performance.

⁸ According to WQA (2021a), "Wheat quality refers to the performance of grain to meet requirements of its use in flour milling, breads, noodles, cereals, pasta or animal feed. Quality is defined by the genetic attributes of the variety grown and the environmental conditions during the crop growth."

Figure 1. The Australian wheat quality management system across the wheat supply chain

The classification process involves assessing the inherent quality characteristics of new varieties focusing on processing and end-use performance. The assessment is based on 30 quality parameters that are evaluated against control varieties (high and low performers) for three growing seasons

(WQA, 2016). New varieties are assessed through a comprehensive classification process which, when successful, concludes with their inclusion in the Variety Master List (VML) (WQA, 2016, 2021b). Since only VML varieties are accepted at delivery for human consumption in domestic and/or export markets, registering a variety is practically essential for ensuring its production and sale.

The new variety is classified in one of the wheat classes listed below and within one of the following classification zones: Western, Southern, South Eastern, and Northern. The Australian wheat classes comprise three main categories:

1. Premium Hard wheats: Australian Prime Hard APH, Australian Hard AH, and Australian Premium White APW.
2. Multipurpose wheats such as Australian Standard White, ASW.
3. Specialty wheats including Australian Premium Durum ADR, Australian Soft ASFT, Australian Standard Noodle ANW, and Australian Premium Noodle APWN (WQA, 2021c)

Prior to deregulation of marketing, the wheat classification system was created and managed by the AWB. An expert panel, composed of cereal experts, managed and administered the new variety registration process. Breeding programs (either the state-funded programs prior to privatization or private breeders afterwards) had a Breeders Group as a point of access to the AWB policies pertaining to classification. The market information, in terms of desired functionality by end-users, was fed back to breeding programs through the interaction of AWB with the Breeders Group.

After losing its single-desk powers, there was no reason for the AWB to continue providing a function with industry-wide benefits at its own private cost. Various study participants indicated that consensus emerged quickly among industry groups that maintaining the classification system was very important to maintain the good reputation of Australian wheat. At the onset of deregulation, the expert panel was folded under GRDC, an arrangement that allowed the expert panel to continue its work amid structural changes in the industry. In 2012, GRDC and Grain Trade Australia (GTA), the industry organization whose membership comprises grain marketers, partnered in founding the WQA as an independent company responsible for managing the wheat classification process. WQA owns and publishes the Variety Master List (VML) every September on its website (WQA, 2021).

WQA's core business takes place through two bodies: the classification panel and the classification council. The panel assesses new varieties submitted for classification as described earlier. As expected, its work has a very strong technical aspect, and it occasionally provides input to the council regarding technical aspects of a policy issue under consideration (WQA interview data).

The council is responsible for setting the policy framework for classification. As noted by various participants, the council holds considerable discretion on setting classification policies. Although the WQA's board of directors is the final body that approves or rejects the policies brought forward, almost all the work leading to policies is undertaken by the council.

The council consists of various industry stakeholders that provide in-kind (uncompensated non-financial) contributions. More specifically, at the time of the interviews in 2016 the council members consisted of two representatives from wheat breeding, four marketers (GTA members by the virtue of co-ownership), one from the baking/milling sector (end-user sector) and one from the Australian Export Grain Innovation Centre (AEGIC). Since then, the composition of the council has altered, an additional (fifth) representative from marketers, three grower representatives and one representative from GRDC, perhaps reflecting the WQA's funding model by which GRDC funds the whole operation despite the joint ownership with GTA (WQA, 2021; Interview data).

Although the overarching goal in assuring quality is important for all council members, despite their industry affiliation, players sometimes have competing interests regarding more specific issues pertaining to the classification policy. The classification requirements for Late Maturity Alpha Amylase (LMAA) is a good illustration of competing positions taken by different stakeholders, such as breeders and marketers.⁹

While the WQA ownership resides with GRDC and GTA as equal partners, the funding arrangements have changed considerably overtime. At the start, WQA partners contributed equally and initially had much higher financing requirements since WQA aimed to follow the United States Wheat Associates (USWA) model. GTA financed its portion through substantial fees paid by its largest members (typically the grain companies such as GrainCorp, CBH, Viterra, Cargill, etc.). Despite the initial strong support for the classification system, overtime, GTA's largest contributing members questioned the value proposition in regard to extending any activities beyond classification. The funding arrangements for WQA to support a widening of its scope eventually broke down.

Reflecting on this development, one participant indicated that a better path would have been for WQA to expand incrementally by originally starting with the classification function, which had received wide support from the industry. Upon demonstrating the added value to the industry, the organization could have grown gradually to provide other services to meet additional needs. Such gradual growth could have ensured a more systematic, comprehensive, and financially viable provision of other industry goods related to quality.

Amid negotiations to resolve the funding of WQA in early 2014, GRDC took the lead and entirely financed the WQA activities pertaining to classification. The GRDC is jointly funded by producers and federal government contributions and represents the parties most interested in benefiting from, or responsible for, the provision of this public good. The new funding arrangement did not alter the ownership structure as it was deemed important to maintain traders' participation and representation in the WQA council. To this effect, GTA provides in-kind contributions through the work of council members. The WQA funding arrangements are expected to continue in this or similar forms for the foreseeable future. A potential model that requires breeders to pay registration fees for new varieties to cover the operating cost of the panel was also contemplated (WQA Interview data). Overall, despite its early difficulties, WQA has established itself as an industry organization that provides a critical function in the WQMS.

The wheat quality management system along the supply chain

Breeding

Privatization of breeding, facilitated by the introduction of end point royalties and R&D technological advancements through genomics, are the major drivers shaping the nature and performance of new varieties in Australia. The main varietal developers for wheat are private breeding companies, most notably Australian Grain Technologies (AGT), Intergrain,¹⁰ LongReach, and S&W Seeds. In the last

⁹ While the current LMAA requirement was strongly advocated by traders, breeders viewed this quality problem more as an environmentally expressed trait than a genetic one to be assessed through classification. Including such a requirement in the classification process required testing for it which created considerable bottleneck issues for advancing lines in trials. This has caused breeding programs to discard elite lines with other attractive quality attributes. To resolve the issue, GRDC has supported LMAA research which could better assist WQA in placing LMAA requirements in a way that strikes the proper balance in controlling for LMAA while ensuring that elite lines are not discarded prematurely (various participants' interviews data).

¹⁰ AGT and Intergrain originated from the privatization of state-run breeding programs in the early 2000s, with GRDC and universities taking an active ownership stake in them. Therefore, the federal government and producers, through their

decade, there has been a consolidation of the private breeding activities through various mergers and acquisitions.

The predetermined wheat classes, currently managed by the WQA, continue to guide wheat breeding programs. Wheat breeders clearly stated in their interviews that in developing new varieties they target a certain wheat class and therefore would strongly focus on the parameters required to fall into that class. Therefore, maintaining the integrity of wheat classification is very important for breeding activities.

Breeding companies have organized a Breeders Referencing Group (BRG) as a lobbying group to provide a unified voice for common concerns in dealing with various governmental and industry entities. Two BRG representatives in the WQA council inform the classification policy from the breeders' perspective. In addition, BRG participation in the council ensures that breeders receive feedback on quality attributes demanded in the marketplace, an essential feature of a market-based classification system.

Although such representation creates opportunity for market-based feedback, the question is whether market signals for quality attributes are adequately generated by parties with direct exchanges with end-users, such as the milling or baking sector, and whether this feedback is transmitted in a timely and effective manner to breeders. In other words, does the current system have the ability to gather intelligence regarding the desired functionality traits in various markets and the end-users' willingness to pay for these desired attributes and then provide that information to breeders ensuring these attributes are targeted accordingly in breeding programs? This issue is discussed later.

Production

Growers participate in the WQMS by choosing to cultivate varieties that provide the highest return on the area cultivated. Persistent price premiums for higher quality wheats often attract growers to adopt these varieties, provided they are acknowledged to be high-yielding varieties. However, if the price premium for higher quality wheats is insufficient to compensate for any relative yield reduction, a grower may opt to grow the higher-yielding, lesser quality variety. This issue is further discussed later.

Growers also participate in the WQMS through being required to accurately declare the variety they deliver and the chemical regime they use in the production of that variety. Accurate variety declaration is important for end-point royalties collection, which ensures breeders are properly rewarded for their varieties. If growers inaccurately declare as a variety with a lower royalty rate, this cost-saving practice can prove difficult to deter. Furthermore, misdeclaring varieties could result in deliveries being comingled with varieties belonging to classes with different quality attributes and could undesirably affect the functionality expected by end-users.

If misdeclaring is widespread, such practice becomes potentially problematic for quality. A few participants noted that although cases of inaccurate variety declaration have occurred, this is not a prevalent issue, and it does not seem to be strategic. More specifically, investigated cases of misreporting of varieties revealed the errors were primarily due to random errors, such as the grower's inaccurate information about their seed mix or information errors by third parties responsible for transporting (trucking) the deliveries (Interview data).

funding and governance of GDRC and the federal government through its support for universities, have a large stake in these breeding companies.

Lastly, farmers also play a role in affecting the quality of the wheat stored on their farms. Since deregulation has increased marketing opportunities for growers, on-farm storage capacity has expanded considerably, especially in eastern Australia where a myriad of domestic market opportunities prevail. High-quality storage capacity in steel silos has doubled in the period 2013-18 (White et al., 2018).

On-farm storage can affect quality in various ways. Firstly, the physical condition in which the wheat is stored can directly affect its quality, and investments in better quality storage can protect grain quality. Secondly, the capacity to store wheat mitigates, to some extent, the volatility of production and price due to weather conditions and affects the availability of certain qualities of wheat, such as feed wheats or prime hard wheats. On-farm storage also enhances grain blending opportunities, from which growers can derive financial benefits, as discussed later in this paper.

Storage, handling and transport

Currently the Australian supply chain is characterized by a high degree of vertical integration of grain storage/handling and marketing and an increase in foreign ownership (Stretch et al., 2014; White et al., 2018). This is the result of decade-long changes, such as the deregulation of domestic marketing in 1989, privatization of state handling authorities in the early 1990s, consolidation of the grain handling and storage industry in the early 2000s, deregulation of export marketing in 2008, and further consolidation through a number of takeovers and acquisitions by multinational grain companies in the early 2010s.¹¹

Grain companies play an important part in the WQMS (Figure 1). The main players in this space are the vertically integrated regional monopolies/duopolies with GrainCorp in the Eastern seaboard, Emerald Grain and Cargill in Victoria, Viterra, a subsidiary of Glencore, in South Australia, and Co-operative Bulk Handling (CBH) and Bunge in Western Australia (White et al., 2018). In addition, a number of domestic and international agribusinesses which operate in the export marketing space are not fully-fledged grain companies, and as a result, must rely on “the system” or the infrastructure of the main grain regional monopolies to handle their grain (Interview data).

As per the definition of quality, the environmental conditions during crop growth determine many aspects of quality. This environmentally determined aspect of quality is captured by the harvest grading, also known as the Industry Trading Wheat Standards, which are measured at receival sites when the wheat is first delivered or when the grain is out-turned. Site and zone composite testing are performed to measure physical characteristics of wheat such as protein content, moisture, screenings and test weight (WQA, 2021a; GTA, 2016). Along with variety declarations, these tests are the basis for determining the wheat grade (receival standard) used in the segregation of comingled wheat. The wheat is stored, handled and transported to fulfil contract specifications for shipments.

Prior to deregulation, the AWB published the Wheat Trading Standard, which is administered in conjunction with bulk handlers. After deregulation, this function was picked up by GTA, whose core mission is to facilitate grain trade. GTA’s membership is open to all companies within the grain industry.¹² Since the grain handling and storage companies had administered the standards at harvest delivery prior to deregulation, the publishing and administering of the trading standards by GTA in the new marketing regime seemed a natural fit. Study participants stated that consensus developed quickly among GTA members and, without any government directive, the GTA took over this function

¹¹ See White et al. (2018, p. 31) for a chronological outline of all mergers, acquisitions and ownership changes.

¹² GTA had officially changed its name in early 2009 from National Agricultural Commodities Marketing Association (NACMA). NACMA was created in 1991 and had gone through a number of changes in the period before deregulation of export wheat marketing, most notably the withdrawal from advocacy and lobbying activities, a move that quickly opened NACMA’s membership to other companies within the grain industry. The name change to GTA, along with a sharper focus on trade functions, was taken in direct response to marketing deregulation (GTA study participants).

when the Marketing Bill came into effect on July 1, 2008. The GTA has been administering the trading standards since then, and the annual review of such standards has become part of GTA's core business (GTA, 2020). This is an important role that GTA plays within the WQMS.

Another contribution of GTA is the development of the Industry Code of Practice which was funded by the then named Australian Government Department of Agriculture and Water Resources. The Code is a self-regulating mechanism that provides guidelines and expectations for managing and assuring the quality of grain as it moves along the commercial supply chain. The Code has been mandatory for GTA members since 2014, and Australia is the only OECD country that has developed such a code (GTA, 2016, 2020).

The GTA also serves as the secretariat for the National Working Party for Grain Protection (NWPGP),¹³ a body responsible for providing management in the area of grain storage, chemical use, market requirements and chemical regulation in Australia (GTA, 2016; NWPGP, 2020). While the work of the NWPGP is independent and is funded by GRDC, the GTA facilitates the distribution of relevant information produced by NWPGP and supports the NWPGP annual conference (NWPGP, 2020; GTA study participants).

In the Storage, Handling and Transport stage of the supply chain (Figure 1), bulk handlers participate in the WQMS through operating receival sites. First, they check the delivered wheat varieties against the VML (published by WQA and distributed by GTA) in order to accept the delivery for human consumption and to collect end point royalties. Next, they conduct site and zone composite testing for various quality parameters to determine the grade of delivered wheat based on GTA's receival Trading Standards (various participants from grain companies). The zone testing is typically conducted in zone laboratories of large bulk handlers at different locations to ensure that quality parameters are accurately measured at receival sites. This practice not only ensures that testing equipment at receival sites are recalibrated properly when a discrepancy occurs, but it also collects intelligence about the grain quality of available stocks at various locations (GrainCorp study participant).

In addition, at the receival sites, chemical residue status is determined as per industry guidelines published by NWPGP. Once the grades and chemical residue status are determined for compliance with Maximum Residue Limits (MRLs), the accepted deliveries are segregated. The segregation by grade and MRLs is maintained during storage and transportation, and quality tests are performed again at outturn.

Export marketing and international shipment

In the export marketing stage of the supply chain (Figure 1), marketers participate in the WQMS by assembling shipments as per their client contract specifications. The GTA's Trading Standard that serves as the basis for determining the harvest grade along with MLRs guides the contract specifications. In the single-desk regime, the AWB as the sole export marketer of wheat, had control of all grain stocks and was well-positioned to draw deliveries from a large number of storage locations and blend them to assemble shipments that met contract specifications. In a deregulated environment, the large vertically integrated marketers, which have sufficient storage infrastructure both inland and at port, are better positioned to blend wheat deliveries and assemble shipments that meet contract requirements at a lower cost than non-integrated marketers (Various participants).

In the international shipment stage of the supply chain, several additional activities ensure quality. First, wheat exporting is only undertaken by a Registered Export Establishment approved by the Department of Agriculture, Water and the Environment (DAWE). In addition, before shipment,

¹³ See <http://www.graintrade.org.au/nwpgp> for more details regarding the work of NWPGP.

inspections by government authorized officers are undertaken to ensure compliance with quarantine requirements. A final audit for MRLs compliance (both Australia's and the importing country) is undertaken by the National Residue Survey, a DAWE agency (GTA, 2016; Various participants).

Lastly, before shipment, a buyer or a seller, can conduct additional tests on the cargo through an independent service provider to ensure that the shipment complies with contract specifications. Such a practice is more applicable to small sellers. Many participants expressed in different ways that the established grain handlers and export marketers have strong incentives to manage the quality and assemble shipments according to contract specifications as maintaining a reputation of being a reliable supplier is important for their future trading.¹⁴ In addition, the costs of not meeting contract specifications on any individual loaded vessel can be significant in terms of time and money. Since this self-enforcing system is sufficiently powerful, independent inspections of shipments to ensure they comply with contract requirements are atypical but nevertheless remain available to parties. In addition, many importing countries have agencies that check for compliance with quality and pest, disease and weed management requirements.

End users

Finally, end-users play an important role in the WQMS. End-users of Australian wheat comprise a diverse body of international and domestic bakers, millers, and feedlot operators. Their satisfaction with the quality attributes of purchased wheat, particularly for milling and baking, is important for marketers to maintain their competitive position and market share.

In the single-desk regime, the AWB had developed stable access to certain markets and was well-positioned to preserve the good reputation of Australian wheat. This was further supported by the market conditions at the time, where state-to-state trading with a number of Middle Eastern countries was a major and stable market for Australian wheat. However, in the new marketing environment, overseas buyers may change their Australian sellers or look to do business with other international competitors. Fostering long-term relations can help maintain market share. To that effect, the main marketers, such as the vertically integrated grain companies that are heavily invested in grain trading, are incentivised and better positioned to undertake repetitive market exchanges to prove themselves as reliable suppliers and to develop and maintain the reputation of the Australian wheat as a quality product. Having said that, some of the international marketers may supply contracts on an optional origin basis which allows them to fill the contract with wheat from multiple export sources, as long as they meet contract specifications. Hence, multi-national grain traders like Glencore (Viterra) or Cargill are unlikely to have any special allegiance to Australian wheat and its quality.

Another important aspect of end-users' involvement in the WQMS is related to the feedback that sellers receive regarding the quality of the product. Such information provides important market signals to all supply chain players, from sellers to growers and further upstream to breeders. As previously outlined, producing such market intelligence has industry-wide benefits. This is an instance of the complementarity nature of various industry goods (quality and market intelligence) that when provided jointly, enhance each other's benefits.

In the single-desk regime, end-users' feedback was conveyed by and to the AWB with relative ease, particularly because the AWB deliveries typically met and often exceeded quality requirements of contract specifications, a statement universally expressed by study participants. While a number of participants also spoke favourably of AWB's ability to engage without much difficulty in market development and market intelligence in the international market, there were others who accurately

¹⁴As one participant said "The established firms have made investments and they want to stay in this business for the long haul."

pointed out that state-to-state trading with Middle Eastern countries, which did not require great efforts in market development, constituted a considerable share of the AWB business.

Our reading in 2016 of competing claims in interviews is that at that time, market intelligence was not being provided in a systematic way at the industry level. A number of participants stated that large grain companies conducted their own market research for their own intended goals and as expected, such information was not shared with the industry. This market intelligence was more about maximizing the returns within the given crop year. It was more narrowly focused on pricing and annual production that depended on weather conditions and similar dynamics about international competitors, considerations that varied greatly from year to year and tended to be short term.

AEGIC

Many participants spoke of the industry lacking adequate market intelligence with a longer-term view and identified AEGIC¹⁵ as an organization, which at that time, was increasingly playing a role in that space to fill that need. A number of participants also indicated that AEGIC was also seen to potentially fill the gap in providing international millers/bakers with technical training about the use of Australian Wheat (Interview data).

AEGIC annual reports of the last five years clearly demonstrate AEGIC's vision to become a leading organization in providing the grain industry with "market insight, innovation and applied technology" (AEGIC, 2020a). Study participants from AEGIC interviewed in 2017 spoke on how the organization was strongly positioning itself to service the industry by undertaking medium to long term (5-10 year) market analysis and providing strategic insights in developing new markets. In addition to export market intelligence, the technical training for end-users, an important industry function for which there was a considerable need after deregulation, has become an important part of AEGIC's core functions (AEGIC, 2020b).¹⁶

In the last few years, AEGIC has undertaken a number of studies with a strong focus on the competitiveness of the Australian grains industry. These include analysis on the cost of Australian grain supply chains as well as comprehensive market analysis for a number of international competitors such as Russia, Ukraine and Argentina. More recently, AEGIC has undertaken analysis of market dynamics for important buyers (for instance Indonesia and Vietnam) with particular focus on the types of wheats and relevant quality attributes that will be demanded in the future (AEGIC, 2020a).¹⁷ Additionally, AEGIC had directly engaged with end-users such a flour millers, brewers, maltsters and processors by surveying to understand their preferences and desired functionalities of grains in various Asian markets (AEGIC, 2019a).

Such activities facilitate the information feedback flows that are critical in a market-driven classification system, and AEGIC is playing a critically important role in the current WQMS. Overall, AEGIC's important work in servicing the export grains industry is viewed positively by the industry stakeholders (AEGIC, 2019a). However, its journey to reach the current maturity in scope of its functions and the high regard from other industry stakeholders has not been without challenges.¹⁸

¹⁵ AEGIC was founded in 2012 by the Department of Agriculture in Western Australia and GRDC with the mission to increase value to the Australian grain exports industry. These continue to be its primary members.

¹⁶ See <https://www.aegic.org.au/australian-industry/> for the numerous events and market engagements, as well as training and education opportunities undertaken by AEGIC.

¹⁷ See the AEGIC website at <https://www.aegic.org.au/resources/reports/> for the numerous published reports on these important issues.

¹⁸ Some study participants noted that AGEIC's early work, which explored issues of quality as experienced by end-users in the international markets in the newly deregulated environment, was received with suspicion by major marketers. Questions were raised regarding the report's proper context, methodology, and the way these stakeholders were engaged. At that

In 2016, AEGIC changed its strategic direction focusing sharply to establish itself as an organization that adds value to the industry and is committed to a collaborate and meaningful engagement with various stakeholders (AEGIC, 2016). These changes have gradually and positively shifted the views of industry players regarding AEGIC's role and its important contribution to the industry, as mentioned above.

Emerging Trends in a Deregulated Environment

This section outlines developments in the new deregulated marketing regime that have important implications for quality. While some of these are directly and closely related to deregulation, others are due to the ramifications of domestic and international market dynamics. In our analysis, we raise a few speculative questions for the future.

Front loaded system provides fuzzy signals for quality wheats

Marketing deregulation has altered the nature of wheat market transactions. A few participants pointed out that a major trend observed in the deregulated environment is the high speed at which the market is cleared: most of the crop is sold within the first and second quarter after harvest. A major contributing factor was the way port/shipping stems were allocated under Port Access Regulation.¹⁹

Under Port Access Undertakings, until 2015, allocation of shipping stems took place well in advance of shipping using primarily an auction system. Even with the long-term agreements which replaced the auction system under the Port Access Code, exporters made shipping stem commitments well in advance. With such early commitments, there was a high incentive to clear the crop as fast as possible once it was harvested. As a result, the system became very front-loaded with shipping stems being far less used later in the crop year. As one participant stated "...when the Board (i.e., the AWB) was the single-desk institution, except in exceptional years, there was always crop carried through the storage system into the next season and now that is absolutely the exception."

One implication of a front-loaded system and less carry-out stocks is that variable weather conditions will inevitably create volatility in the volumes transacted increasing price volatility and leading to varying spreads on premiums for high quality wheats. For instance, in a moist year that results in high yields and hence a large crop, clearing the crop within the crop year will lower the price. Typically, in a moist year, the protein content of any variety is lower, so the high protein stock available is limited resulting in a high premium for it. On the contrary, in a dry year with a smaller crop, the general protein content of wheat is higher, and the price of wheat is often higher. This is especially true in eastern Australia due to its large domestic demand for feed and food grains and feed grain demand often being very high in dry years. In these dry years, when protein levels in wheat are generally higher, the price premium for high protein wheat lessens, as observed recently. This situation could be further exacerbated if growers in a dry year cultivated high protein wheat varieties due to a previous high premium received in preceding moist years.

time, this controversial issue adversely affected the AEGIC prospect of receiving recognition and credibility from major traders as an entity that could effectively provide market intelligence for the industry. Numerous external reviews, short term funding commitments and frequent changes in the executive leadership in the first few years raised some concerns about AEGIC's role in the industry and its financial stability.

¹⁹ Since removal of single-desk marketing, the regulation pertaining to port access has undergone a number of changes. The initial Port Access Undertakings was reviewed in 2015 and was followed by the Port Access Code administered by the Australian Competition and Consumer Commission (ACCC). Some operators are exempted from the Ports Access Code, which is still in place after the ACCC 2017 review (Productivity Commission, 2010; White et al., 2018).

The premium spread is unpredictable and volatile being primarily determined by the acreage planted of high quality varieties, carry-in stocks of high-quality wheat, and the weather conditions during growing and harvest. Carter and Kingwell (2019) argue that premium spreads are mostly affected by local conditions. They found that for ANW varieties, spreads over ASW1 for other classes grown in Western Australia were normally distributed, but the AH1 had the widest range, an indication that hard/higher quality wheats do not consistently pay a substantial premium.

While we have no data for premium spreads of prime hard varieties which are primarily grown in the Northern zone, it is reported that the production volatility in the last 20 years in the Eastern seaboard (Queensland, New South Wales, and Victoria) has been much higher than in Western Australia (Kingwell, 2019a). One may expect that in such situations, the prime hard premium spreads may be even more volatile. Overall, the volatile and unpredictable premium spread provides a very fuzzy signal to growers as to whether it is worth growing high quality wheats. Therefore, farmers' decisions on what variety to grow are mostly driven by expected yields and/or expected revenues. Many participants indicated that choosing a high yielding variety of a mid-protein wheat is the most common practice as it often achieves high or acceptable profitability per hectare.

A few participants mentioned the AWB's Golden Rewards Program that incentivised growers to cultivate high quality wheats by consistently paying a significant premium for higher protein content of deliveries within the same wheat class, something that is no longer available in the new marketing regime. In addition, AWB followed a multiyear approach by carrying-over stock in the next crop year, and thus, reduced volatility in quantity and price for a certain wheat grade. If such an approach is followed, it could result in consistently extracting more value from higher quality wheats and preventing their use for feed.²⁰ This requires however, a concerted effort from the major marketers that have the storage capacity to carry the crop forward and that are exempt from the Port Access Code, and hence, may be more incentivised to take such a multi-season approach. Growers also have access to various handler programs to supply targeted specifications and to see the premiums. Many growers can segregate grains straight off the harvester, and thus, they have an option to either blend their own grain or segregate for a potential future delivery. Whether such a multi-year strategy is commercially attractive or not for both growers and grain handling companies depends on the opportunity cost of storing grain and the relative frequency of wide spreads for high quality wheat.

Another closely related issue concerns the lack of information regarding stock availability along the supply chain during the trading cycle. Various participants indicated that such information, which would be very useful for trading decisions, is lacking in a deregulated regime. Despite concerns being raised primarily from growers and smaller grain traders, most parties involved, especially the dominant grain handlers and marketers (CBH, Viterra and GrainCorp), are not inclined to disclose such information. The main concern of handlers is that the grain buyers use the information to talk down the offer price. Nevertheless, such information can be accessed on a pay for service basis for those who can afford the service. For instance, Profarmer or Australian Commodity Forecasters provide a subscription service that includes these data. Also, shipping stems include the export volume numbers. By our own observation, we were unable to find, for the purpose of this study, any publicly available data (even historic ones) on quantities of wheat produced/exported by grades within government databases. In contrast, export volume information by grade type is publicly available for Canadian wheat on an ongoing basis (with some time delay) as part of grain statistics published by the Canadian Grain Commission (CGC, 2019).

²⁰ One participant spoke of missed opportunities due to the one cycle approach. For instance, the rainy season in the East coast in 2011, resulted in a high production year and an exportable surplus of feed wheats. The domestic price reduced to \$120 per tonne from \$300 in the previous season; the entire supply was cleared and sold at a discount, even competing with United States corn in Vietnam.

Delivery to specifications at the minimum requirements

Many participants stated that in the new marketing regime there has been a shift in sellers increasingly delivering to minimum levels as allowed within the contract specifications. It is important to note that grain, including wheat, can be traded several times at the same location before it moves along the supply chain. Most parties, regardless of holding a GTA membership, use GTA trading contracts which are readily available at the GTA website.²¹ Although parties may make some modifications or even have a more tailored contract, GTA contracts are widely used in Australia, which has considerably reduced transaction costs of trading grain. The contract specifications for quality are typically those determined by the trading standards such as protein content, moisture, screenings, etc.

Many participants indicated that contract specifications regarding “the grade” were typically met at the minimum specifications. Participants who had milling and processing backgrounds also indicated that deliveries usually lacked variability in the parameters within the range of the contracted grade. For instance, H2 grade has an allowable protein range from 11.5 to 13 per cent (GTA, 2020).²² In a contract that specified a shipment of H2, the protein content would meet the lower bound of H2 specification but be no higher than 11.5 per cent.

We understood from many participants that before deregulation, AWB would typically assemble shipments somewhat above the minimum specifications. In this hypothetical case, an AWB delivery of H2 would be somewhat higher than minimum of 11.5 per cent. In contrast, a delivery in the post single-desk era consists of a blended batch averaged right at 11.5 per cent.

For longstanding AWB customers that had come to expect quality beyond the minimum specifications, this shift has contributed to a perception of a lower quality product being offered by Australian exporters. Since perceptions (whether or not founded) are critically important in maintaining the reputation of Australian wheat as a quality product, the interview data reveals some controversy surrounding this issue. Depending on who you discuss this issue with, a number of points were raised.

A few participants stated that AWB had “over-delivered” on quality, meaning that consumers received incrementally higher quality at no cost to them. Such practice created expectations that when buying Australian wheat, one would normally expect a quality over and above what was paid for. However, when new marketers delivered shipments to minimum specifications, it is understandable that some customers’ expectations were no longer met.

There were also claims that buyers’ complaints for quality were likely used to negotiate more favourable prices. In such a situation, adjustments either in the form of lowering buyers’ future expectations for quality or increasing buyers’ willingness to pay more for a higher contracted quality would eventually resolve any gaps in quality and expectations. In other words, the market would eventually take care of the problem through the pricing mechanism and contract specifications.

A few participants from the marketing organizations stated that if buyers would specify more clearly and more explicitly their desired quality requirements in contract terms, marketers would certainly deliver accordingly. It appears that this practice has increasingly become the norm. Overtime, to reduce the variability from blending across different grades, buyers have learned to be more proactive in tightening the specifications of protein parameters in their contracts.

²¹ See <http://www.graintrade.org.au/contracts> for various contracts.

²² Other quality parameters (e.g., maximum moisture content, minimum weight, maximum screenings, and minimum falling number) are the same for both H1 and H2 (GTA, 2020). These factors generally do not constrain contract specifications being met, so they can be provided at little cost to marketers in most years.

If AWB was indeed “over-delivering” in quality, were there any benefits (not measured in price) for doing so? One obvious explanation relates to transaction costs²³ which are nonzero and take various forms such as searching, negotiating and enforcing a contract (Williamson, 1985). In the transaction cost literature, repetition and reputation are important mechanisms that lower transaction costs and facilitate market transactions more efficiently. One could argue that fostering customer loyalty by “over-delivering” to repeat customers (millers and bakers), cemented that repeat business and so secured future sales.

These mechanisms also mitigate adverse selection, which arises when the buyer, unlike the seller, cannot fully observe the quality attributes of the product (Akerlof, 1970). Some participants with closer knowledge in the milling sector revealed that meeting the contract requirements at the minimum specifications masked another problem which may not be resolved with the pricing mechanism we described above since there was still an incentive for sellers to increase revenues by blending different grades.

Suppose that in the previous hypothetical contract, the delivery for an H2 contract was at 11.5 per cent protein, a legally acceptable level. This meant that the blend at 11.5 per cent contained batches of higher than 11.5 per cent protein (within the H2 grade), but also batches of lower than 11.5 per cent, or wheats truly belonging to the APW1 grade. These batches from a different class would underperform in terms of desired functionality attributes such as extensibility, water absorption, dough strength etc., all of which are very important to end-users, but are not directly measured in grade parameters.

Instead, this is a matter of an incomplete contract. Wheat grades are determined based on a set of quality parameters (protein content, moisture, screenings, falling number, etc.) which are physically measured in an objective way. Nevertheless, these are not direct indicators of functionality (extensibility, water absorption, colour, dough strength, etc.), but are proxies for certain desired functionalities that are difficult to measure or observe when wheat is traded. While the seller has more information on the composition of the blend, the end-users cannot observe the quality attributes that are relevant to them until they use the product.

As long as these imperfect measures of functionality are kept within a given wheat class, using these proxies to specify contracts will not lead to an incomplete contract. However, the contract becomes incomplete when the seller, motivated to get a higher price or margin of the sale, blends wheats from other classes that underperform in terms of functionality despite legally meeting the contract specifications of a given grade.

To work effectively, even an explicit contract requires some implicit understanding between the parties (Mahoney and Thelen, 2009).²⁴ One could argue that before deregulation, there was an implied but shared understanding between the AWB and end-users that the contract specifications honoured certain quality attributes implicitly linked to a certain functionality. In the new marketing regime, however, there is no reason to believe that the same shared understanding between end-users and new marketers would continue, particularly when sellers could earn higher revenues from a different practice.

Is it practically possible to design and implement a more “complete” contract to address the issue? The most obvious method would be for buyers to increase their contracted requirements for the grade

²³ Even in the case of a commodity like wheat, transaction costs are nonzero; for instance, measuring the physical attributes is considered a form of transaction cost.

²⁴ Although Mahoney and Thelen refer to Durkheim’s notion of “the non-contractual basis of contracts”, to make this argument in a broader institutional context, the same logic could apply to a specific contract.

parameters (which are proxies for functionality) to ensure a minimum level of performance. To mitigate deliveries at the minimum specification of the grade range, buyers should typically avoid contracting for specifications on the edge of two different grades or classes. For instance, a buyer needing a H2 wheat grade should aim for a 12.5 percent protein specification to ensure the baking performance of the delivered blend. This prevailing practice has been enabled by the increased ability to segregate wheats, sometimes right from the harvester on the farm. For sellers (producers and marketers), the issue is to what extent they need to segregate wheats to meet the largest market opportunity while minimizing the cost. As noted earlier, this practice developed overtime and has currently become the norm.

Since the functionality of measured attributes can differ across wheat varieties, another way to achieve a more complete contract is to specify particular varieties known to have certain functionality attributes. This has already taken place in niche markets which have established their own separate supply chain and are able to trace the product effectively to ensure identity preservation. One participant shared the story of a few mills in northern Queensland that would contract directly with farmers to grow certain varieties.

Additionally, there are consistent purchases of APH directly from growers through container trades to China and Taiwan. For these customers, the functional trait of high extensibility and the colour of APH are most suitable for certain noodles of great cultural importance. Hence, they are willing to pay a premium since these functionalities cannot be easily obtained in high protein wheats grown in other countries.

Lack of substitutability is an important condition for developing profitable niche markets for high quality wheats. A few participants stated that these opportunities are more likely to be pursued by small scale players rather than major grain companies that operate on a throughput business model. Unless there are large (voluminous) niches such as the Udon noodle market into Japan, it is less likely that all large bulk handlers will be involved in these markets. However, White et al. (2018) report the increased interest and the marketing shift of GrainCorp, the chief grain operator in the Eastern seaboard, to service highly specialized, high value, and small volume grain markets in the future.

Blending of grades at earlier stages in the supply chain

With bulk handlers also assuming marketing, the desire to capture additional value within the supply chain is only natural. Given the large scale of wheat accumulation and the large capacity to store, these companies undertake blending of grades so that the lower and cheaper grades can be improved and assembled in shipments that fetch a higher price. The incentive to blend lower grades exists for all marketers and those that possess the infrastructure to blend will definitely do so.

Competition drives all players to engage in blending, making it a widespread practice in the bulk-handling stage of the supply chain. Growers also are blending, as mentioned by various participants including farmers. The increase in storage capacity at the farm level, mentioned earlier, is partially driven by the same incentive to receive a higher price or avoid a discount. Since a lot of blending is occurring upstream in the supply chain by farmers and marketers, end-users have lost some of their own ability to blend.

The minimum specifications for delivery of a certain grade and the lack of variability within the grade, a prevalent practice at the start of deregulation, considerably reduced the ability of the millers/bakers who wanted to blend themselves to achieve a certain functionality in a way that is primarily guided by the science of baking. As long as blending is done upstream, better specified contracts or paying higher prices for higher protein will not fully address those millers' concerns, since marketers or growers do

not necessarily command knowledge of blending for functionality, plus protein content is not the only characteristic of functionality end users require.

Is there a way to affect the traders/growers' incentives to reduce blending? One participant from the milling sector suggested that increasing the number of grades within a class and having smaller steps in scaling the grade's parameters (for instance in 0.8 per cent rather than 1.5 per cent increments in protein content) may weaken incentives to bring substantially lower quality wheats into the blend. While this may be a reasonable technical solution, it is a difficult proposition to contemplate. As noted, Trading Standards are managed by GTA, whose main members are the major grain companies. Although there is a process for input by which various industry players (including millers) could make submissions to the GTA Standards Review Committee, there is no indication that milling/baking industry representatives have formally pursued any suggestions of the nature discussed above. Even if that occurred in practice, it is unlikely that GTA would recommend changes that might potentially lessen the trading revenues of its main members. However, as noted earlier, buyers have adjusted their specifications for the desired protein content within a given grade, a practice that has become the new norm.

Increased container trade

Another emerging trend in a deregulated marketing environment is the use of containers. Australia, more specifically the eastern seaboard, is a large net importer of containers and their use in grain export has cost-saving advantages relative to container shipping from other areas. The containerised volume of exports has increased considerably in the last decade with Victoria and Queensland exporting an average of more than 50 per cent of their grains in containers during the 2012-16 period (White et al., 2018). According to our interview data, the volume traded in containers was estimated at about 4mmt of grains in 2016.

At the start of the deregulation period, containerised shipments provided a suitable means of transport for small scale operations, and hence, facilitated entry of small firms. Unfortunately, some new entrants lacked experience and knowledge of the product, industry, and markets. They traded low quality wheats that were rejected by large marketers and were diverted to "the hospital bin," a term used in the industry to describe poor quality deliveries. At that time, the container trade was associated with poor quality product (interview data).

Later, as the benefits of the container trade became more evident, more serious players (Quadra Commodities for instance) developed a number of packing facilities which enhanced the infrastructure to support the container trade on a regular basis. As a result, the volume of container trade grew steadily, eventually overcoming its initial negative reputation. One participant, with intimate knowledge of the containerised business, spoke of various reasons as to why players choose containers. Some overseas buyers could avoid theft and product contamination during transportation to inland end-users' milling sites, an important issue in countries with weak law and order. Additionally, small-scale operations that could not partake in "take it or leave it" costly contracting with rail operators, found the containerised export of grain to be sufficiently remunerative. White et al. (2018) also note that this model has provided smaller start-up companies with a path to grow their businesses and eventually compete with bulk traders.

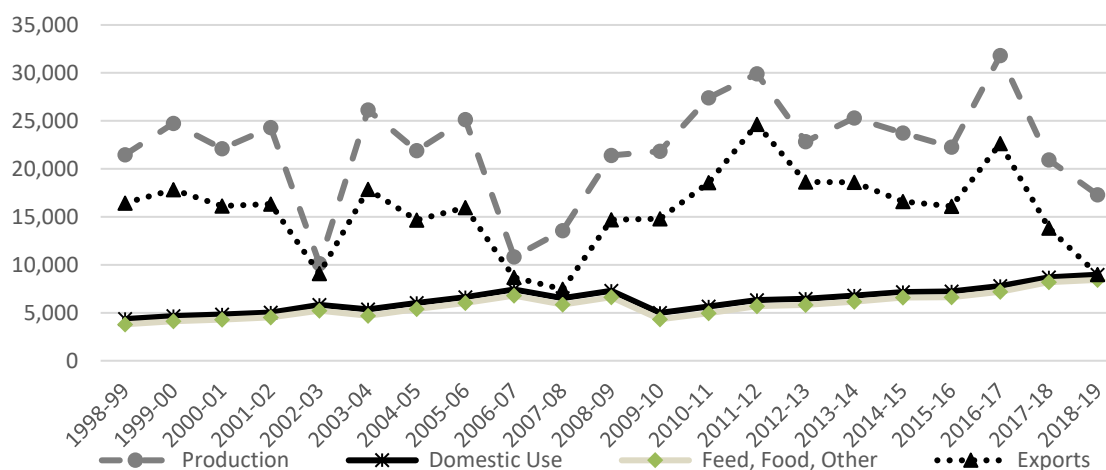
Most importantly, the use of containers has facilitated the movement of differentiated products where guaranteed segregation and identity preservation is critically important in ensuring a premium. In addition, niche markets are often initially best served through containerised sales of grain that facilitate trades of small volumes of grain. However, in 2020, and worsening throughout 2021, there has been a marked escalation in the cost of shipping containers and even the availability of food grade

containers required for the export of food grains (e.g., wheat and pulses). As a result, containerised sales of grain have become unreliable and problematic. Accordingly, in 2021 especially, curtailment of the export of wheat in containers has occurred, lessening the market opportunities for some high protein wheat.

Shifting dynamics in the domestic and international markets

Australia is a major producer and exporter of wheat. Australia's annual production of wheat in the last 20 years has averaged about 22mmt, with droughts greatly affecting production variability. As seen in Figure 2, the domestic and feed use have more than doubled during this period, reaching 8.96mmt and 8.42mmt respectively in the 2018-2019 crop year (ABARES, 2020a). Such increases, primarily in the east coast, are driven by population growth and increasing demand for animal feed, a trend that is expected to continue (Kingwell, 2019b). The steady increase in demand means that surpluses for exports are even more affected by the variability in production, as displayed in Figure 2.

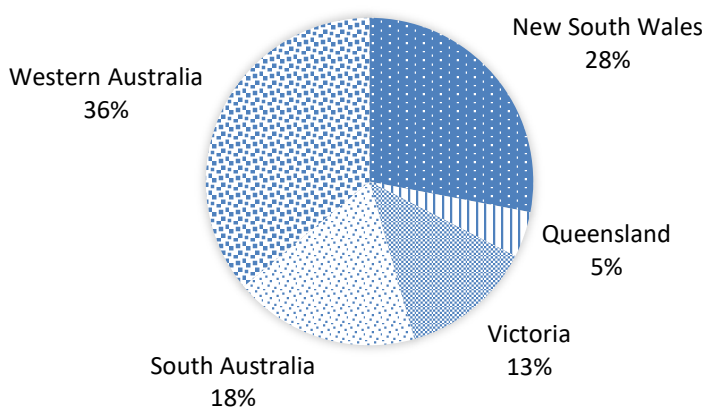
Figure 2. Australia's wheat production, domestic use, feed use and exports (Kt), 1998-99 to 2018-19



Source : ABARES (2020a)

The spatial market dynamics are such that South Australia and Western Australia, which account for 54 per cent of average production (see Figure 3), face relatively low local domestic demand and continue to produce primarily for export markets (more than 85 per cent of their production is exported). The eastern seaboard (Queensland, New South Wales and Victoria) produces on average 46 per cent of Australian wheat (ABARES, 2020b). This includes some of the best quality, premium hard wheats that are only produced in the northern zone (AEGIC, 2019b). In contrast to the western states, this production is primarily destined for the domestic market.

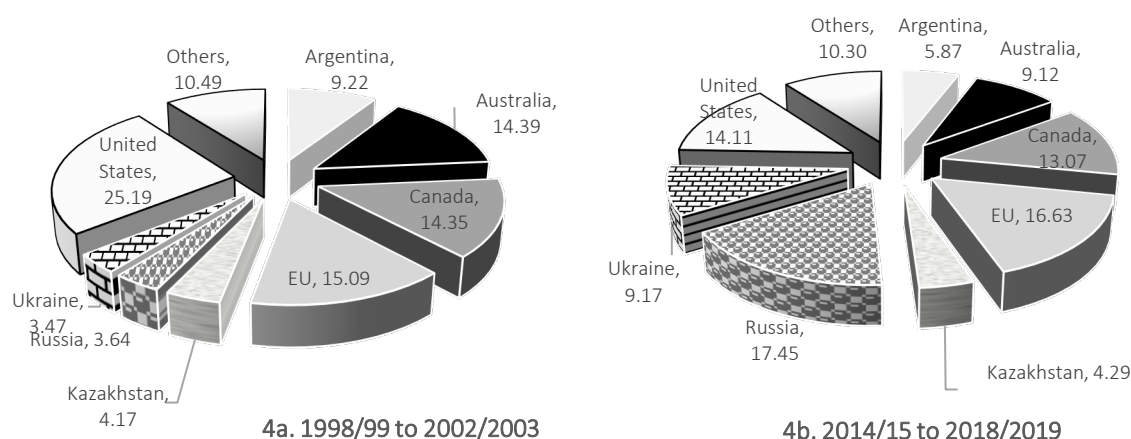
Human consumption in the more densely populated region of Australia's eastern seaboard and its burgeoning livestock industry comprise most of the domestic demand (Kingwell, 2019b). The feed demand, especially in drought years, is often met with the regional production of high-quality hard wheats due to relatively high freight costs for imported feed grain. As a result, the eastern seaboard's export share of wheat has decreased over time, even though the prime hard and hard wheats grown in this region are highly desirable in some export markets (various participants).

Figure 3. Average wheat production by state (%), 2013-14 to 2017-18

Source: ABARES (2020b)

This dynamic in the domestic market begs some important questions related to quality, particularly for the feed class. With the demand for feed expected to rise in the future, should high quality hard wheats continue to partially meet this demand? Currently, feed wheats are basically stocks deemed unsuitable for human consumption.²⁵ Is there scope for breeding programs to develop high yielding, premium feed varieties with functional traits better suited to this end-use that could deliver better feeding outcomes, such as metabolizable energy, fibre, protein etc.? Additionally, if breeders could successfully select and develop such varieties, would these be commercially viable? If the economics are favourable for such feed varieties, would growers who have traditionally grown high-quality wheats, be willing to switch their practices and adopt them?

Turning attention to the international market dynamics, Figure 4 shows that although Australia is a major wheat exporting country, its share of world wheat exports displays a declining trend (USDA, 2019). As noted above, Australian exports are closely related to production fluctuations. Export volumes and market shares decline during periods of drought, but increased competition from other international suppliers can also affect Australia's export standing, even in years of high production. Black Sea countries like Russia and Ukraine are emerging as low-cost players in the last two decades.

Figure 4. Market share of world exports (%)

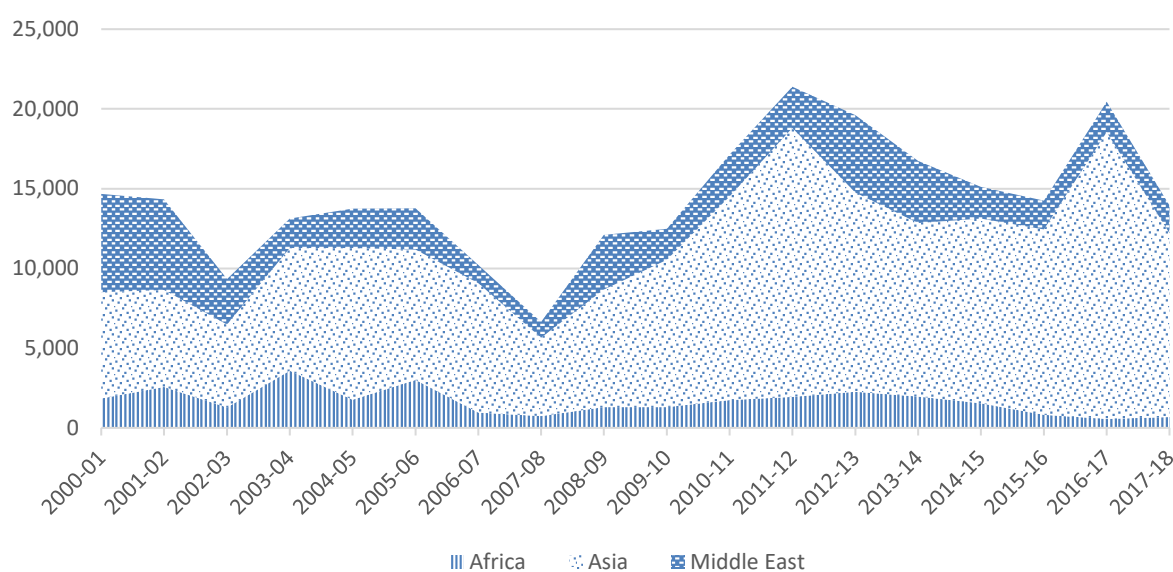
Source: USDA (2019)

²⁵ Corn and sorghum are feed substitutes for feed wheat and barley. Typically, when these grains stocks are at normal levels, the premium for hard wheat rises.

As Kingwell et al. (2016a, 2016b) show, they pose a serious competitive threat in Australia's traditional export markets not only with their competitive pricing, but also because buyers value their increased reliability and quality of supply.²⁶ Once forced to use substitutes for Australian wheat and having learned how to use those cheaper substitutes, end-users often continue to rely on these cheaper new sources of wheat (AEGIC, 2019c).

The export destinations for Australian wheat have changed considerably in the last two decades as seen in Figure 5. With the steady decline in North Africa and Middle East,²⁷ Asia has overwhelmingly become the major destination for Australian wheat, accounting for more than 75 per cent of Australian wheat exports. This increase is due not only to the stability and increase of exports in traditional markets such as Indonesia, Japan, and South Korea, but also due to the increase in exports to emerging economies like Vietnam and the Philippines (ABARES, 2020c).

Figure 5. Australia's wheat exports by destination (Kt), 2000 - 2018



Source: ABARES (2020c)

What do these trends mean for the types and the quality of wheats grown in Australia? To serve these Asian markets, Australia will continue to cultivate wheats suited for Asian food products, most notably different types of noodles and Asian steam breads. Australia may cultivate less wheats suitable for flat breads, popular in the Middle East and North Africa. Australia has earned a reputation as the “noodle specialist” since Australian wheats have high functional performance in a wide range of noodles (Elliott et al., 2019). Delivering to these markets and preserving Australia's reputation as a reliable supplier should continue to underpin Australia's market share in many Asian countries. As White et al. (2018) conclude, faced with highly competitive pressures on the cost of the supply chain, Australia would greatly benefit by focusing on nearby markets that pay a premium for wheats with functional characteristics that are difficult to replicate by competitors.

²⁶ Domestic conditions within these countries are also at play in determining their international competitive standing. For instance, to ensure meeting its own domestic demand, Russia has imposed an export tariff this last crop year.

²⁷ While there has been a drastic decline of exports to Egypt, Nigeria has emerged in the last five years as a major importer in Africa. Exports to Iraq, Iran and Saudi Arabia have diminished significantly although Yemen and Kuwait continue to be stable markets in the Middle East.

Concluding Remarks about the Australian System

This study provides an account of the organizational and institutional evolution of the wheat quality management system in Australia after the 2008 marketing deregulation. We pay particular attention to new organizational arrangements that filled the void of providing industry goods pertaining to quality, such as the wheat classification, market intelligence, and technical training for use of Australian wheat, all of which facilitate a well-functioning quality management system.

We found that when consensus and common ground were found by industry players to provide industry goods, such as preserving the integrity of wheat variety classification or wheat trading standards, new organizations and institutional arrangements were relatively fast to emerge. By illustration, Wheat Quality Australia was founded in 2012 as an independent corporation to administer the wheat classification system. Additionally, publication and administration of the trading standards was taken over by Grain Trade Australia without any government directive. These standards continue to serve as the basis for grading at harvest and contract specifications.

The main classification functions were maintained throughout the transition, and no major changes in wheat classes occurred. The most notable exception pertains to the zone classification for the APH Class, which since 2018 expanded from the northern zone and became a national class (WQA, 2021c). Changes have been incremental in nature with most new varieties classified giving yield increases or better disease resistance within the already established classes. Is this a sign of stability or of a system still in transition which may lack the proper agility to effectively receive and respond to market signals?

Other industry goods, such as market intelligence and market engagement (generic promotion, education and technical training for using Australian wheat), complement varietal classification, trading standards, and their administration. However, being more prone to free riding, un-fragmented organizations for these services were much slower to emerge. Overcoming some initial challenges, AEGIC has established itself as the chief provider in this space over the last few years.

Market intelligence regarding the desired functionality attributes and identifying end-users' willingness to pay for them in various markets is very important for breeding programs in a market-based classification system. Although market deregulation adversely affected the provision of market intelligence, the emergence of AEGIC has aided the supply of market intelligence to breeding companies and helped WQA to be more aware of market signals and market requirements regarding desired functionality of Australian wheats.

The governance structure of new organizations permits relatively wide representations from various industry stakeholders. Along with the collaborative engagement of these representatives, these organizations have increased their credibility in servicing the industry into the future. A major industry development took place in March 2020 when GRDC announced the founding of Grains Australia Limited (GAL), an independent company aimed to consolidate the provision of industry goods. Years in the making and through negotiation among major stakeholders such as Grain Growers, Grain Producers Australia, GTA and GRDC, a new business model was developed that aims to streamline the functions provided by various organizations.²⁸ With the founding GA Board of Directors in place only in August 2020, the scope of industry functions and the full extent of transition of services from other

²⁸ The GRDC press release outlines the following as GAL core functions: "To establish and maintain a grain variety classification system; To provide services that maintain and improve trade and market access; To develop long term market and consumer analysis and product awareness to support longer term demand and value creation; To ensure technical support and training is available for customers of, and participants in the Australian grains industry" (GRDC, 2020b).

organizations into the new model, at the time of writing, was yet to be determined and operationalized. So far, Wheat Quality Australia has come under the jurisdiction of GAL and the Grain Industry Market Access Forum (GIMAF) has been absorbed into GAL as of October 2021.

We found that during this transitional period, GRDC played a central, albeit less direct, role in leading the provision of industry goods primarily through provision of funding. For instance, GRDC has financed the operation of WQA from its creation, eventually becoming its sole funder. In addition, GRDC has provided a significant portion of the AEGIC financing in partnership with the Western Australian Department of Primary Industries and Regional Development. Understandably, given the diverse and often competing interests of industry stakeholders, new organizations face many challenges to credibly establish themselves. GRDC financing has facilitated their establishment and operation amid many uncertainties, and allowed industry organisations the time and opportunity to evolve, mature and establish themselves as organizations that add value for the industry. It is not surprising to also see GRDC playing a critical role in the most recent industry development, the founding and funding of GAL.

The few trends we identify point out that the deregulated marketing environment, by its very transactional nature, does not necessarily, systematically and consistently provide incentives or rewards for farmers to grow high quality wheats. When it comes to managing high-quality wheats and preserving their reputation and availability, there is a need for a long-term approach in managing their stocks across multiple cycles and in developing longstanding relationship with overseas customers. Opportunely, some large vertically integrated grain companies which have the capacity and infrastructure and a vested interest in Australian wheat and Australian wheat growers are well positioned to partake in such practices where a strategic commercial advantage is likely.

Additionally, with increased delivery to specifications and incentives to blend grades in early links of the supply chain, identity preservation of high-quality wheats is a challenge. Designing contracts with specifications that better reflect functionality may aid end-users and producers of these wheats to mutually benefit. Containerised sales of grain, up until more recently, was one avenue to profitably serve niche markets for higher quality wheat. While the quality improvements in terms of yield gains, disease resistance and drought tolerance may likely dominate the expansion of mid-protein varieties in bulk commodity markets, further developments of niche markets that value high performance and functionality attributes of high-quality wheats will continue to add to the diversity of market opportunities.

After more than a decade of organizational and institutional changes in Australia, the industry has come full circle. The prevailing model has an undeniable element of centralisation that was present in the single-desk era. The most recent consolidation of industry functions under GAL, which is funded mostly by GRDC, signifies the need for coordination and joint provision of complementary industry goods, which can be achieved more effectively in a centralized structure. GRDC expects that grain industry organisations will be active contributors to the operations of GAL through involvement in committees, councils and working groups.

What Insights Does the Australian Case Offer for Canada?

The Canada Grain Act, which is currently under review,²⁹ gives the Canadian Grain Commission (CGC) the authority and the resources that enable it to provide a number of industry goods related to grain quality. As Weisensel (2020) note, the private trade in Canada has criticized the CGC outward

²⁹ In its discussion document initiating the review, Agriculture and Agri-Food Canada (AAAF) has identified four main issues: (i) access to binding determination of grade and dockage; (ii) producer payment protection; (iii) CGC licencing; (iv) official inspection and weighting (AAAF, 2021).

inspection in terms of service levels and fees which are typically higher than those charged by the third-party private inspections. The higher CGC inspection fees include the overhead costs of providing other services such as classification, grade administration and impartial grade dispute resolution. Recent funding surpluses of the CGC, combined with the general thrust towards deregulation within the industry, has resulted in grain marketing firms advocating a smaller role for the CGC in quality assurance.

The developments in Australia beg three questions for policy makers engaged in the review of the Canada Grain Act. If the CGC activities are curtailed, will industry goods related to quality assurance still be delivered at an adequate level and at a reasonable cost to industry stakeholders? If so, what organisations will perform these functions? Perhaps more important, who will fund these activities in a sustainable manner?

Çule and Gray (2021) explore these questions in a policy brief and offer a few lessons for Canada which are reiterated in this section. Since local context plays an important role in the evolution of the industry, we also note a few differences in the structure of provision of industry functions and in the key industry players in Australia and Canada, some of which derive directly from regulations. Both Canada and Australia currently have few organisations that play a dominant role in grain quality management and Table 1 summarizes the main functions within the system and the organizations that perform them.

First, in Canada, CGC has historically administered wheat classification and the grade management, and thus, unlike in Australia, these activities were not directly affected by the elimination of the Wheat Board. Nevertheless, Australia's case indicates that even for functions that were deemed valuable by the entire industry, the transaction costs associated with interruption, reorganization and coordination of services were real and non-negligible. Canada should be mindful of such costs when contemplating any changes in the way classification and grading functions are provided. If the Grain Act Review would result in any changes in CGC activities, the long-term funding mechanisms for carrying out these particular functions should be agreed upon before transition.

Second, unlike Canada, the grain trade (handling and marketing) in Australia has organized itself with an industry organization like GTA that provides a common voice and representation in other industry organizations. However, regarding operational support, GTA's contribution is limited mostly to in-kind contributions such as participation in committees and working groups, while the GRDC has primarily provided funding for the industry goods. In Canada grain trade comes together under Cereals Canada (CC). In 2020, the levy funded CIGI merged with CC, aiming to consolidate the function of market development. While the whole industry could benefit from a more coordinated and unified representation, it is unlikely that the grain companies will voluntarily fund the provision of these industry goods.

Third, in Australia, AEGIC directly and through WQA provide breeders with important information about current and future buyer demand for wheat quality attributes. Australia's experience shows that establishing the level and scope with which these functions are currently provided was a lengthy and challenging process. In Canada, CIGI and the CGC work with domestic and international customers and provide important feedback through the quality committee's variety approval process. If revisions to the Grain Act scale back the CGC activities, it is important to assess how quality feedback to the breeding community would be impacted.

Closely related is the technical training of international customers. In Canada, these activities are carried out by CIGI, while in Australia, they were transitioned to AEGIC only in the last few years. Such interruption in the post single-desk era in the Australian context should bring about appreciation for

CIGI's continued work. The lesson for the Canadian industry is to ensure a sustainable funding model for CIGI's activities in the future.

Table 1. Participating organizations in quality assurance

| FUNCTIONS | Organizations | |
|--|---|---|
| | AUSTRALIA | CANADA |
| Wheat Classification | Wheat Quality Australia | CGC- Classifications are established by the Standards Committees. Registration in a wheat class - CFIA upon the recommendation of regional crop committees. |
| Grading/Trading Standards | Grain Trade Australia Grain Trading Standard Committee reviews and publishes grading standards annually to account for the crop quality of the season. | CGC - grades established by Western and Eastern Standards Committees through standard annual primary and export samples. CGC - third party grade dispute resolution. |
| Enforcement of Grading Standards | Bulk Handlers Grain Companies, following the Industry Code of Practice. | CGC for export shipments. Producer grades are decided by mutual agreement but are subject to official CGC grading if requested by a producer. |
| Inspection of Shipments for Contract Specification | Third parties, if it is specified in contract. | CGC outward inspections issue final export certificate or other specifications if requested. |
| Trade Disputes Resolution Services | GTA certified arbitrators for violation of GTA stipulated trade rules; limited to domestic trade actors and typically for non-quality related contract terms. | CGC When a customer disputes product quality and/or contamination, the CGC sends a technical team to assist in resolving the issue. |
| Market Analysis/ Market Development/ Generic Promotion | AEGIC – long term Grain companies - short term with their own customers. | CC/ Industry Canada Grain companies - short term with their own customers. |
| Technical Training of End-users | AEGIC | CIGI |
| Market Intelligence for Breeders | AEGIC and WQA Council | CGC, CIGI, CC annually meet with breeders at Prairie Grain Development Committee meetings. |

Next, when considering the resolution of grain quality disputes, Canada may have a better mix of functions for resolving them. CC and CIGI can call on the CGC as an independent third-party quality verification to adjudicate trade disputes pertaining to quality. While GTA provides trade resolution services through certified arbitrators, these disputes pertain to violations of non-quality terms of contracts.

In addition, the Australian experience shows that in order to mitigate deliveries of blends that include lower grades than contracted, buyers adjusted to require much tighter specifications within a certain grade, and thus, have moved away from contracting only for a grade. This evolution in contract design took some time in a learning by trial process. In Canada, CGC issues the final export certificates as a way to enforce and safeguard the contracted grades for Canadian wheat. If revisions to the Grain Act scale back the CGC activities and the final export certificates will no longer be issued, the Australian experience offers a valuable lesson. Buyers of Canadian wheat should be fully aware of the potential undesirable blending practices when contracting only for certain grades. The adjustment in the contract design to tighten specifications for protein content could be swift and need not go through the same learning by trial process as in Australia.

Perhaps the most important lesson for Canada is the consolidation of the provision of industry goods under the GAL. After more than a decade of organizational and institutional changes in Australia, the industry has come full circle. The “one-stop shop” model of GAL clearly demonstrates the need for joint provision of complementary industry goods, which is achieved more effectively in a centralized structure. In contemplating changes to CGC activities, close attention must be paid to the complementary nature of these activities and whether their funding can be viably sustained if they are decentralized, separated, or delegated to third parties.

As for funding the industry functions, GRDC has played a crucial role in funding and facilitating industry organizations to fill the AWB void after deregulation. Currently, there is no similar entity to GRDC in Canada that could single-handedly step in to address industry wide concerns during transitional times. Hence, contemplating any changes in the CGC activities regarding quality assurance should be approached with a full awareness on whether, in the current Canadian context (absent of a GRDC-type entity), the Canadian industry is likely to achieve successful collective actions to provide an adequate level of service and ensure its funding.

Considering the source of funding, in Australia, AEGIC, WQA, and the newly formed GAL are all funded via GRDC indirectly via producer levies and the federal government matching funds, or in the case of AEGIC, also by state government funds. In Canada, the required inspection fees raise revenues to support other industry-related activities of the CGC. If this revenue source is eliminated or significantly reduced, then the current CGC industry good activities must be funded in some other way. One apparent funding option is by provincial Wheat Commissions, which have access only to refundable producer check-offs. This funding model could (i) increase the scope for free-riding as potentially higher check-off rates needed to raise more funds in the future may induce producers to ask for refunds, and (ii) reduce the Commissions’ ability to support other activities, such as research and breeding.

Perhaps more importantly, an elimination or reduction of CGC activities would likely result in shifting these activities under the control of the CC – CIGI partnership. It is not clear whether the grain trade is willing to raise additional funding for industry-related goods to support additional functions. In fact, the private grain trade is currently advocating for private party inspections to be allowed to contest the CGC mandatory inspection fees in an attempt to reduce their operating costs. Given this position, how likely is it for the same companies to willingly impose on themselves a different type of cost to fund the provision of industry goods in the future? Furthermore, the potential shift of CGC activities

to the CC-CIGI partnership could in turn jeopardize resolution of buyers disputes by a third-party and impartial entity, a role currently performed by the CGC.

In closing the argument about funding, we point to another crucial difference in the level of funding within the industry. In Australia GRDC raises around \$200 million per year for all grains. In addition, endpoint royalties generate \$60 to \$100 million per year to directly support the breeding activities of InterGrain and AGT. In stark contrast, in Canada, the one-dollar check-off on wheat sales amounts to about \$40 million, and the royalties for the public wheat varieties generate another \$5 million per year. Although the wheat sector is smaller in Australia, producers have significantly more money in their control which can provide funding for industry related goods. If the industry related goods provided by the CGC have to be funded by Canadian producers, this will considerably jeopardize an already underfunded system.

The Australian experience would suggest that quality assurance entails many complementary functions we currently see in Canada and that together these functions enable the grain sector to develop, market and deliver quality grain to customers. Having explored options to “do more with less”, these functions have each been restored and eventually are being more centralized as a means to coordinate these activities effectively. Notably, the GRDC has funded most of these initiatives, signifying the need to design enduring funding mechanisms for these industry goods.

Abbreviations

AAFC – Agriculture and Agri-Food Canada
AEGIC – Australian Export Grains Innovation Centre
AWB – Australian Wheat Board
CC – Cereals Canada
CFIA – Canadian Food Inspection Agency
CGC – Canadian Grain Commission
CIGI – Canadian International Grains Institute
CWB – Canadian Wheat Board
GAL – Grains Australia Limited
GRDC – Grains Research & Development Corporation
GTA – Grain Trade Australia
WQA – Wheat Quality Australia
WQMS – Wheat Quality Management System

References

AAFC (2021, January 12), *Minister Bibeau announces launch of consultation on the Canada Grain Act review* [News release]. <https://www.canada.ca/en/agriculture-agri-food/news/2021/01/minister-bibeau-announces-launch-of-consultation-on-the-canada-grain-act-review.html>

ABS (2006, January 20), *The Australian wheat industry*. 1301.0 - Year Book Australia, <https://www.abs.gov.au/ausstats/abs@.nsf/previousproducts/1301.0feature%20article212006>

ABARES (2020a), *Australian wheat supply and disposal, Table 21.4*. Australian Government, Department of Agriculture, Water and the Environment. [Data set]. <https://www.agriculture.gov.au/abares/research-topics/agricultural-outlook>

ABARES (2020b), *Wheat production*, Australian Government, Department of Agriculture, Water and the Environment. [Data set]. <https://www.agriculture.gov.au/abares/research-topics/agricultural-outlook/data#2010>

ABARES (2020c), *Volume of Australian exports of wheat by destination, Table 21.3*. Australian Government, Department of Agriculture, Water and the Environment [Data set]. <https://www.agriculture.gov.au/abares/research-topics/agricultural-outlook>

AEGIC (2016), *Annual Report 2016*. Australian Export Grains Innovation Centre. <https://www.aegic.org.au/wp-content/uploads/2016/10/AEGIC-Annual-Report-2016.pdf>

AEGIC (2019a), *Annual Report 2019*. Australian Export Grains Innovation Centre. https://www.aegic.org.au/wp-content/uploads/2019/11/AEGIC-AR-19_LR-web.pdf

AEGIC (2019b), *Australian Wheat: Quality, versatility and reliability*. [Note]. Australian Export Grains Innovation Centre. https://www.aegic.org.au/wp-content/uploads/2018/02/AEGIC-Grain-Note-wheat_LR.pdf

AEGIC (2019c, October 15). *Cost of uncertain supply*. [Blog #36]. <https://www.grainsinnovation.org/blog/2019/10/4/costs-of-uncertain-supply>

AEGIC (2020a), *Reports*. <https://www.aegic.org.au/resources/reports/>

AEGIC (2020b), *Australian Industry*. <https://www.aegic.org.au/australian-industry/>

Akerlof, G. (1970), "The market for 'Lemons': Quality uncertainty and the market mechanism", *Quarterly Journal of Economics*, 84(3), 488-500.

Brynjolfsson, E., & Milgrom, P. (2013), "Complementarity in organizations", In R. Gibbons, & J. Roberts (Eds.), *Handbook of Organizational Economics* (pp. 11-55). Princeton University Press.

CGC (2019, February 28), *Statistics*. Canadian Grain Commission. <https://www.grainscanada.gc.ca/en/grain-research/statistics/>

Carter, C., & Kingwell, R. (2019, April 9), *Wheat price availability: a view from the West*. [Blog #29]. Australian Export Grains Innovation Centre. <https://www.grainsinnovation.org/blog/2019/4/9/wheat-price-variability>

Çule, M., & Gray, R. (2021), *Canada Grain Act Review and Industry Goods: Lessons from Australia*. Johnson Shoyama Graduate School of Public Policy, University of Saskatchewan and University of Regina, Policy Brief, April 8, 2021. <https://www.schoolofpublicpolicy.sk.ca/research/publications/policy-brief/canada-grain-act-review-and-industry-goods.php>

Elliot, P., Kingwell, R., & Carter, C. (2019), *The growing consumption of bread and baked goods in Indonesia: an opportunity for Australian wheat*. Australian Export Grains Innovation Centre. <https://www.aegic.org.au/wp-content/uploads/2019/12/AEGIC-Bread-and-baked-goods-in-Indonesia.pdf>

Fulton, M. (2011), *Challenges facing the grain handling and transportation system in Western Canada in a post Canadian Wheat Board environment*. Working Paper, Johnson Shoyama Graduate School of Public Policy, University of Saskatchewan, Canada.

GRDC (2020a, August 12), *Grains Australia launches with leaders on board*. [Media release]. <https://grdc.com.au/news-and-media/news-and-media-releases/national/2020/august/grains-australia-launches-with-leaders-on-board>

GRDC (2020b, March 31), *GRDC unveils Grains Australia Ltd to consolidate a range of industry services and functions*. [Media release]. <https://grdc.com.au/news-and-media/news-and-media-releases/national/2020/march/grdc-unveils-grains-australia-ltd-to-consolidate-a-range-of-industry-services-and-functions>

Griffith, G., Fleming, E., Mounter, S. and Malcolm, B. (2014), *Accounting for Externalities in Agriculture and Food Sector Value Chains and Networks: Chain Failure, Chain Goods and Chain Bads*, Final Report to Meat and Livestock Australia on Project B.COM.1086, UNE Business School, The University of New England, Armidale, July.

GTA (2016), *Australian Grain: A quality product*. [Brochure]. Grade Trade Australia. <http://www.graintrade.org.au/sites/default/files/Publications/Australian%20Grain%20-%20A%20Quality%20Product%202016.pdf>

GTA (2020), *GTA Grain Trading Standards 2019/2020*. http://www.graintrade.org.au/commodity_standards

Honey, G. (2012), *Grain Trade Australia*. [PowerPoint slides]. Personal communication.

Kingwell, R., Elliott, P., White, P., & Carter, C. (2016a), *Ukraine: An emerging challenge for Australian wheat exports*. Australian Export Grains Innovation Centre. <http://aegic.org.au/wp-content/uploads/2016/04/Ukraine-Supply-Chain-Full-Report.pdf>

Kingwell, R., Carter, C., Elliott, P., & White, P. (2016b), *Russia's wheat industry: Implications for Australia*. Australian Export Grains Innovation Centre. <https://www.aegic.org.au/wp-content/uploads/2016/09/Russia-wheat-industry-Implications-for-Australia.pdf>

Kingwell, R. (2019a, May 19), *Volatility in Australia's wheat export supply chains*. [Blog #30]. Australian Export Grains Innovation Centre. <https://www.grainsinnovation.org/blog/2019/5/9/30-volatility-in-australias-wheat-export-supply-chains>

Kingwell, R. (2019b), *Australia's grain outlook 2030*. Australian Export Grains Innovation Centre. <https://www.aegic.org.au/wp-content/uploads/2019/11/AEGIC-Australias-Grain-Outlook-2030.pdf>

Mahoney, J., & Thelen, K. (2009), "A theory of gradual institutional change", in Mahoney, J., & Thelen, K. (Eds.) *Explaining Institutional Change: Ambiguity, Agency and Power*. Cambridge University Press.

Mounter, S., Fleming, E. and Griffith, G. (2019), "Financing agricultural value chain R&D: a framework with examples from the red meat industry", *Australasian Agribusiness Review*, Volume 27, Paper 3, 45-64.

North, D. (1990), *Institutions, Institutional Change and Economic Performance*. Cambridge University Press.

NWPGP (2020), *National Working Party on Grain Protection*. GTA.
<http://www.graintrade.org.au/nwpgp>

Productivity Commission (2010), *Wheat Export Marketing Arrangements*. Australian Government.
<https://www.pc.gov.au/inquiries/completed/wheat-export/report>

Rohr, S., Mounter, S. Fleming, E. and Griffith, G. (2020), "A diagrammatic framework for accounting for externalities in agriculture and food sector value chains", *Australasian Agribusiness Review*, Volume 28, Paper 5, 106-121.

Sandler, T. (1992), *Collective Action*. Michigan University Press.

Stretch, T., Carter, C., & Kingwell, R. (2014), *The cost of Australia's bulk grain export supply chains: An information paper*. Australian Export Grains Innovation Centre.
<https://www.aegic.org.au/wp-content/uploads/2016/04/The-cost-of-Australias-bulk-grain-export-supply-chains-Full-Report.pdf>

USDA (2019), *World wheat and flour trade*. [Data set].
<https://usda.library.cornell.edu/concern/publications/zs25x844t?locale=en&page=22#release-items>

Weisensel, W. (2020), *Review of Potential Changes to the Canada Grain Act*. Saskatchewan Wheat Development Commission.
<https://static1.squarespace.com/static/5c40f31a620b85cf0d073e7b/t/6026c2de25b2481827961a52/1613152990644/SWDC+-+Review+of+Potential+Changes+to+the+Canada+Grain+Act+-+Final+Oct+2020+%281%29.pdf>

White, P., Carter, C., & Kingwell, R. (2018), *Australia's supply chains: costs, risk and opportunities*. Australian Export Grains Innovation Centre.
https://www.aegic.org.au/wp-content/uploads/2019/01/FULL-REPORT-Australias-grain-supply-chains-DIGITAL_.pdf

Williamson, O. (1985), *The Economic Institution of Capitalism*. Free Press.

WQA (2016), *Wheat Quality Australia: Independently classified Australian wheat*. [Brochure]. WQA.

WQA (2021a), *What is quality*. Wheat Quality Australia.
<https://wheatquality.com.au/about/what-is-wheat-quality/>

WQA (2021b), *Wheat Quality Australia*.
<https://wheatquality.com.au/>

WQA (2021c), *Classes*. Wheat Quality Australia.
<https://wheatquality.com.au/classification/how-it-works/classes/>